

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**  
**GCSE GATEWAY SCIENCE**

**B751/02**

**PHYSICS B**

**Physics modules P1, P2, P3**  
**(Higher Tier)**

**WEDNESDAY 5 JUNE 2013: Afternoon**

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

**MODIFIED ENLARGED**

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

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|--------------------------|--|--|--|--|--|-----------------------------|--|--|--|--|
| <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:**

**None**

**OTHER MATERIALS REQUIRED:**


**Pencil**

**Ruler (cm/mm)**

## **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**

- Your quality of written communication is assessed in questions marked with a pencil (  ).
- A list of equations can be found on pages 4–6.
- 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**

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

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2} at^2$$

$$m_1 u_1 + m_2 u_2 = (m_1 + m_2) v$$

$$\text{refractive index} = \frac{\text{speed of light in vacuum}}{\text{speed of light in medium}}$$

$$\text{magnification} = \frac{\text{image size}}{\text{object size}}$$

$$I_e = I_b + I_c$$

$$\frac{\text{voltage across primary coil}}{\text{voltage across secondary coil}} = \frac{\text{number of primary turns}}{\text{number of secondary turns}}$$

$$\text{power loss} = (\text{current})^2 \times \text{resistance}$$

$$V_p I_p = V_s I_s$$

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**Answer ALL the questions.**

**SECTION A – MODULE P1**

**1 Allan wants to reduce energy losses from his house.**

**He asks an energy adviser for help.**

**(a) The adviser uses a camera to produce a thermogram of the house.**

**Explain how the thermogram can be used to compare how much heat energy is lost from different parts of the house.**

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**[2]**

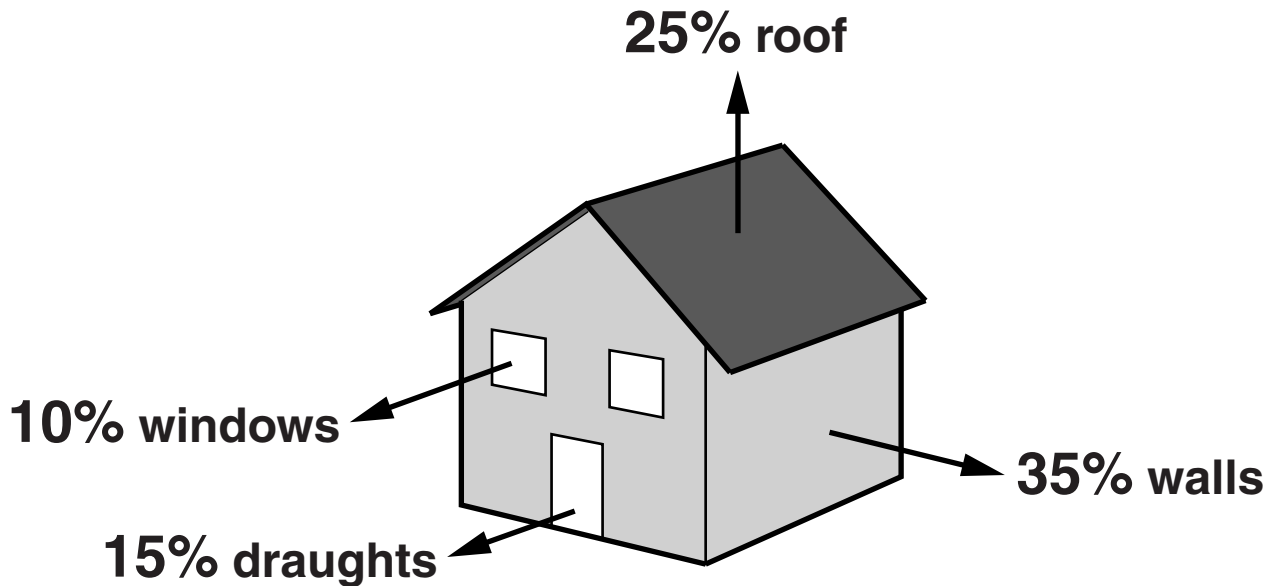


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**TURN OVER FOR THE REMAINDER OF QUESTION 1**

**(b) The energy adviser draws a diagram of Allan's house.**

**It shows where some of the energy losses happen.**



**Energy saving methods are used to reduce energy losses from this house.**

**The table shows some costs and savings for four of these methods.**

|          | <b>Energy saving method</b>   | <b>Cost to fit in £</b> | <b>Annual saving on energy bills in £</b> | <b>Payback time in years</b> |
|----------|-------------------------------|-------------------------|---|------------------------------|
| <b>A</b> | <b>double glazed windows</b>  | <b>4800</b>             | <b>100</b>                                |                              |
| <b>B</b> | <b>loft (roof) insulation</b> | <b>270</b>              | <b>45</b>                                 |                              |
| <b>C</b> | <b>draught-proofing</b>       | <b>90</b>               | <b>30</b>                                 |                              |
| <b>D</b> | <b>cavity wall insulation</b> | <b>240</b>              | <b>120</b>                                |                              |

**The adviser tells Allan that he should install methods C and D in his house.**

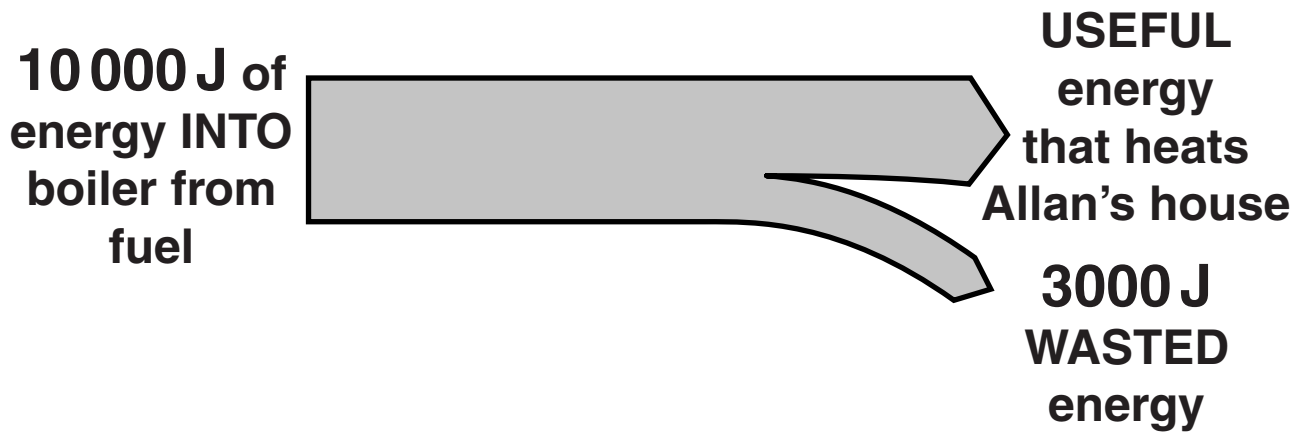
**Complete the table and use the information to explain why C AND D are the best methods for Allan to install.**

|  |  |
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|  |  |
|  |  |

**[3]**

- (c) The energy adviser also suggests that Allan replaces his old central heating boiler.

The Sankey diagram shows energy data for Allan's boiler.



- (i) Calculate the efficiency of Allan's boiler.

Give your answer as a percentage.

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efficiency \_\_\_\_\_ %

[3]

- (ii) Allan thinks that some of the energy completely disappears.

How could the adviser use the Sankey diagram to explain that this was NOT scientifically correct?

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[1]

[TOTAL: 9]

- 2 (a) Damien wants to cook a curry he bought at the supermarket.

He looks at the label on the packaging of the meal.

Place the meal in a glass dish.  
Cook in either:  
**CONVENTIONAL ELECTRIC OVEN;**  
cook at  $190^{\circ}\text{C}$  for 36 minutes.

or  
**MICROWAVE OVEN;**  
cook for 6 minutes.

### **CONVENTIONAL OVEN**

Uses infrared radiation to cook the meal.

Energy used =  
**5 400 000 J**

### **MICROWAVE OVEN**

Uses microwave radiation to cook the meal.

Energy used =  
**270 000 J**

**Explain in detail the mechanisms for both cooking methods and link these to the data for the energy used and cooking times needed.**



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

[illegible]

**(b) Microwaves are also used for mobile phone messages.**

**Damien is worried about allowing his children to use mobile phones.**

**He finds evidence in some reports about possible dangers. Look at the notes he makes about the reports from three different years.**

**A: 2005**

**Studied phone use for 4000 people. Concluded that the risk of a cancerous tumour was not increased, at least in the first ten years.**

**B: 2007**

**Scientists exposed rat and human cells to microwave radiation and found this caused biological changes to the cells that could lead to tumours developing.**

**C: 2011**

**35 800 people aged 30 or over studied for 13 years of phone use. Study concluded that there was no increased risk of brain cancer or any other types of cancer.**



**Damien decided to allow his children to use mobile phones after considering the evidence from these reports.**

**Suggest reasons why he did this.**

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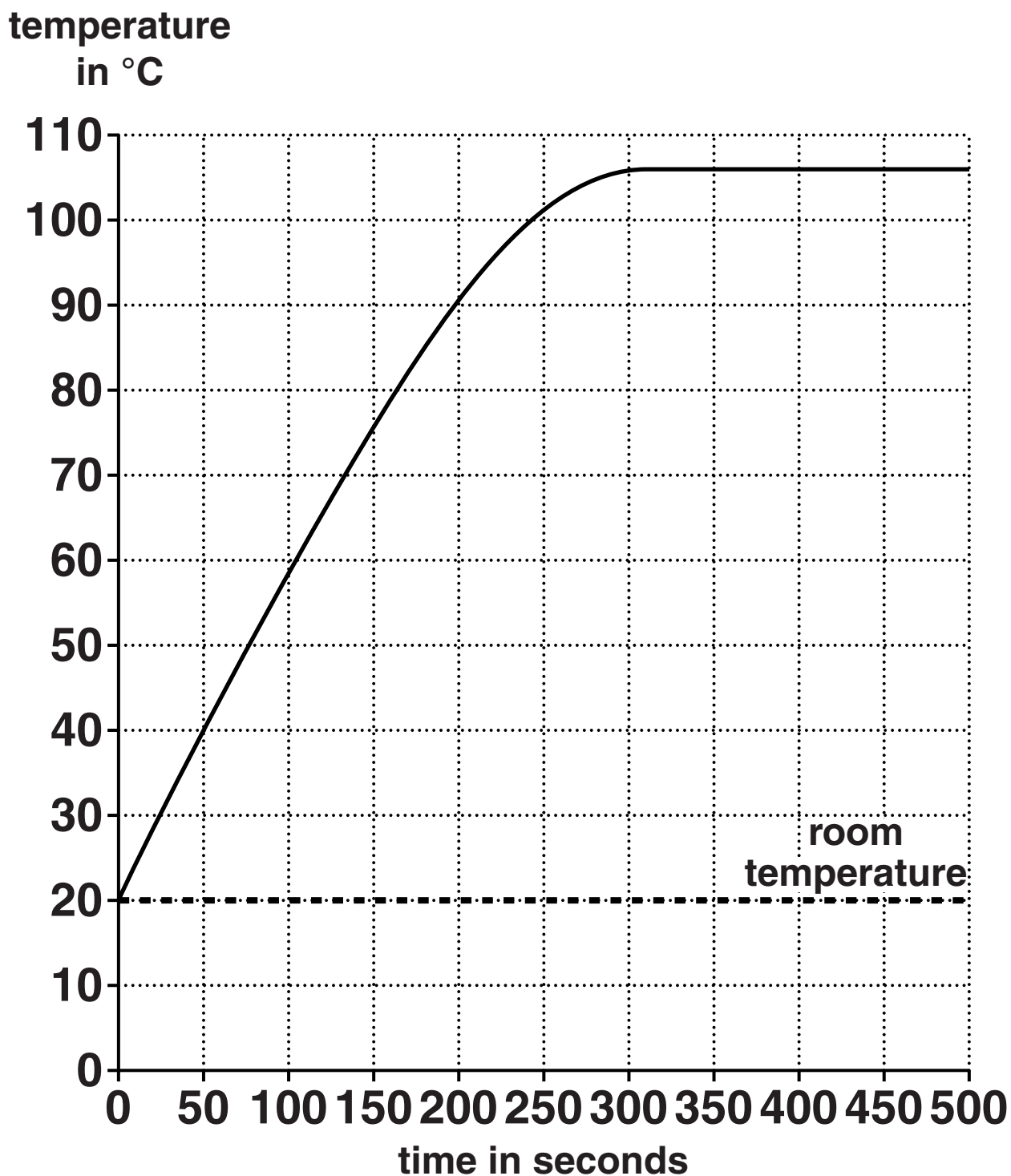
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[2]

**[TOTAL: 8]**

- 3 Layla heats the liquid in a beaker for 500 seconds and records the temperature.

Look at the graph of her results.



**Write down the time interval during which ALL of the energy supplied was used to change the state of the liquid, and explain how the energy supplied causes this change of state.**

**time interval is from \_\_\_\_\_ seconds to**

**\_\_\_\_\_ seconds**

**explanation**

\_\_\_\_\_

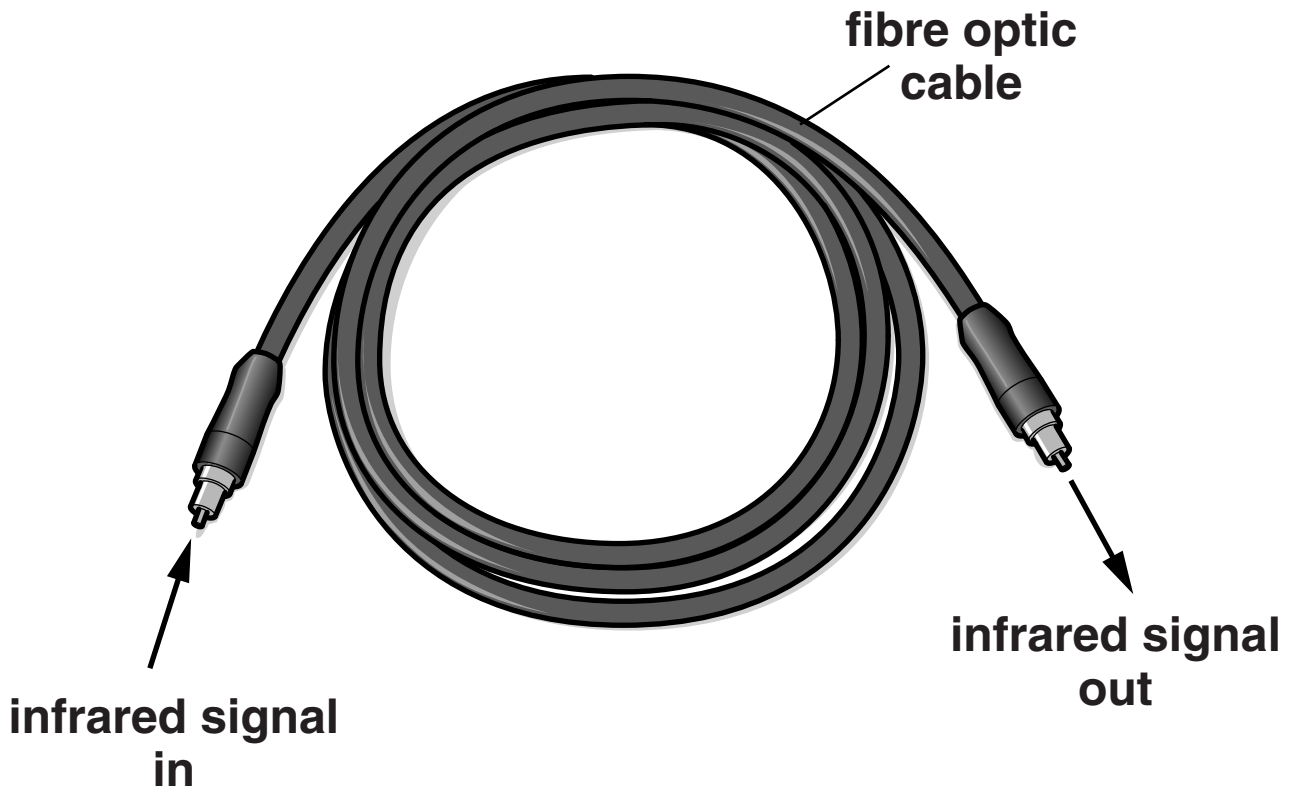
\_\_\_\_\_ [2]

**[TOTAL: 2]**

**4 Reeta is learning about different types of waves.**

**Electromagnetic waves are used for communication.**

**(a) (i) Infrared waves can transmit signals from one end of a fibre optic cable to the other.**



**Infrared waves of wavelength  $1.5 \times 10^{-6} \text{ m}$  travel along this optical fibre.**

**The speed of the infrared waves in the fibre is  $2.2 \times 10^8 \text{ m/s}$ .**

**Calculate the frequency of the infrared waves.**

**Give your answer in STANDARD FORM and to 2 significant figures.**

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**answer \_\_\_\_\_ Hz [2]**

- (ii) When the infrared (IR) radiation leaves the fibre, it is refracted as it enters the air.

Reeta makes a table to compare the speed, wavelength and frequency of the IR signal in the air and in the optical fibre.

Complete the table opposite by putting one tick (✓) in each ROW.

- (b) Reeta learns that digital signals are used in optical fibres.

Digital signals are used to transmit signals over long distances. As the signal strength falls, it is amplified at points along the cable.

Describe and explain the advantages of using DIGITAL signals for transmitting information along optical fibres.

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[2]

[TOTAL: 6]

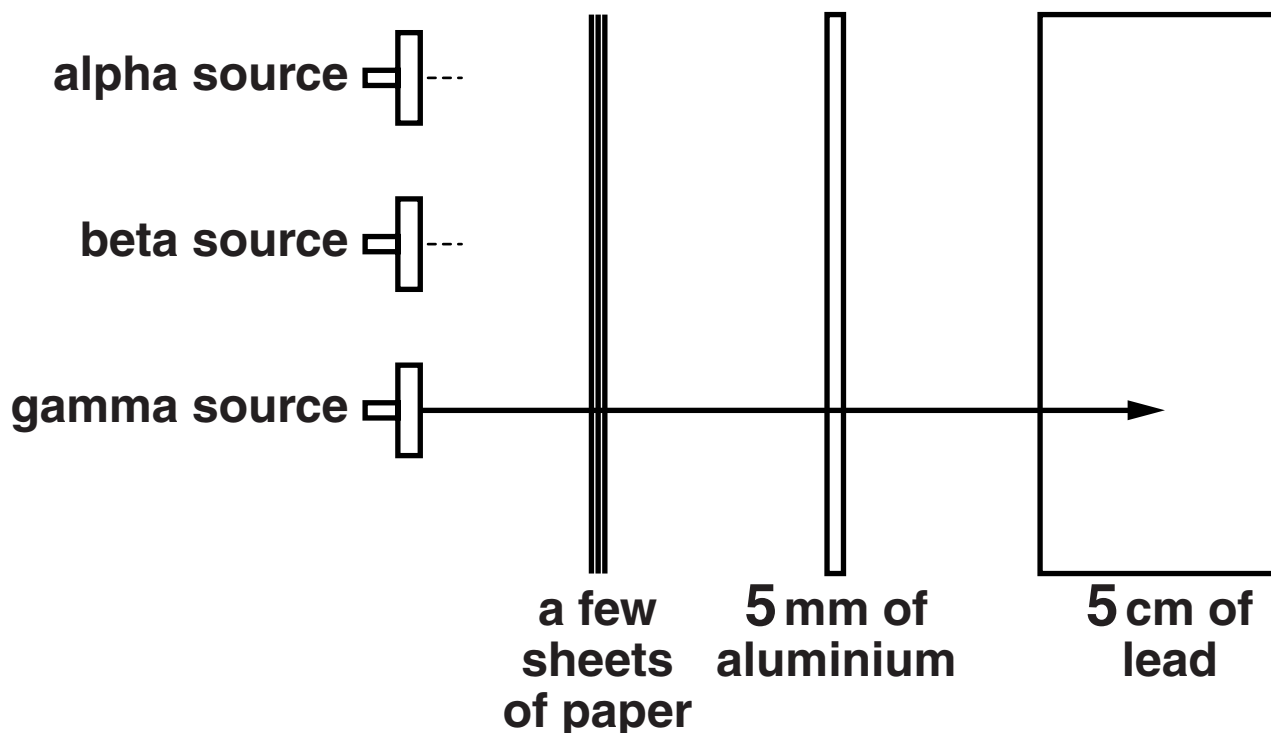
|                         | In air > in fibre | In air = to that in fibre | In air < in fibre |
|-------------------------|-------------------|---------------------------|-------------------|
| <b>Speed of IR</b>      |                   |                           |                   |
| <b>Wavelength of IR</b> |                   |                           |                   |
| <b>Frequency of IR</b>  |                   |                           |                   |

[2]

## SECTION B – Module P2

5 This question is about nuclear radiation.

- (a) Complete the diagram to show the penetrating power of alpha AND beta radiation.  
Gamma radiation has been completed for you.



[1]

- (b) Write down TWO examples of beneficial uses of gamma radiation.

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[2]



**(c) Explain the problems of dealing with radioactive waste.**

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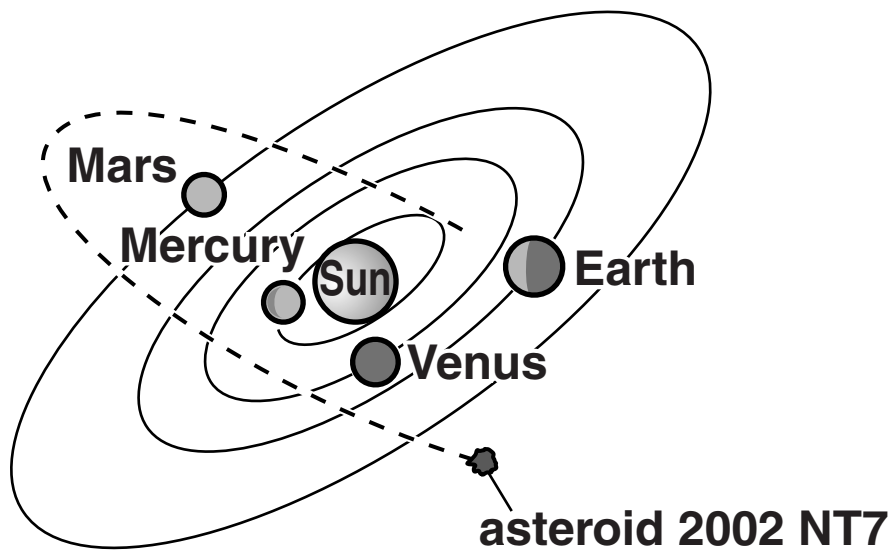
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**[2]**

**[TOTAL: 5]**

- 6 The asteroid named 2002 NT7 is a Near Earth Object (NEO) with a diameter of 2 km.**



**Asteroid 2002 NT7 has a low probability of colliding with the Earth in the year 2019.**

**Explain why most asteroids are not normally a threat, and discuss the possible actions needed to manage the threat of asteroid 2002 NT7.**



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

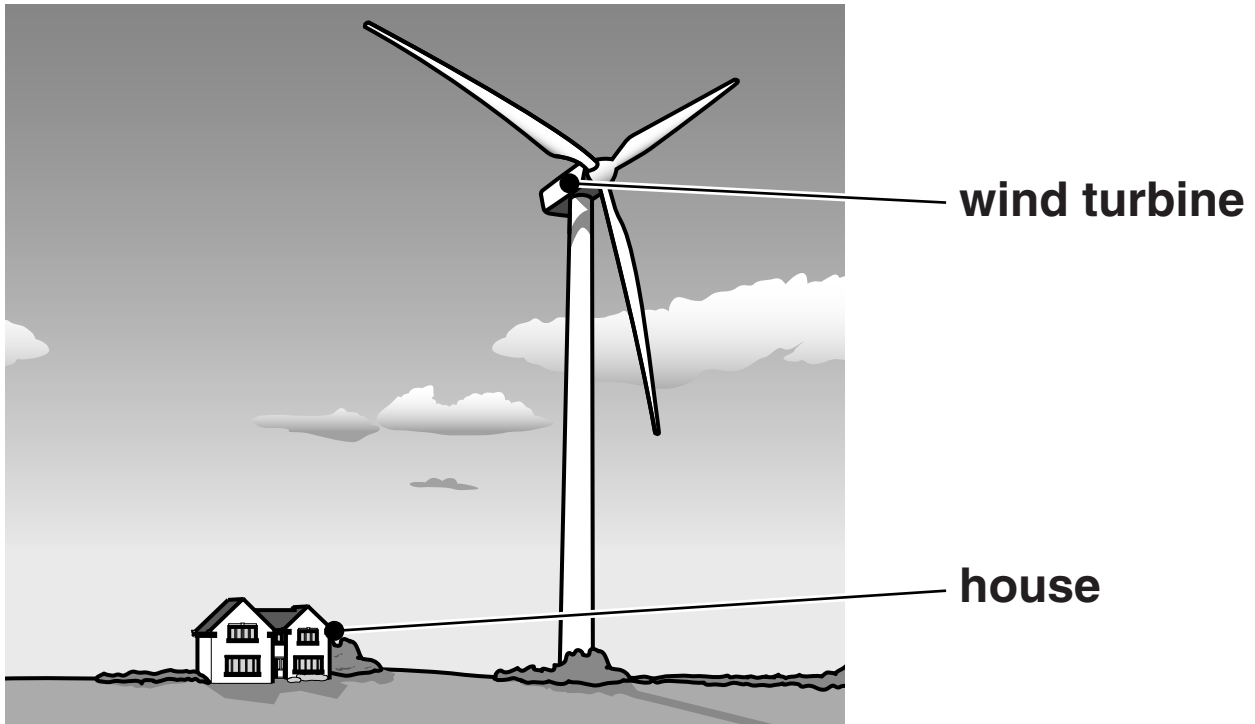
[illegible]

**[TOTAL: 6]**

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- 7 The Sun's energy produces convection currents that cause wind.

Wind is used to drive turbines.



- (a) Describe the **ADVANTAGES** of wind turbines compared to a conventional coal power station.

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[2]

- (b) The people in the house are concerned about noise from the turbine.**

**Look at the graph.**

**Each dot shows a measurement of the noise from the wind turbine.**

- (i) Use the graph to describe how the wind turbine noise is affected by wind speed.**

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

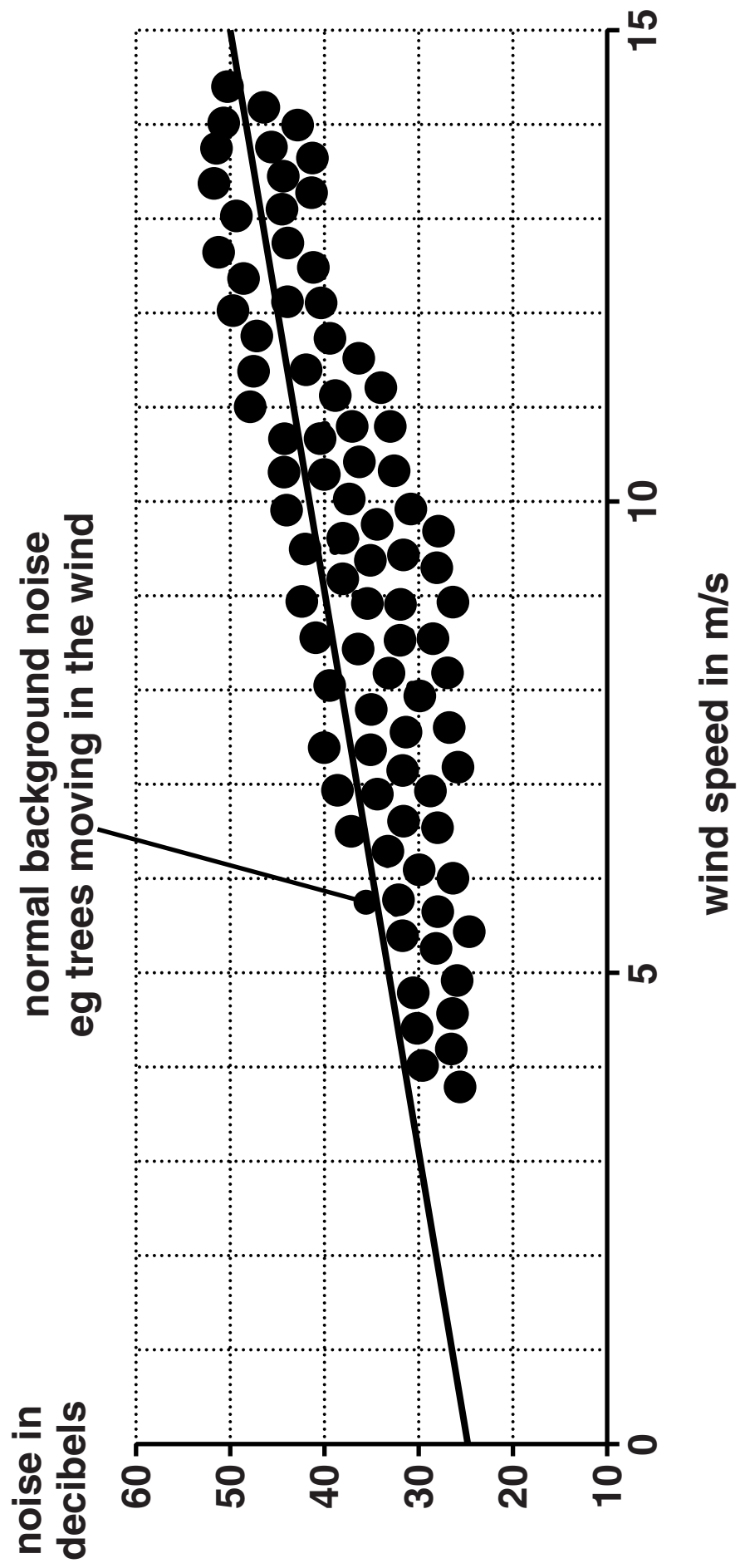
- (ii) The mean wind speed in this area is 5 m/s.**

**The maximum wind speed in this area is usually less than 15 m/s.**

**Explain, using data from the graph, why the people in the house DO NOT normally need to worry about the noise from the turbine.**

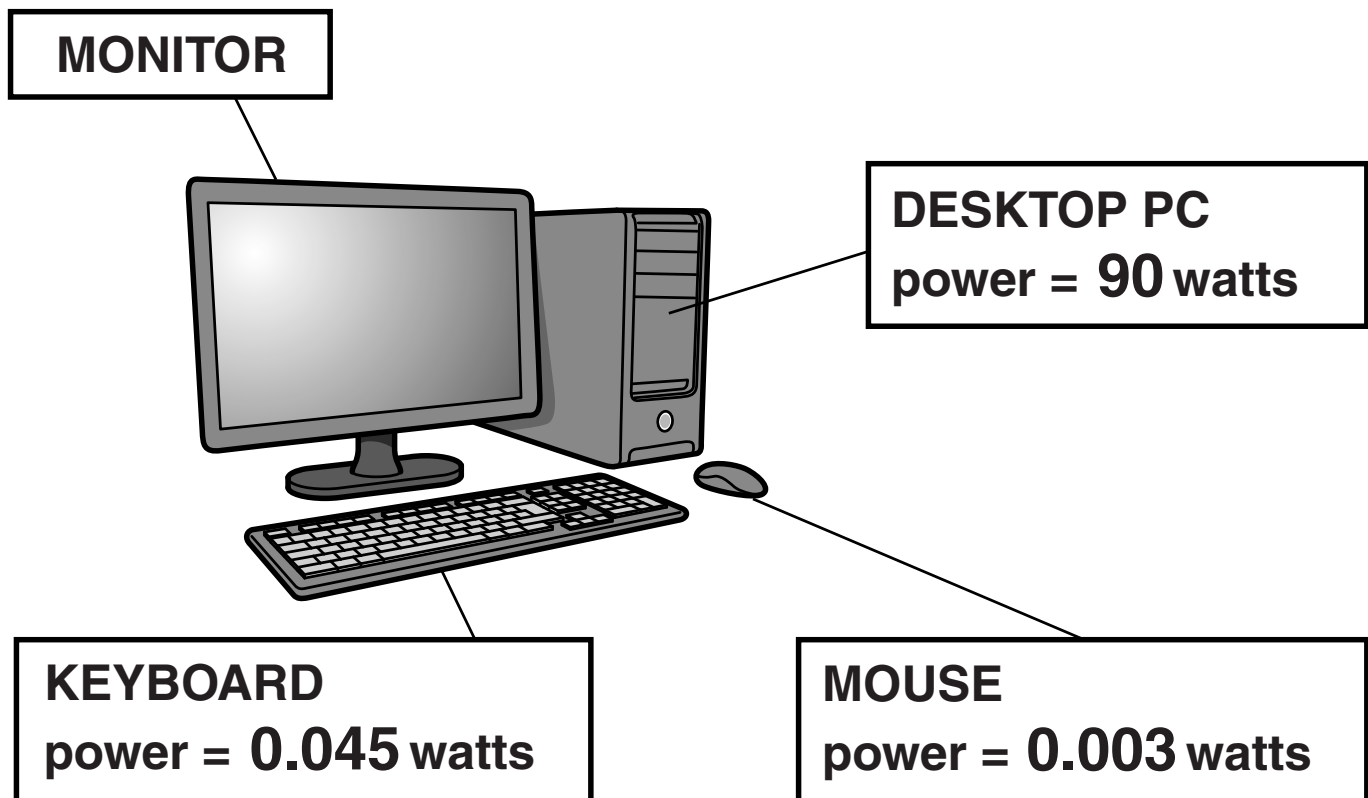
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ **[2]**

**[TOTAL: 5]**



**8 Kyle has a wireless computing system.**

**Look at the information in the diagram.**



- (a) The monitor plugs into a 230V supply and uses a current of 0.5 A.**

**Calculate the power of the monitor in kilowatts.**

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

**[2]**



- (b) The energy supplied to the desktop pc in a day is **0.45** kilowatt hours.

How many hours does Kyle use the desktop pc for that day?

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answer \_\_\_\_\_ hours [2]

- (c) The monitor and the desktop pc are connected to a **230V** supply.

The mouse and the keyboard use **3V** batteries.

Put the four parts of the system in order of the size of current used.

One has been done for you.

highest current \_\_\_\_\_

\_\_\_\_\_

keyboard

\_\_\_\_\_

lowest current \_\_\_\_\_ [1]

**(d) Increasing the use of technology has increased energy consumption.**

**This may have contributed to global warming.**

**People have different views about reducing energy use.**

**Fatima thinks that it would help if everyone changed to using low energy light bulbs.**

**Claire thinks we could all reduce energy use by walking instead of driving cars.**

**Analyse these views and discuss how effective they could be for reducing global warming.**

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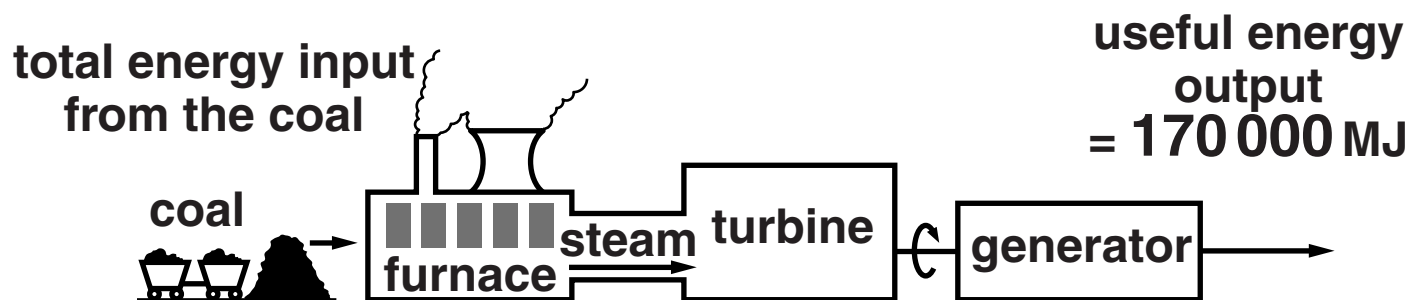
[2]

**[TOTAL: 7]**

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**QUESTION 9 BEGINS ON PAGE 36**

## 9 Electricity is generated in power stations.



(a) The efficiency of this power station is 34%.

Calculate the total energy input from the coal.

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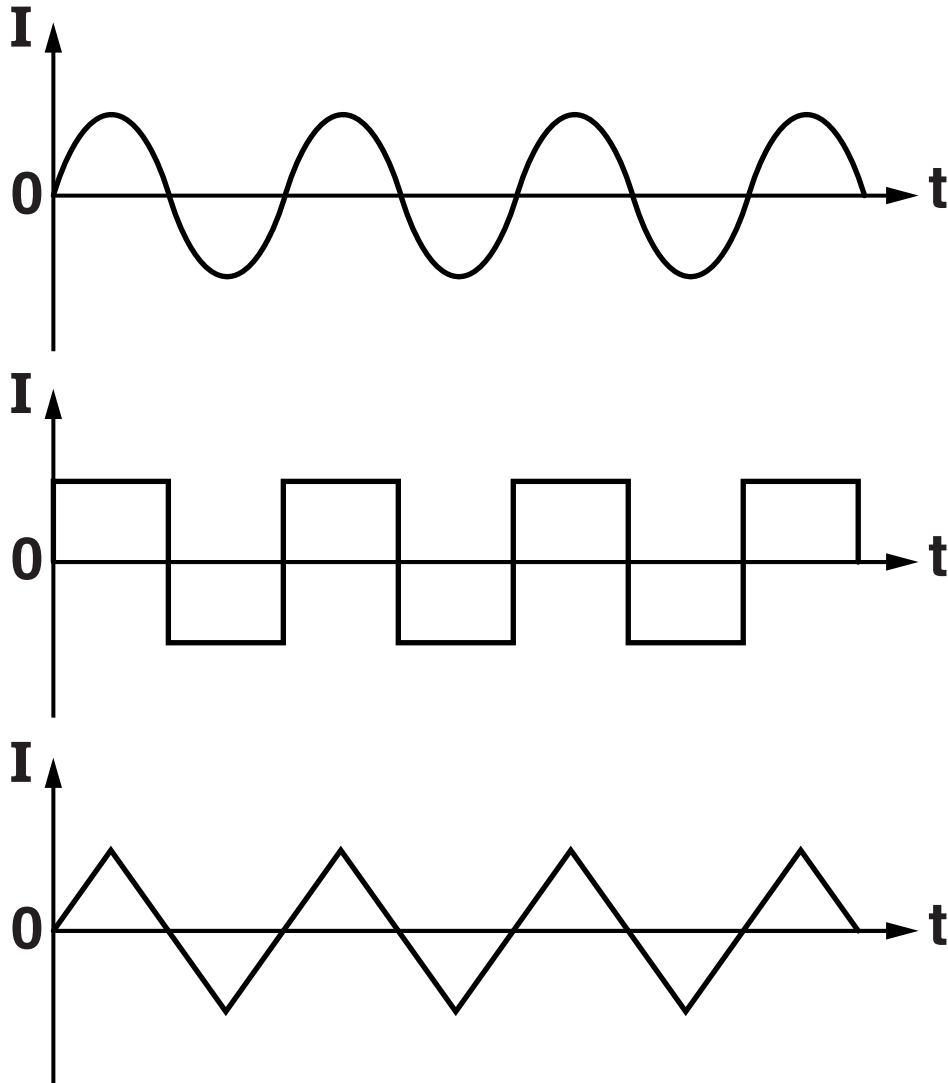
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answer \_\_\_\_\_ MJ

[1]

- (b) The generator in the power station produces alternating current (AC).

Look at the three different current-time graphs.



Describe why all the graphs show alternating currents.

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[1]

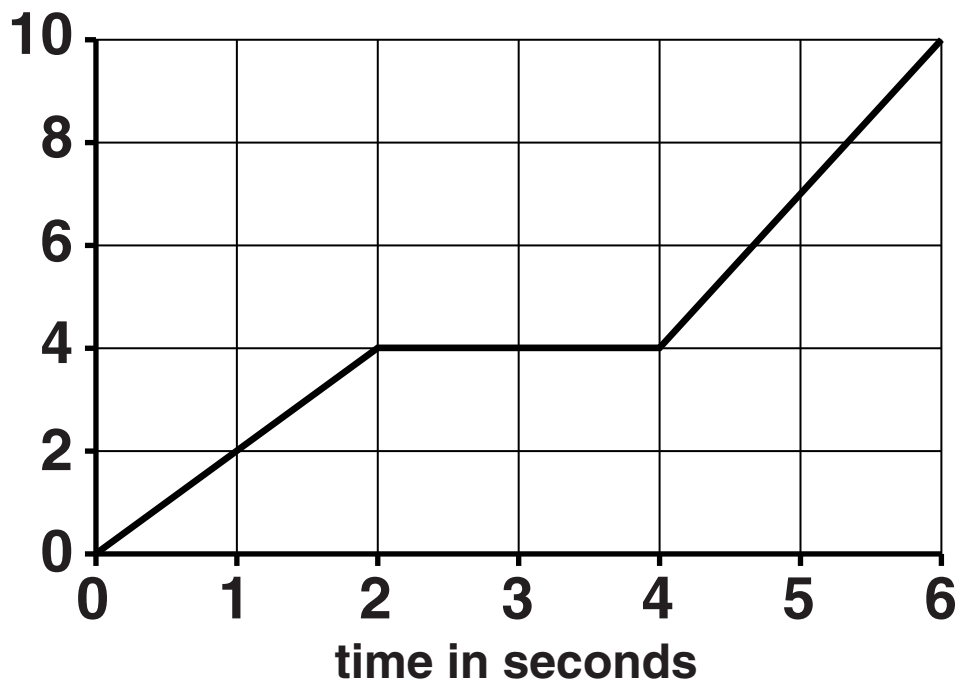
[TOTAL: 2]

## SECTION C – Module P3

10 Daisy uses her remote controlled model car.

Look at the simple velocity-time graph for this car.

velocity  
in m/s



[illegible]

**[6]**

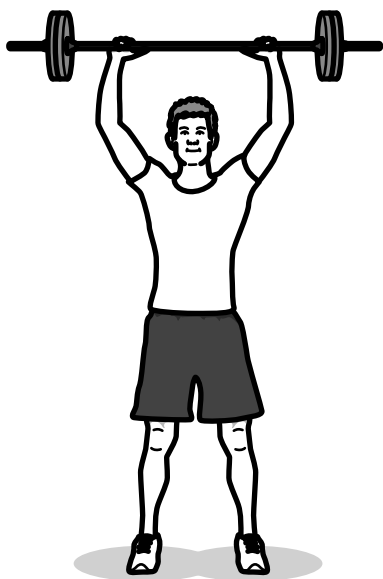
39

**11 Hossein is a weightlifter.**

**His best lift in training is a bar with a mass of 250kg.**

**He does 5000 J of work on the bar with a mass of 250kg when he lifts it.**

**The gravitational field strength (g) on Earth is 10 N/kg.**



**Calculate the weight of this 250kg mass, and how high Hossein lifts the bar.**

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**weight = \_\_\_\_\_ N**

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**height lifted = \_\_\_\_\_ m [3]**

**[TOTAL: 3]**



**12 Aditi looks at the table of stopping distances for a car.**

| <b>Speed<br/>in m/s</b> | <b>Thinking<br/>distance<br/>in m</b> | <b>Braking<br/>distance<br/>in m</b> | <b>Stopping<br/>distance<br/>in m</b> |
|-------------------------|---------------------------------------|--------------------------------------|---------------------------------------|
| <b>4.5</b>              | <b>3</b>                              | <b>1.5</b>                           | <b>4.5</b>                            |
| <b>9</b>                | <b>6</b>                              | <b>6</b>                             | <b>12</b>                             |
| <b>18</b>               |                                       |                                      |                                       |
| <b>27</b>               |                                       |                                      |                                       |

**The thinking, braking and stopping distances change with speed.**

**(a) The thinking time for the driver does NOT change with speed.**

**Calculate the thinking time for the driver in seconds.**

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

**[2]**

**(b) Aditi says that at 18 m/s the thinking distance is 9 m.**

**Is she correct?** \_\_\_\_\_

**Explain your answer.**

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

**(c) Aditi says that at 27 m/s the braking distance is 18 m.**

**Is she correct?** \_\_\_\_\_

**Explain your answer using the data in the table and ideas about energy.**

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

**(d) Complete the sentences.**

**Stopping distances increase with speed and depend on thinking and braking.**

**The thinking distance is the \_\_\_\_\_  
while the driver is reacting.**

**Thinking distance increases with speed but also  
increases if this driver is \_\_\_\_\_  
\_\_\_\_\_ .**

**Braking distance increases with speed but also  
increases if the road \_\_\_\_\_  
or the tyres \_\_\_\_\_ . [3]**

**[TOTAL: 10]**

### 13 Modern cars have many safety features.

Some features protect people in a crash.

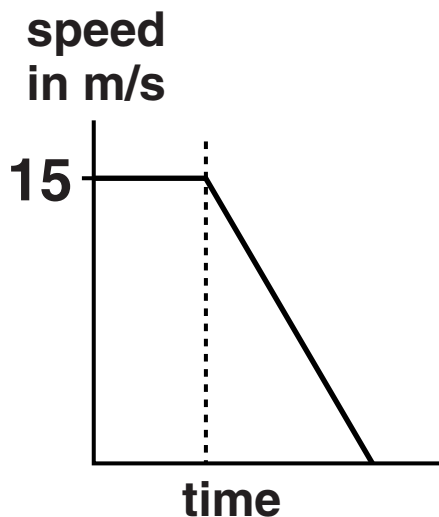
Scientists use crash dummies inside real cars to determine their safety ratings.

(a) Look at the data from two crash tests at **15 m/s**.

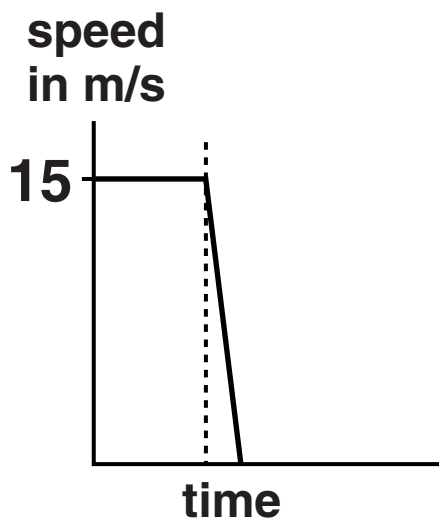
One is for a MODERN car.

The other is for an OLD car.

#### MODERN CAR



#### OLD CAR



**The forces on the crash dummies in the old car are much higher.**

**Old cars do not have crumple zones.**

**Use the information in the graphs to explain why crumple zones in modern cars reduce forces on crash dummies.**

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[3]

**(b) More effort is now being made to keep pedestrians safer in car crashes.**

**(i) Scientists use dummies and cars in tests to improve pedestrian safety.**

**Describe the steps that scientists take when carrying out these tests.**

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[2]

**(ii) These scientists will publish their results.**

**Why is it important to publish these results?**

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**[1]**

**[TOTAL: 6]**

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