

**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 24pt**

|                               |  |                              |  |
|-------------------------------|--|------------------------------|--|
| <b>Candidate<br/>forename</b> |  | <b>Candidate<br/>surname</b> |  |
|-------------------------------|--|------------------------------|--|

|                          |  |  |  |  |  |                             |  |  |  |  |
|--------------------------|--|--|--|--|--|-----------------------------|--|--|--|--|
| <b>Centre<br/>number</b> |  |  |  |  |  | <b>Candidate<br/>number</b> |  |  |  |  |
|--------------------------|--|--|--|--|--|-----------------------------|--|--|--|--|

**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.**

## **EQUATIONS**

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

**energy = mass × specific latent heat**

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

**wave speed = frequency × wavelength**

**power = voltage × current**

**energy supplied = power × time**

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

**distance = average speed × time**

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

**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**

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

**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.**

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**[2]**

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

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[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]



**BLANK PAGE**

**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.**

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[6]

**(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?**

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**[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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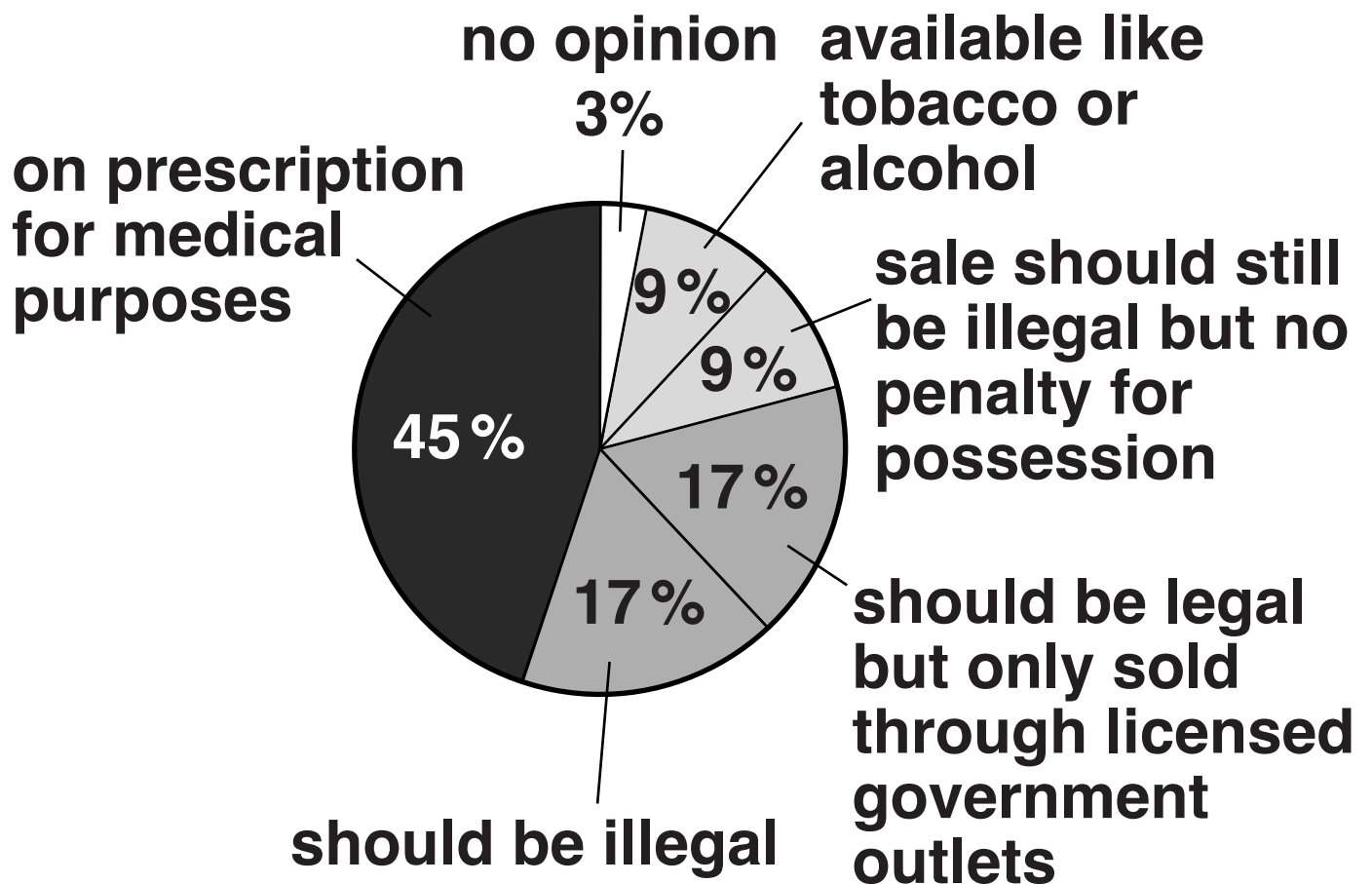
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[2]

**(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 opposite 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<br/>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**

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**Number of short offspring**

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**[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.**

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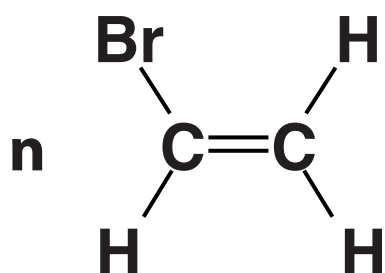
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**[1]**

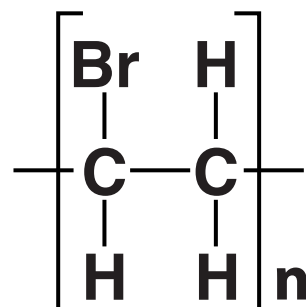
## SECTION B – Module C1

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

**compound A**



**compound B**



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

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

**Explain why.**

\_\_\_\_\_

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



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

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

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

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

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ **[3]**

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

**Choose from the list.**

**ALKANE**

**ALKENE**

**DIBROMO**

**SATURATED**

**UNSATURATED**

\_\_\_\_\_ **[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.**

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**[2]**

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

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

**Look at his results in the table opposite.**

**(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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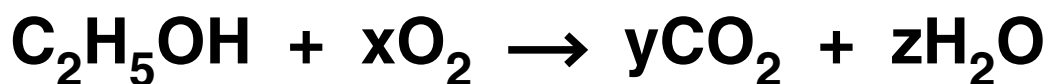
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**[3]**

| <b>Fuel</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>                |

**(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 = \_\_\_\_\_**

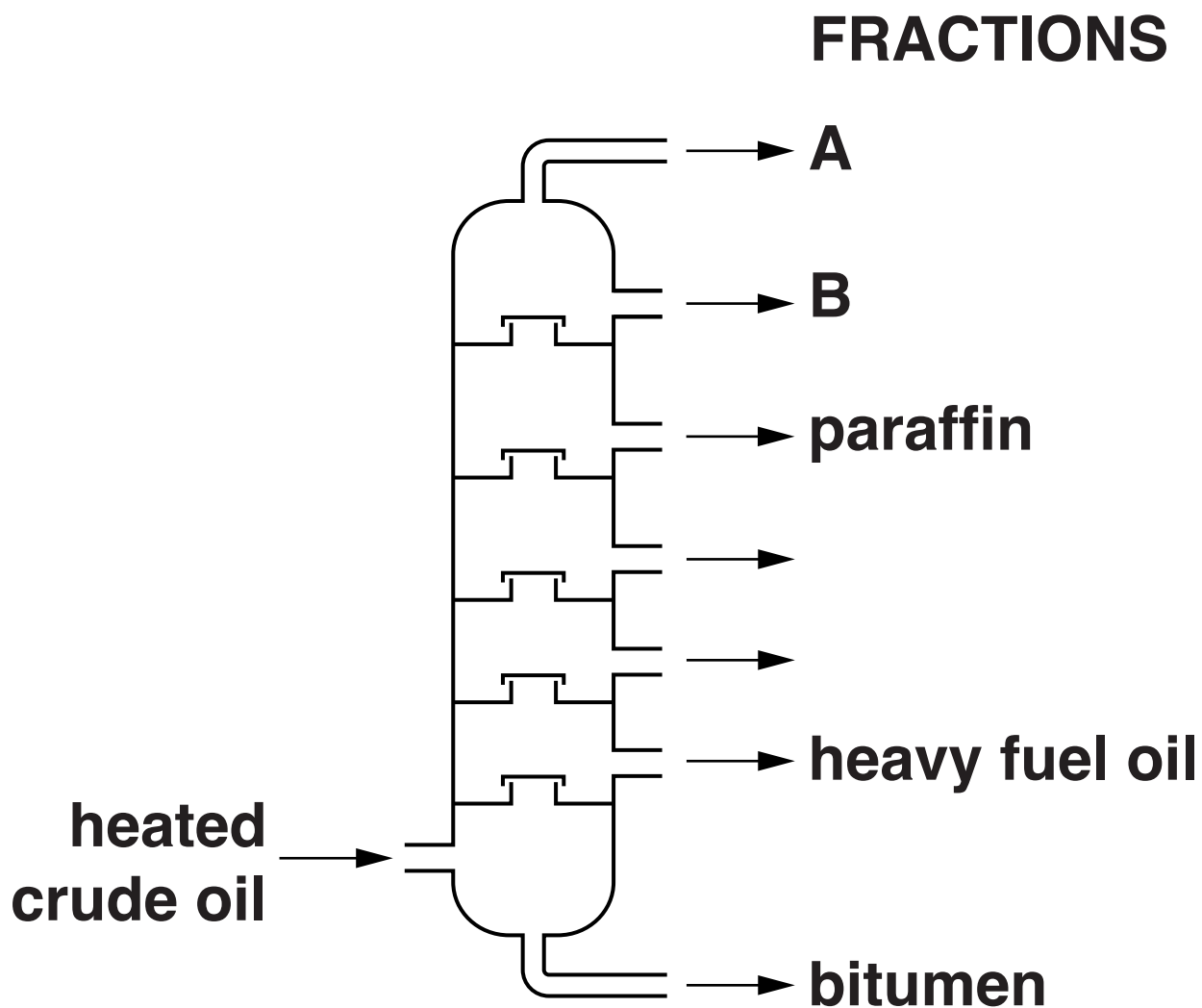
**[1]**



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

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

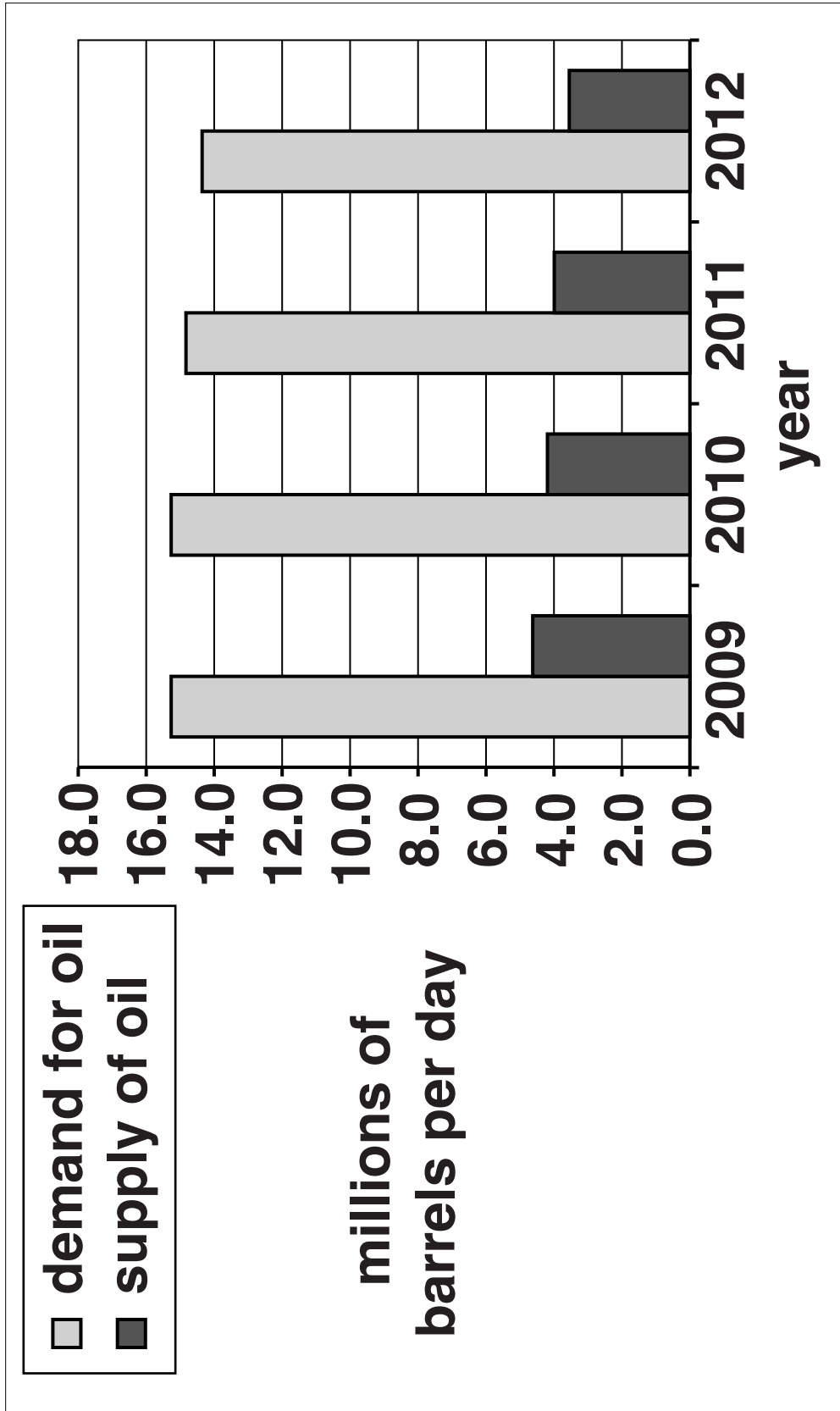
**What trends can you deduce about the supply and demand of crude oil from 2009 to 2012?**

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[2]



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

|                              |                                       |   |                                        |
|------------------------------|---------------------------------------|---|----------------------------------------|
| <b>Molecular formula</b>     | <div>C<sub>2</sub>H<sub>6</sub></div> | → | <div>C<sub>8</sub>H<sub>18</sub></div> |
| <b>Boiling point</b>         | <div></div>                           | → | <div></div>                            |
| <b>Intermolecular forces</b> | <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.**

|                 |               |                 |
|-----------------|---------------|-----------------|
| <b>COVALENT</b> | <b>HIGH</b>   | <b>IONIC</b>    |
| <b>LOW</b>      | <b>STRONG</b> | <b>WEAK [2]</b> |

**(d) Distillation of  $C_8H_{18}$  does not make individual carbon and hydrogen atoms.**

**Explain why.**

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**[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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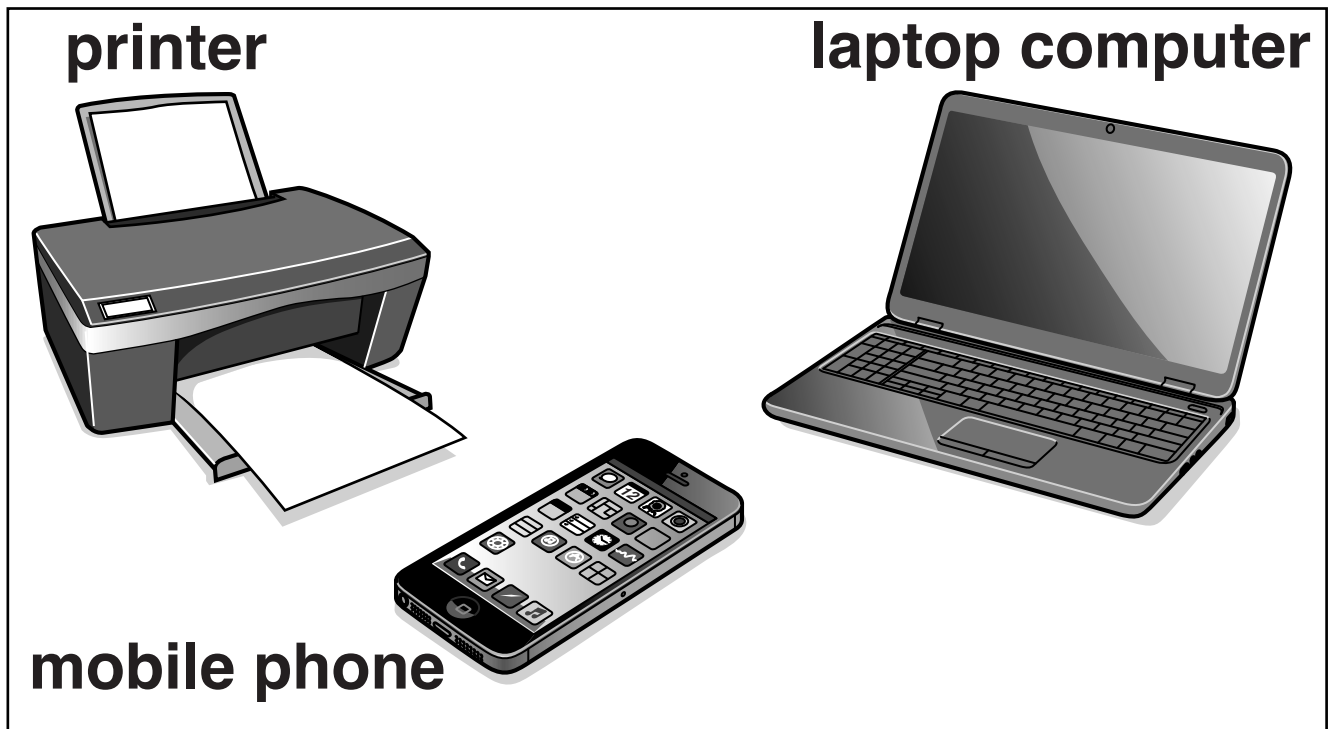
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**[6]**

## **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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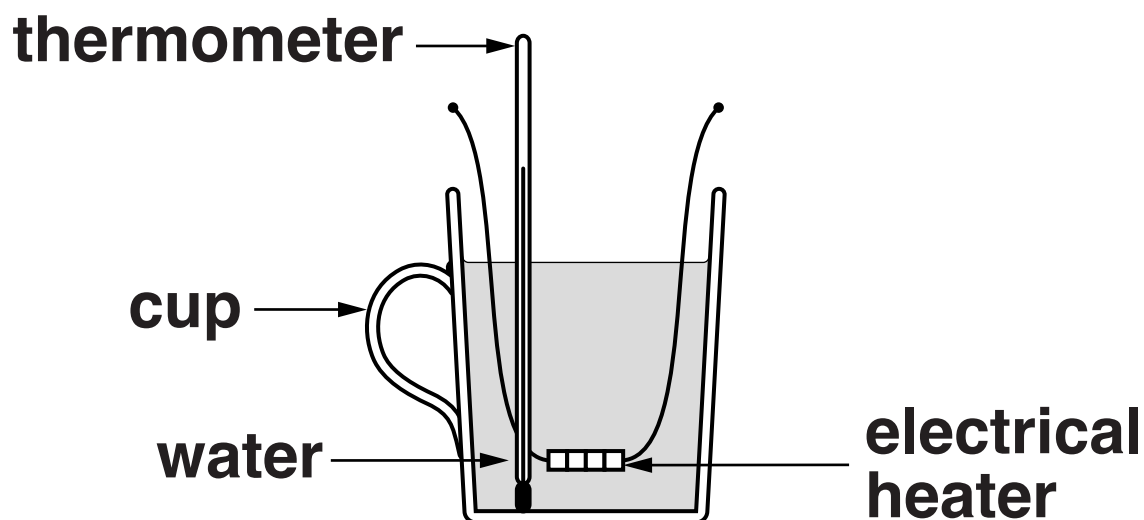
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**[2]**

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**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 in the table opposite.**

| <b>Mass<br/>of<br/>water<br/>in kg</b> | <b>Initial<br/>temperature<br/>in °C</b> | <b>Final<br/>temperature<br/>in °C</b> | <b>Energy<br/>absorbed<br/>by water<br/>in J</b> | <b>Energy<br/>supplied<br/>by heater<br/>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.**



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

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**[6]**

**(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:**

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**convection can be reduced by:**

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**[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.**

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**[2]**

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

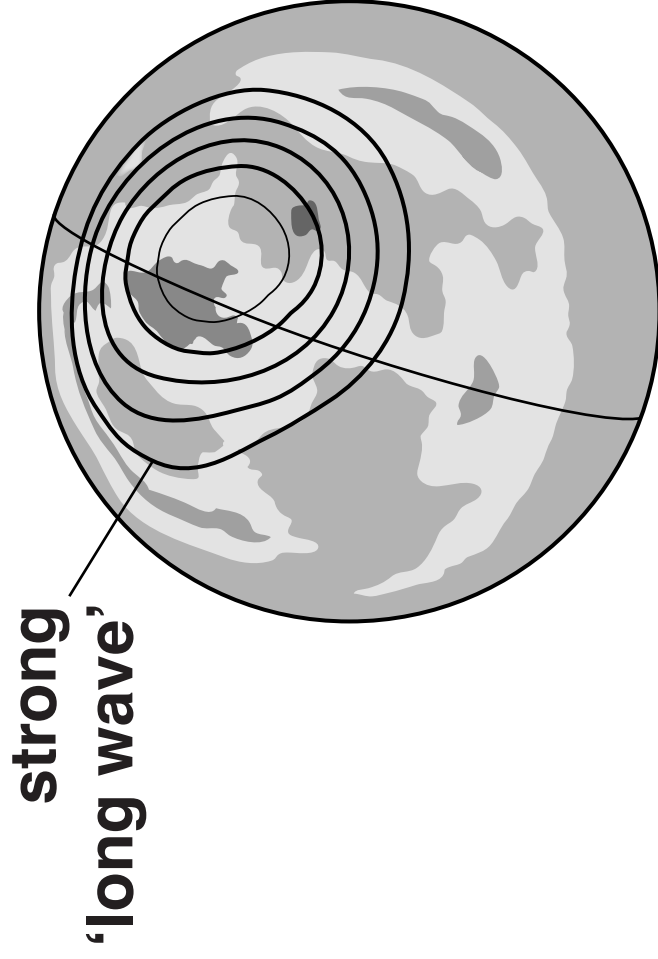
**They have also measured the strength of 'long waves'.**

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

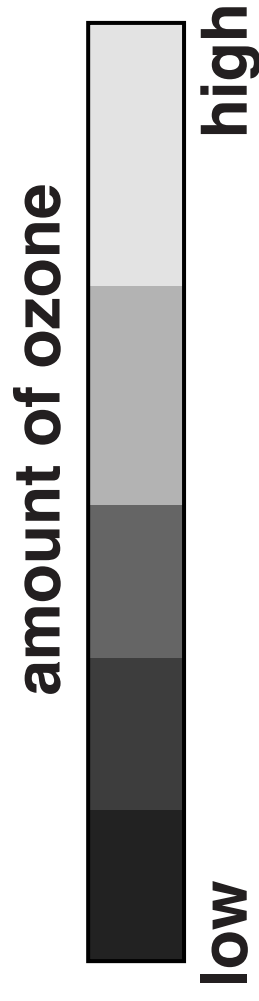
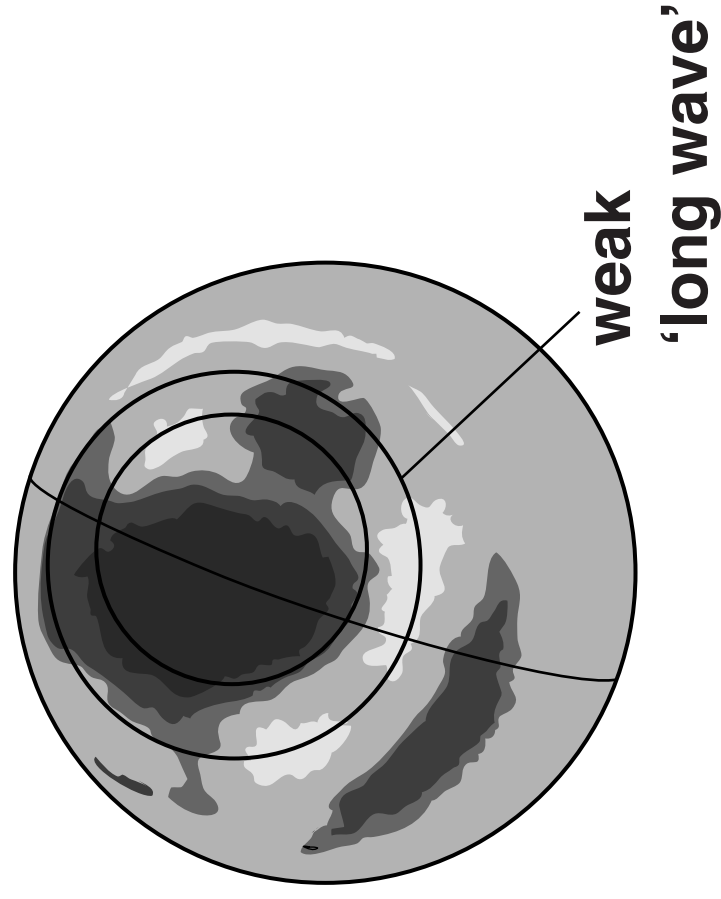
**They help to keep the temperature of the upper atmosphere constant.**

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

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



**Earth's ozone and  
long wave  
measurements 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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**[2]**

**(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]**



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**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.**

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**Explain your answer.**

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**[2]**

**END OF QUESTION PAPER**

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