

**Tuesday 24 January 2012 – Morning****GCSE GATEWAY SCIENCE  
SCIENCE B****B621/01** Unit 1 Modules B1 C1 P1 (Foundation Tier)

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

|                       |  |                      |  |
|-----------------------|--|----------------------|--|
| Candidate<br>forename |  | Candidate<br>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**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

2

**EQUATIONS**

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

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

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

$$\text{energy (kilowatt hours)} = \text{power (kW)} \times \text{time (h)}$$

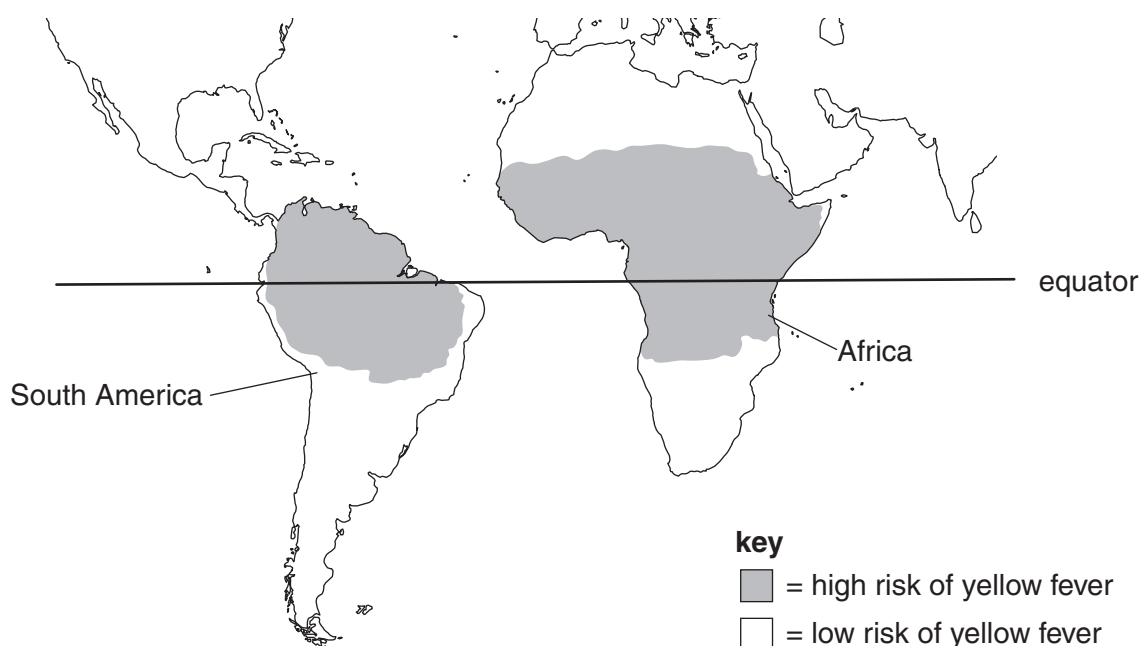
3

Answer **all** the questions.**Section A – Module B1**

- 1** Geoff is planning to travel to Africa.

Yellow fever is a disease which only occurs in South America and Africa.

The map shows areas where people get yellow fever in South America and Africa.



- (a)** What does the map show about where people get yellow fever in South America and Africa?

.....

..... [1]

- (b)** Yellow fever is caused by a virus.

Finish the table by writing in the cause of two other conditions.

Choose your answers from this list.

**bacteria****fungi****inherited genes****protozoa**

| condition       | cause |
|-----------------|-------|
| cystic fibrosis |       |
| athlete's foot  |       |

[2]

[Total: 3]

4

- 2 (a) In some places in the world people live at high altitude.

These people are often good athletes.

This is because their bodies are very good at getting oxygen from the air.

Scientists have been studying why this is.

The scientists studied

- each athlete's pulse rate
- how much haemoglobin was in their blood
- how much iron was in their diet.

- (i) Describe how the scientists could measure pulse rate.

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

- (ii) The amount of iron in the diet might affect the amount of haemoglobin in the blood.

Suggest why.

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

- (b) (i) Some athletes try to improve their performance by taking drugs.

Which type of drug is most likely to improve an athlete's performance?

Put a (ring) around the correct answer.

**anabolic steroids      aspirin      LSD      temazepam**

[1]

5

(ii) Stimulants can help an athlete run faster.

They do this by increasing the breathing rate and pulse rate.

Explain how these changes may help the athlete run faster.

.....

.....

.....

..... [3]

(c) When athletes run, their bodies generate more heat.

Write down **one** change in their bodies that lets them lose more heat.

..... [1]

[Total: 8]

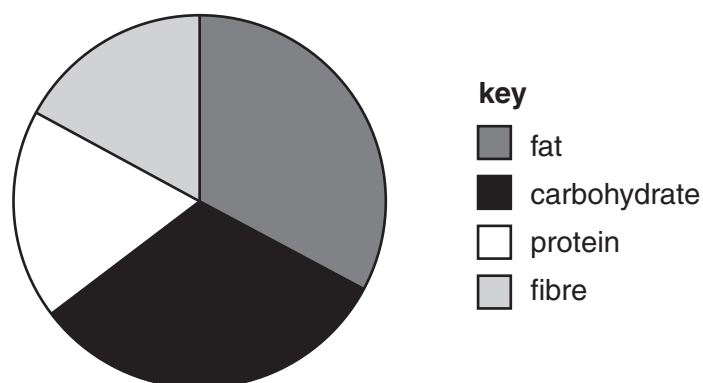
6

- 3 Four people decide to go on four different diets.

The table shows each person's daily intake when they are on their diets.

| person | energy<br>in kJ | fat<br>in g | carbohydrate<br>in g | protein<br>in g | fibre<br>in g |
|--------|-----------------|-------------|----------------------|-----------------|---------------|
| Jilly  | 5406            | 120         | 16                   | 62              | 16            |
| Arthur | 3570            | 12          | 154                  | 32              | 62            |
| Gazza  | 4692            | 78          | 76                   | 44              | 40            |
| Aqsa   | 5134            | 102         | 30                   | 68              | 18            |

- (a) The pie chart shows one person's diet.



Which person's diet is shown on the pie chart?

..... [1]

- (b) Which person's diet would be best for preventing constipation?

..... [1]

- (c) Arthur's diet is the **least** suitable for a growing teenager.

Write down **one** reason why.

..... [1]

7

(d) Jilly has a body mass of 80 kg.

(i) Calculate Jilly's recommended daily average (RDA) protein intake.

Use the formula below to help you.

$$\text{RDA in g} = 0.75 \times \text{body mass in kg}$$

Jilly's RDA = ..... g [1]

(ii) Does Jilly's diet provide her with enough protein?

answer .....

Explain your answer.

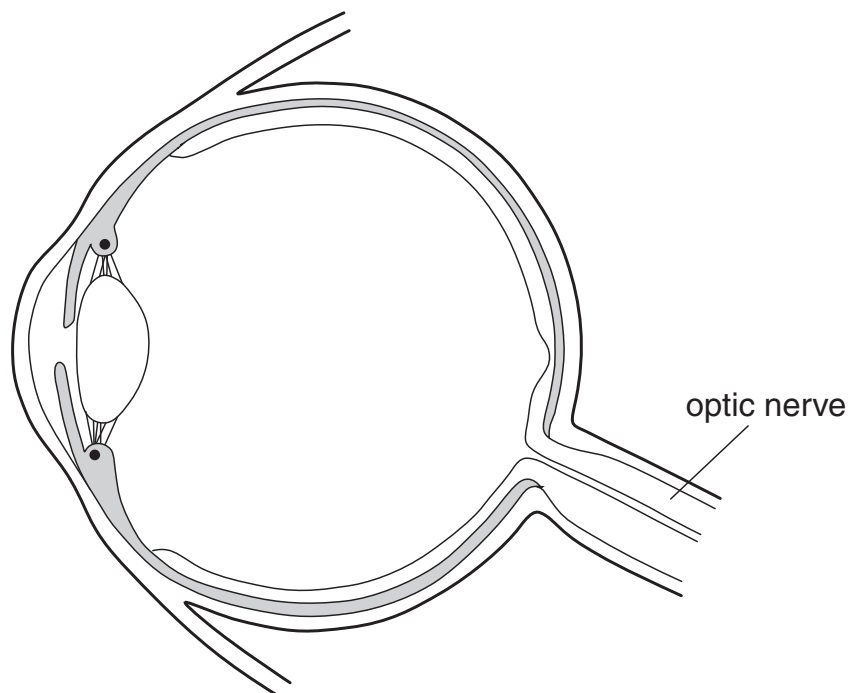
..... [1]

[Total: 5]

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4 Look at the diagram of the eye.



(a) The optic nerve has been labelled.

Add **two** more labels to the diagram to show the positions of the

- lens
- cornea.

[2]

(b) Some people have problems with their eyes.

These problems are caused by something wrong in the eyes.

Finish the table.

| eye problem                | what is wrong in the eyes |
|----------------------------|---------------------------|
| long-sight                 |                           |
| red-green colour blindness |                           |

[2]

[Total: 4]

## Section B – Module C1

5 Crude oil is used to make many substances.

(a) Crude oil is a fossil fuel.

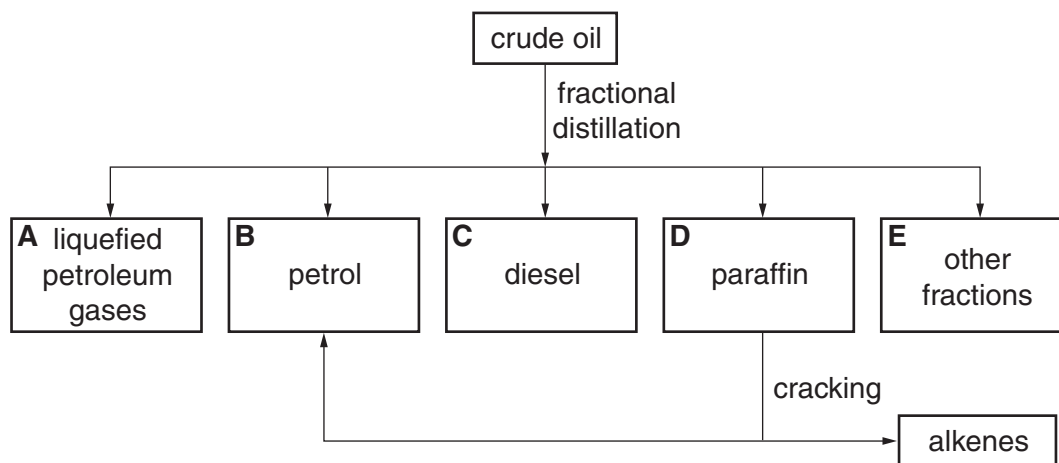
Fossil fuels are non-renewable.

Explain why.

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

(b) Look at the flow chart.

It shows some of the substances that can be made from crude oil.



(i) Fractional distillation separates crude oil into fractions.

Write down the name of one of the other fractions.

Choose from

**bitumen      carbohydrate      coal      nylon**

answer ..... [1]

(ii) Cracking breaks down large hydrocarbon molecules.

Smaller, more useful molecules are made.

Write down **one** substance made by cracking the paraffin fraction.

..... [1]

- (c) Each fraction contains hydrocarbon molecules.

Look at the table.

| fraction                        | number of carbon atoms in each hydrocarbon molecule | boiling temperature in °C |
|---------------------------------|-----------------------------------------------------|---------------------------|
| liquefied petroleum gases (LPG) | 1–4                                                 | below 30                  |
| petrol                          | 5–9                                                 | 30–175                    |
| paraffin                        | 10–16                                               | 176–275                   |
| diesel                          | 12–25                                               | 276–375                   |

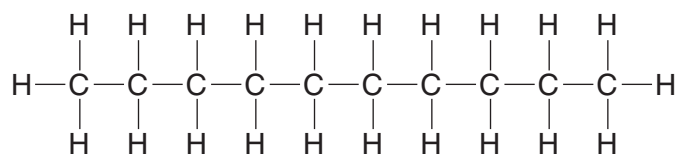
- (i) A hydrocarbon has a boiling temperature of 189 °C.

In which fraction is this hydrocarbon found?

Choose from the table.

answer ..... [1]

- (ii) Look at the displayed formula for hydrocarbon **X**.



Write down the names of the **two** elements which are bonded together in a hydrocarbon.

..... and ..... [1]

- (iii) In which fraction is hydrocarbon **X** found?

Choose from the table.

answer ..... [1]

[Total: 6]

- 6 Aircraft use a hydrocarbon fuel to power their jet engines.



- (a) A gas in the air reacts with the fuel when it burns.

Which gas?

..... [1]

- (b) The owners of the aircraft want to change the fuel the engines burn.

Two of the factors the owners need to think about are

- the energy released per kilogram
- the cost.

Write down two **other** factors the owners need to think about.

1.....

.....

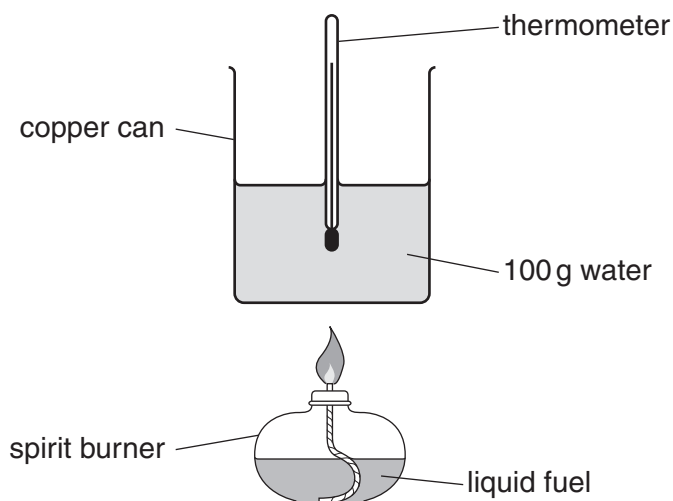
2.....

..... [2]

13

- (c) Cristina wants to compare the energy released by four different liquid fuels.

Look at the diagram of the apparatus she uses.



Each time she burns 2.0 grams of the liquid fuel.

She measures the temperature of the water at the start.

She measures the temperature again when all the fuel has burnt.

Look at her results.

| fuel     | temperature of water at start in °C | temperature of water at end in °C |
|----------|-------------------------------------|-----------------------------------|
| <b>A</b> | 20                                  | 46                                |
| <b>B</b> | 18                                  | 46                                |
| <b>C</b> | 21                                  | 47                                |
| <b>D</b> | 23                                  | 39                                |

- (i) Which fuel releases the most energy?

fuel .....

Explain your answer. ....

..... [2]

- (ii) Cristina notices that all the fuels burn with a yellow flame and make lots of soot.

Suggest why.

..... [1]

[Total: 6]

14

- 7 Many foods and drinks contain food additives.

Look at the bottle of mayonnaise.



The mayonnaise contains some food additives.

One of these additives is benzoic acid.

- (a) Benzoic acid has the molecular formula  $C_7H_6O_2$ .

How many atoms are there in one molecule of benzoic acid,  $C_7H_6O_2$ ?

Choose from

3

6

8

9

13

15

17

answer ..... [1]

- (b) The mayonnaise contains an **antioxidant**.

What is the job of an antioxidant?

.....

..... [1]

15

(c) The mayonnaise contains oil and water.

It also contains an **emulsifier**.

(i) Why is it important that mayonnaise contains an emulsifier?

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

(ii) Write down the name of **another** food that contains an emulsifier.

..... [1]

(d) The mayonnaise bottle is made of a plastic.

Two properties of this plastic are

- it will not break when dropped
- it is non-biodegradable.

(i) Write down one **other** property of the plastic that makes it suitable to make the bottle for the mayonnaise.

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

(ii) What does **non-biodegradable** mean?

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

(iii) Many plastic bottles are thrown away in dustbins.

Write about the different ways in which waste plastics (polymers) can be disposed of.

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

[Total: 8]

16

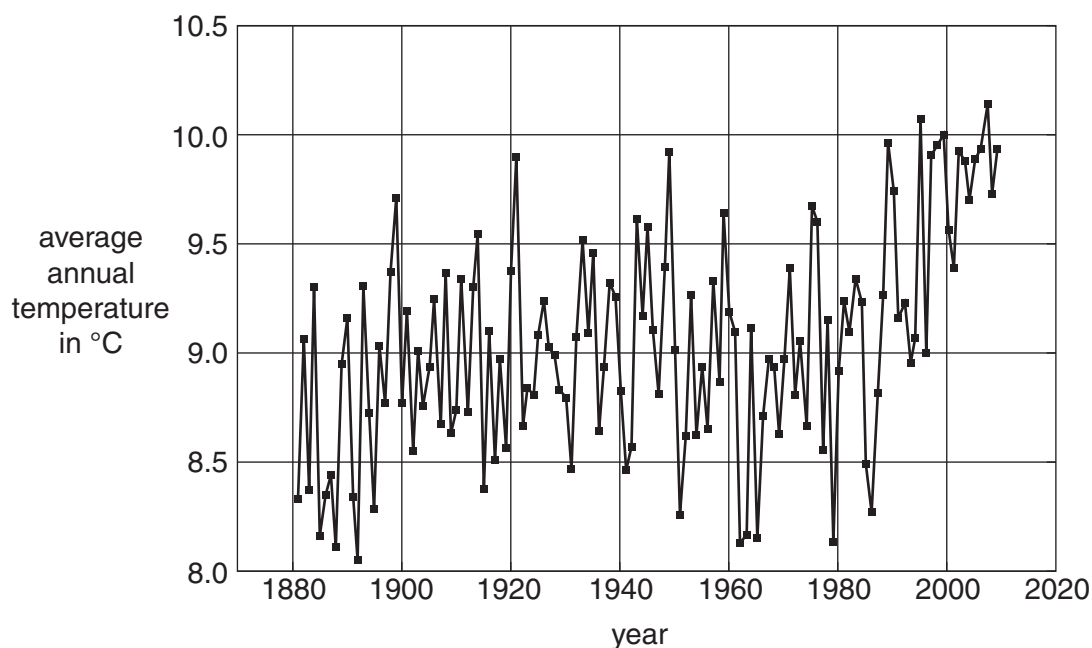
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## Section C – Module P1

8 Look at the graph.

It shows the average annual temperature recorded at one weather station.



(a) The graph suggests that the temperature of the Earth has increased during the last 20 years.

Suggest **two** reasons why the Earth's temperature has increased.

1 .....

2 ..... [2]

(b) Weather patterns are affected by natural phenomena and by human activity.

(i) Dust from a large volcano spreads as a layer around the Earth.

How will this affect the Earth's temperature?

.....

..... [1]

(ii) Dust from a town centre factory can raise the temperature of the town.

Explain why.

.....

..... [1]

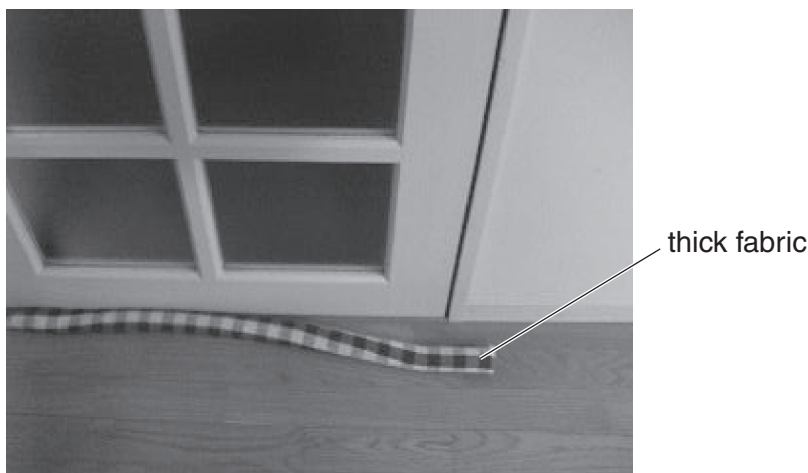
[Total: 4]

18

9 This question is about ways of reducing energy loss from the home.

(a) Tina puts a length of thick fabric at the bottom of her dining room door.

It helps to keep the room warm.



How does the thick fabric reduce energy loss?

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

It absorbs energy from the room and radiates it back into the room.

☐

It is a form of draught proofing and reduces the amount of cold air that can enter the room.

☐

It reduces energy loss by conduction because the fabric is a good conductor.

☐

It reduces energy loss by radiation because it reflects energy back into the room.

☐

[1]

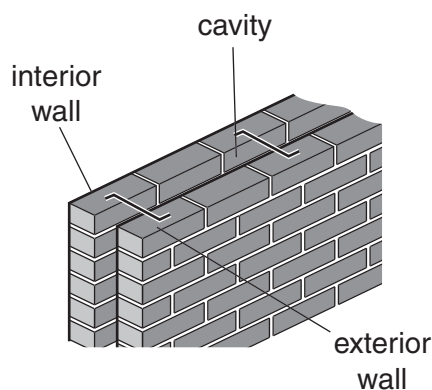
(b) The room has thick curtains and blinds which reduce energy loss through the windows.

Suggest one **other** way of reducing energy loss through the windows.

..... [1]

19

- (c) The diagram shows the cavity between the outer and inner walls of Tina's home.



The cavity is filled with air.

- (i) What happens to the air in the cavity when its temperature rises?

..... [1]

- (ii) Tina investigates ways of insulating her home.

She finds the following information.

| insulation             | installation cost<br>in £ | payback time<br>in years |
|------------------------|---------------------------|--------------------------|
| cavity wall insulation | 250                       | 2                        |
| double glazing         | 5000                      | 50                       |
| draught proofing       | 100                       | 4                        |
| loft insulation        | 250                       | 1.7                      |

She decides to buy **cavity wall insulation**.

Foam is injected into the wall cavity.

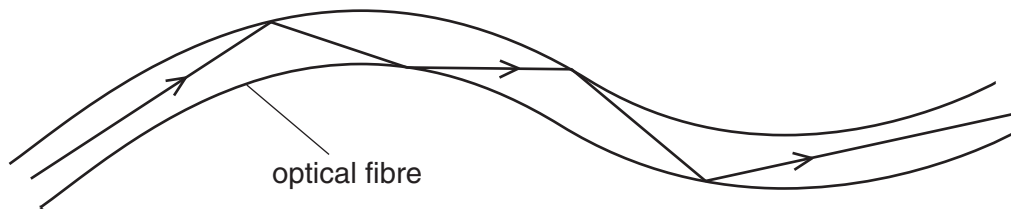
How much will she save on energy bills each year?

.....  
 .....

answer £ ..... [1]

[Total: 4]

- 10 Sam uses infrared radiation to transmit a voice message along an optical fibre.



- (a) What happens to the infrared radiation in the fibre when it reaches a glass-air boundary?

..... [1]

- (b) Infrared radiation travels at a particular speed in space.

What else travels at the same speed as infrared radiation?

Put rings around the **two** correct answers.

**light waves**

**p waves**

**radio waves**

**sound waves**

**s waves**

[2]

- (c) The voice message is produced as an **analogue** signal.

It is changed into a **digital** signal before it is transmitted along the optical fibre.

Finish the sentences to describe the difference between an analogue signal and a digital signal.

An analogue signal .....

.....

A digital signal .....

..... [2]

- (d) Suggest **one other** use for infrared radiation.

..... [1]

[Total: 6]

11 Microwave radiation is used to transmit mobile phone signals.

(a) One frequency used by mobile phones is 900 000 000 Hz.

The wavelength of the radiation is 0.333 m.

Calculate the speed of microwave radiation.

The equations on page 2 may help you.

.....

.....

.....

answer ..... m/s [1]

(b) Write down **one other** use for microwave radiation in the home.

..... [1]

(c) There are concerns about children using mobile phones.

Some scientists think that using mobile phones a lot may harm children's health.

Suggest why they are concerned that using mobile phones may harm children's health.

.....

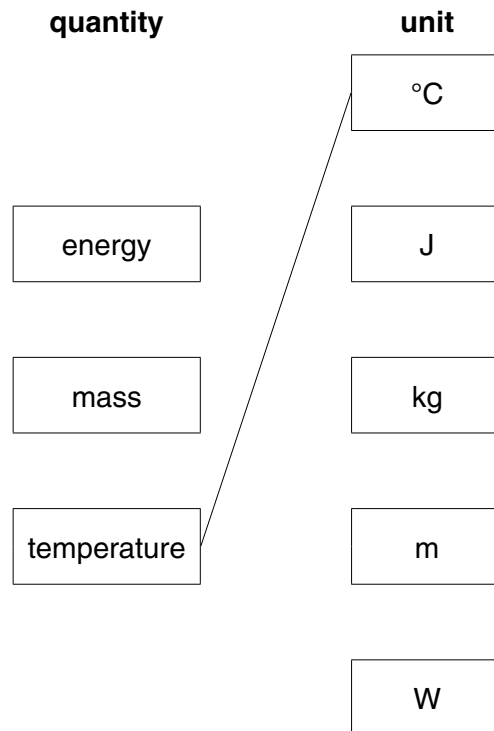
.....

..... [2]

[Total: 4]

**12** Most physical quantities have their own unit.

Draw a straight line from each **quantity** to its correct **unit**. One has been done for you.



[2]

[Total: 2]

**END OF QUESTION PAPER**

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# The Periodic Table of the Elements

| 1                                    | 2                                  | 3                                                                                                                                                            | 4                                     | 5                                       | 6                                      | 7                                                                                   | 0                                    |
|--------------------------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-----------------------------------------|----------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|
| 7<br><b>Li</b><br>lithium<br>3       | 9<br><b>Be</b><br>beryllium<br>4   | <div> <div>1<br/><b>H</b><br/>hydrogen<br/>1</div> <div> <div>relative atomic mass<br/>atomic symbol<br/>name<br/>atomic (proton) number</div> </div> </div> |                                       |                                         |                                        |                                                                                     | 4<br><b>He</b><br>helium<br>2        |
| 23<br><b>Na</b><br>sodium<br>11      | 24<br><b>Mg</b><br>magnesium<br>12 | 11<br><b>B</b><br>boron<br>5                                                                                                                                 | 12<br><b>C</b><br>carbon<br>6         | 14<br><b>N</b><br>nitrogen<br>7         | 16<br><b>O</b><br>oxygen<br>8          | 19<br><b>F</b><br>fluorine<br>9                                                     | 20<br><b>Ne</b><br>neon<br>10        |
| 39<br><b>K</b><br>potassium<br>19    | 40<br><b>Ca</b><br>calcium<br>20   | 27<br><b>Al</b><br>aluminium<br>13                                                                                                                           | 28<br><b>Si</b><br>silicon<br>14      | 31<br><b>P</b><br>phosphorus<br>15      | 32<br><b>S</b><br>sulfur<br>16         | 35.5<br><b>Cl</b><br>chlorine<br>17                                                 | 40<br><b>Ar</b><br>argon<br>18       |
| 85<br><b>Rb</b><br>rubidium<br>37    | 88<br><b>Sr</b><br>strontium<br>38 | 56<br><b>Fe</b><br>iron<br>26                                                                                                                                | 55<br><b>Mn</b><br>manganese<br>25    | 59<br><b>Co</b><br>cobalt<br>27         | 59<br><b>Ni</b><br>nickel<br>28        | 63.5<br><b>Cu</b><br>copper<br>29                                                   | 84<br><b>Kr</b><br>krypton<br>36     |
| 133<br><b>Cs</b><br>caesium<br>55    | 137<br><b>Ba</b><br>barium<br>56   | 45<br><b>Sc</b><br>scandium<br>21                                                                                                                            | 48<br><b>Ti</b><br>titanium<br>22     | 51<br><b>V</b><br>vanadium<br>23        | 52<br><b>Cr</b><br>chromium<br>24      | 70<br><b>Ga</b><br>gallium<br>31                                                    | 131<br><b>Xe</b><br>xenon<br>54      |
| [223]<br><b>Fr</b><br>francium<br>87 | [226]<br><b>Ra</b><br>radium<br>88 | 89<br><b>Y</b><br>yttrium<br>39                                                                                                                              | 91<br><b>Zr</b><br>zirconium<br>40    | 93<br><b>Nb</b><br>niobium<br>41        | 96<br><b>Mo</b><br>molybdenum<br>42    | 112<br><b>Cd</b><br>cadmium<br>48                                                   | [222]<br><b>Rn</b><br>radon<br>86    |
|                                      |                                    | 139<br><b>La*</b><br>lanthanum<br>57                                                                                                                         | 178<br><b>Hf</b><br>hafnium<br>72     | 181<br><b>Ta</b><br>tantalum<br>73      | 184<br><b>W</b><br>tungsten<br>74      | 127<br><b>I</b><br>iodine<br>53                                                     | [210]<br><b>At</b><br>astatine<br>85 |
|                                      |                                    | 104<br><b>Rf</b><br>rutherfordium<br>104                                                                                                                     | 105<br><b>Db</b><br>dubnium<br>105    | 106<br><b>Sg</b><br>seaborgium<br>106   | 107<br><b>Bh</b><br>bohrium<br>107     | [209]<br><b>Po</b><br>polonium<br>84                                                | [222]<br><b>Rn</b><br>radon<br>86    |
|                                      |                                    | 108<br><b>Hs</b><br>hassium<br>108                                                                                                                           | 109<br><b>Mt</b><br>meitnerium<br>109 | 110<br><b>Ds</b><br>darmstadtium<br>110 | 111<br><b>Rg</b><br>roentgenium<br>111 | Elements with atomic numbers 112-116 have been reported but not fully authenticated |                                      |

\* 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.