

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**  
**GCSE (9–1)**  
**J250/06**

**COMBINED SCIENCE**  
**(PHYSICS) A (GATEWAY SCIENCE)**  
**Paper 6, P4–P6 and CS7 (PAGs P1–P6)**  
**(Foundation Tier)**

**FRIDAY 15 JUNE 2018: Morning**  
**TIME ALLOWED: 1 hour 10 minutes**  
**plus your additional time allowance**  
**MODIFIED ENLARGED 24pt**

<b>First name</b>		<b>Last name</b>	
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<b>Centre number</b>						<b>Candidate number</b>				
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**YOU MUST HAVE:**

**a ruler (cm/mm)**  
**the Data Sheet**

**YOU MAY USE:**

**a scientific or graphical calculator**  
**an HB pencil**

**READ INSTRUCTIONS OVERLEAF**



# **INSTRUCTIONS**

**The Data Sheet will be found with this document.**

**Use black ink. You may use an HB pencil for graphs and diagrams.**

**Complete the boxes on the front page with your name, centre number and candidate number.**

**Answer ALL the questions.**

**Write your answer to each question in the space provided.**

**Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).**

# **INFORMATION**

**The total mark for this paper is 60.**

**The marks for each question are shown in brackets [ ].**

**Quality of extended responses will be assessed in questions marked with an asterisk (\*).**

## **SECTION A**

**Answer ALL the questions.**

**You should spend a maximum of  
20 minutes on this section.**

- 1 A transverse wave and a longitudinal wave travel in the direction shown by the arrow.



The table shows how the particles in these waves vibrate as the waves travel.

	Transverse wave	Longitudinal wave
A		
B		
C		
D		

Which row of the table is correct? [1]

Your answer

**2 Which of these electromagnetic waves has the SMALLEST wavelength? [1]**

**A Gamma-ray**

**B Micro-wave**

**C Radio wave**

**D X-ray**

**Your answer**

**3 Atoms contain electrons. An atom can lose its outer electrons.**

**What is this process called? [1]**

**A Friction**

**B Ionisation**

**C Radiation**

**D Radioactive decay**

**Your answer**

**4 Energy is transferred when a machine is switched on.**

- **1000 J is the INPUT ENERGY TRANSFER**
- **750 J is USEFUL OUTPUT ENERGY TRANSFER**

**Use the equation: Efficiency = Useful output energy transfer ÷ Input energy transfer**

**Calculate the efficiency of this machine.**  
**[1]**

- A 0**
- B 0.25**
- C 0.75**
- D 750**

**Your answer**



**5 What is the speed of sound in air? [1]**

**A 30 m/s**

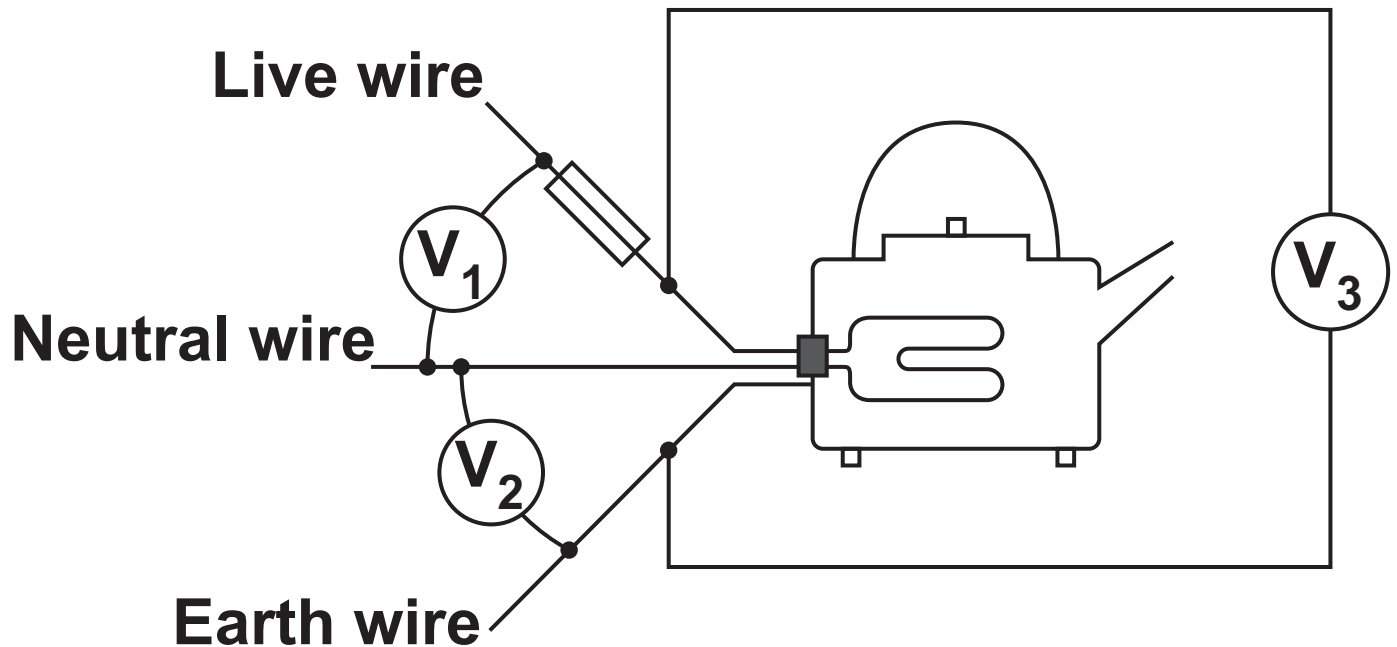
**B 100 m/s**

**C 340 m/s**

**D 300 000 000 m/s**

**Your answer**

- 6 An electric kettle is plugged into a socket. The kettle is switched on. A qualified electrician uses three voltmeters,  $V_1$ ,  $V_2$  and  $V_3$ .



Use the relationship:  $V_3 = V_1 + V_2$

**Which row in the table, A, B, C or D, shows the correct readings for the three voltmeters? [1]**

	$V_1$ (V)	$V_2$ (V)	$V_3$ (V)
<b>A</b>	<b>0</b>	<b>230</b>	<b>230</b>
<b>B</b>	<b>230</b>	<b>0</b>	<b>230</b>
<b>C</b>	<b>230</b>	<b>230</b>	<b>0</b>
<b>D</b>	<b>0</b>	<b>0</b>	<b>230</b>

**Your answer**

**7 An element gives out a beta ( $\beta$ ) particle.**

**The table shows how the atomic number and mass number of the element change.**

	<b>Atomic number</b>	<b>Mass number</b>
<b>A</b>	<b>Decreases by 2</b>	<b>Decreases by 4</b>
<b>B</b>	<b>Decreases by 4</b>	<b>Decreases by 2</b>
<b>C</b>	<b>Increases by 1</b>	<b>Stays the same</b>
<b>D</b>	<b>Stays the same</b>	<b>Increases by 1</b>

**Which row of the table is correct? [1]**

**Your answer**

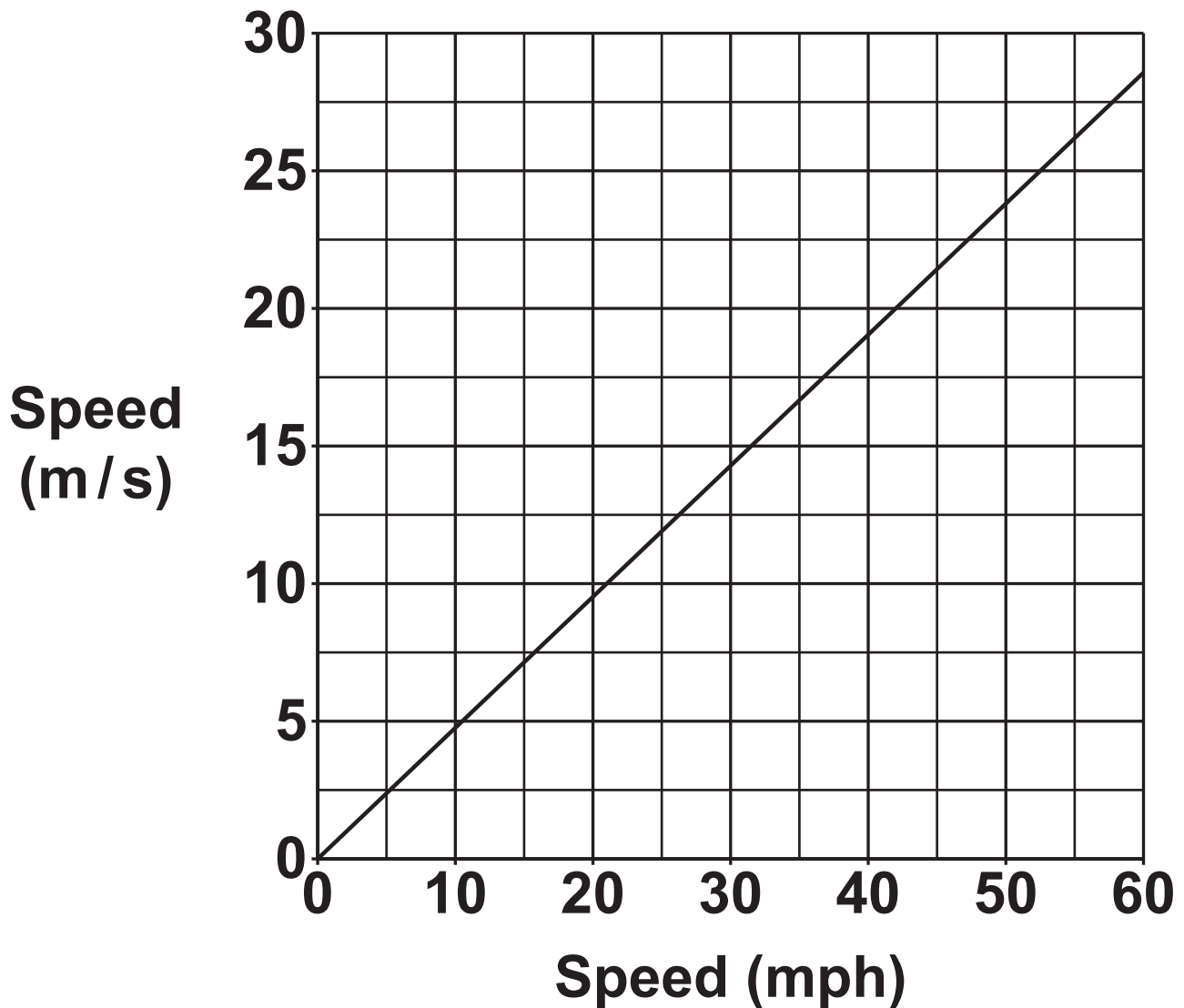
**8 A moving car crashes into a wall.**

**Which row in the table describes one of the energy transfers? [1]**

	<b>Energy store before crash</b>	<b>Energy store after crash</b>
<b>A</b>	<b>Chemical</b>	<b>Electrical</b>
<b>B</b>	<b>Gravitational</b>	<b>Electrical</b>
<b>C</b>	<b>Kinetic</b>	<b>Gravitational</b>
<b>D</b>	<b>Kinetic</b>	<b>Thermal</b>

**Your answer**

- 9 The graph shows how speed in miles per hour (mph) is related to speed in metres per second (m/s).



A car travels at 20 mph.

**What is the speed of this car in m/s? [1]**

**A 8m/s**

**B 9m/s**

**C 43m/s**

**D 45m/s**

**Your answer**

**10 A car travels at a speed of 10 m/s. The mass of the car is 800 kg.**

**Use the equation:**

$$\text{Kinetic energy} = 0.5 \times \text{Mass} \times \text{Speed}^2$$

**What is the kinetic energy of this car? [1]**

**A 4000 J**

**B 8000 J**

**C 40 000 J**

**D 80 000 J**

**Your answer**



## SECTION B

Answer ALL the questions.

11 This question is about radioactivity.

(a) Two isotopes of nitrogen are shown below.



Explain what is meant by the term ISOTOPES.

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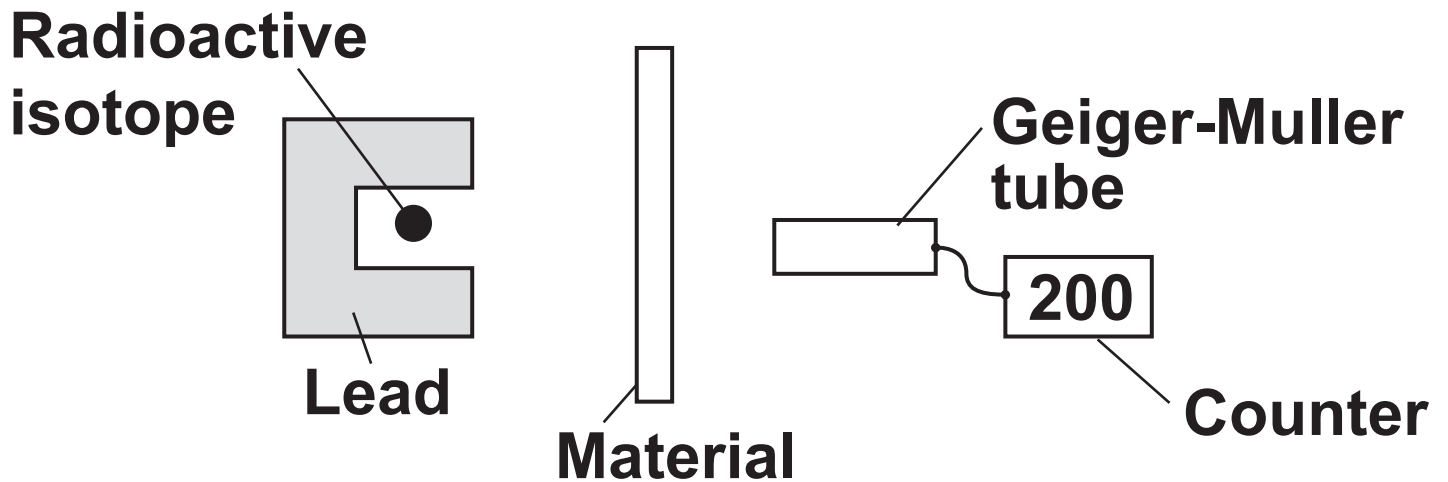
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[2]

(b) A teacher shows his class an experiment. The teacher wants to identify the type of radiation given out by a radioactive isotope.

He uses a Geiger-Muller tube connected to a counter to measure the count rate.

He places different materials between the radioactive isotope and the Geiger-Muller tube.



The table shows the count rate for different materials.

Material	Count rate
No material (air)	200
Thick paper	200
Thin aluminium	197
Thick lead	3

- (i) Suggest why the teacher places lead around most of the radioactive isotope.**

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**[1]**

- (ii) There are three types of radiation, alpha, beta and gamma.**

**Which type of radiation is given out by the radioactive isotope?**

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**Explain your answer.**

**Use the data in the table to help.**

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**[3]**

**12 The table shows some information about electrical appliances in the home.**

<b>Appliance</b>	<b>Power (W)</b>	<b>Current (A)</b>	<b>Resistance (<math>\Omega</math>)</b>
<b>Hairdryer</b>	<b>1800</b>	<b>7.8</b>	<b>29.6</b>
<b>Heater</b>	<b>800</b>	<b>3.5</b>	<b>66.1</b>
<b>Iron</b>	<b>2000</b>	<b>8.7</b>	<b>26.4</b>
<b>Kettle</b>	<b>2500</b>	<b>10.9</b>	<b>21.0</b>

**(a) A teacher says: ‘As power increases, resistance increases’**

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

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

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**[2]**

**(b) The kettle is switched on for 60 seconds.**

**Calculate the energy transferred.**

**Answer = \_\_\_\_\_ J [3]**

**(c) Electricity companies do not use joules (J) in electricity bills. Electricity companies use kilowatt-hours (kWh).**

**(i) A hairdryer has a power of 1800 W.**

**What is the POWER of the hairdryer in kilowatts (kW)?**

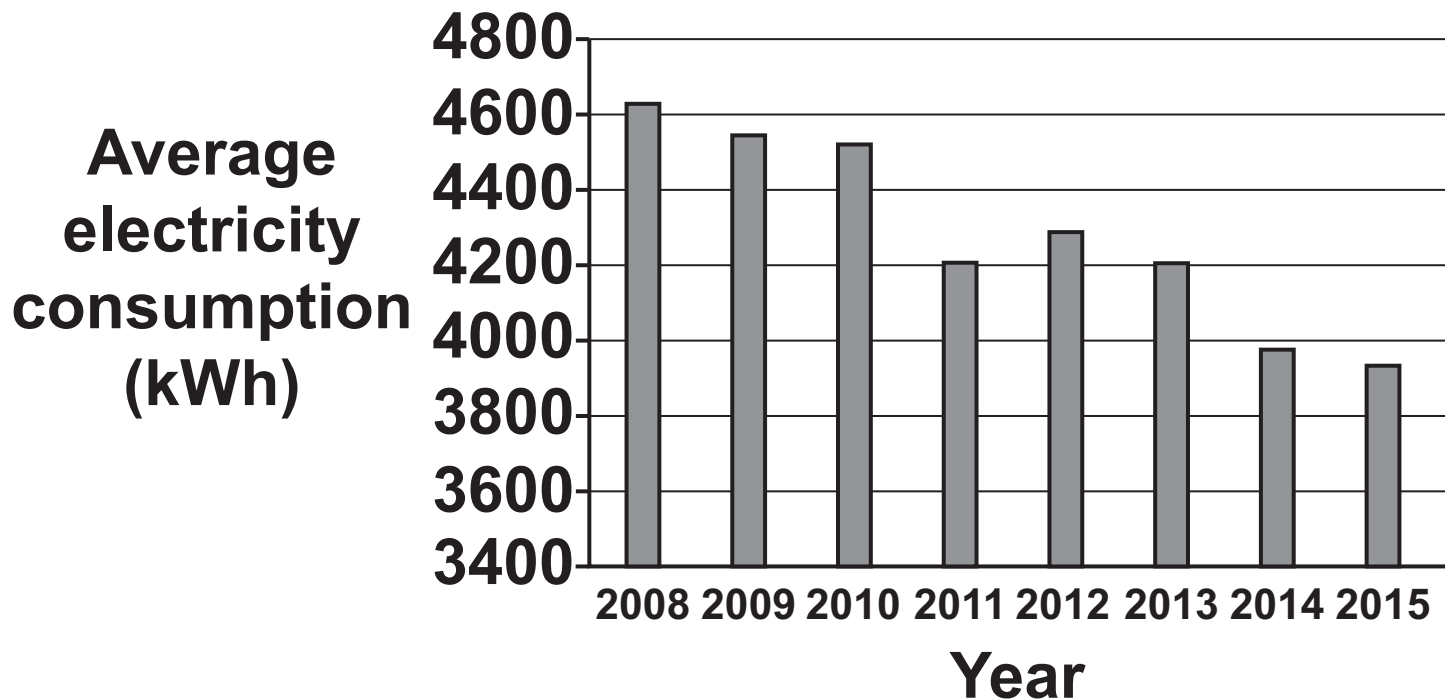
**Answer = \_\_\_\_\_ kW [1]**

**(ii) Suggest why electricity companies charge for electricity using kWh.**

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

**(d) The average electricity consumption per household changes every year.**

**The graph shows how this changes from the year 2008 to the year 2015.**



**Describe AND explain the trend shown by the graph.**

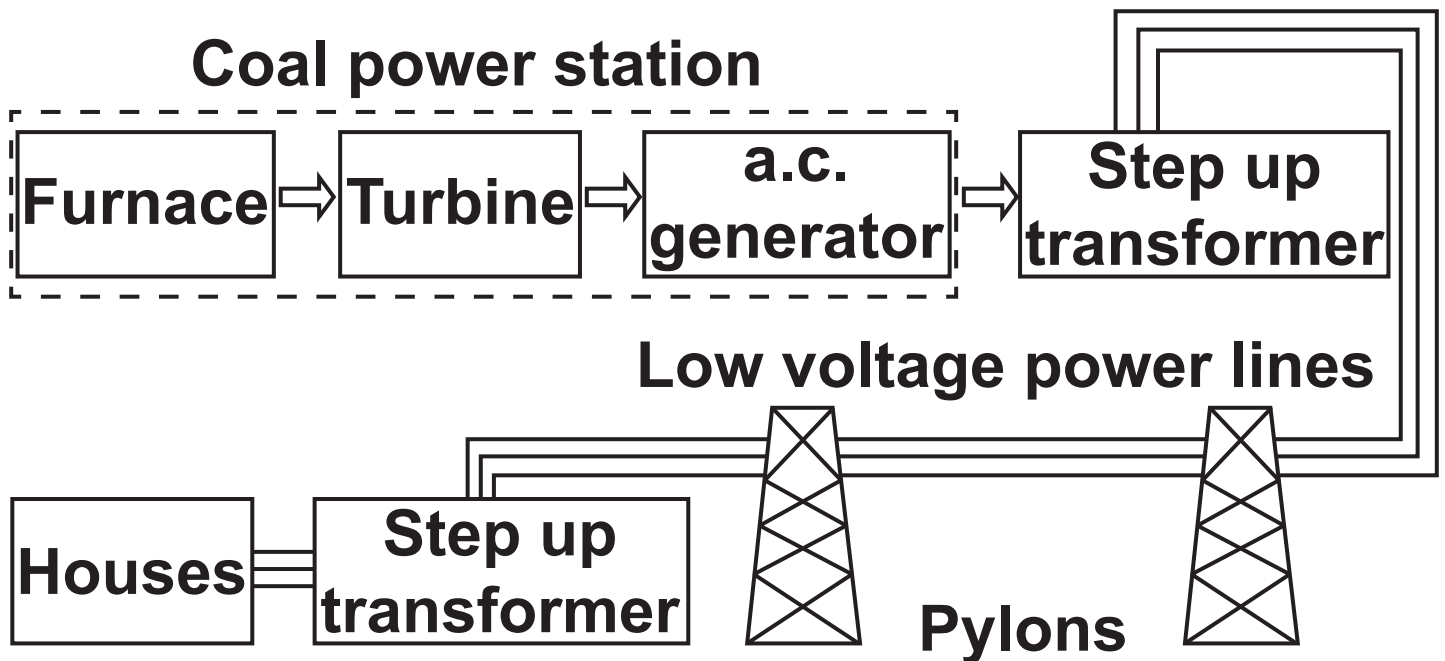
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[2]

**13 A student draws a diagram to show the national grid.**



**(a) State the TWO mistakes in the diagram. [2]**

1. \_\_\_\_\_

\_\_\_\_\_

2. \_\_\_\_\_

\_\_\_\_\_



**(b) The national grid uses transformers.**

**Explain how using transformers makes the national grid more efficient.**

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[2]

**(c) Explain the difference between direct voltage and alternating voltage.**

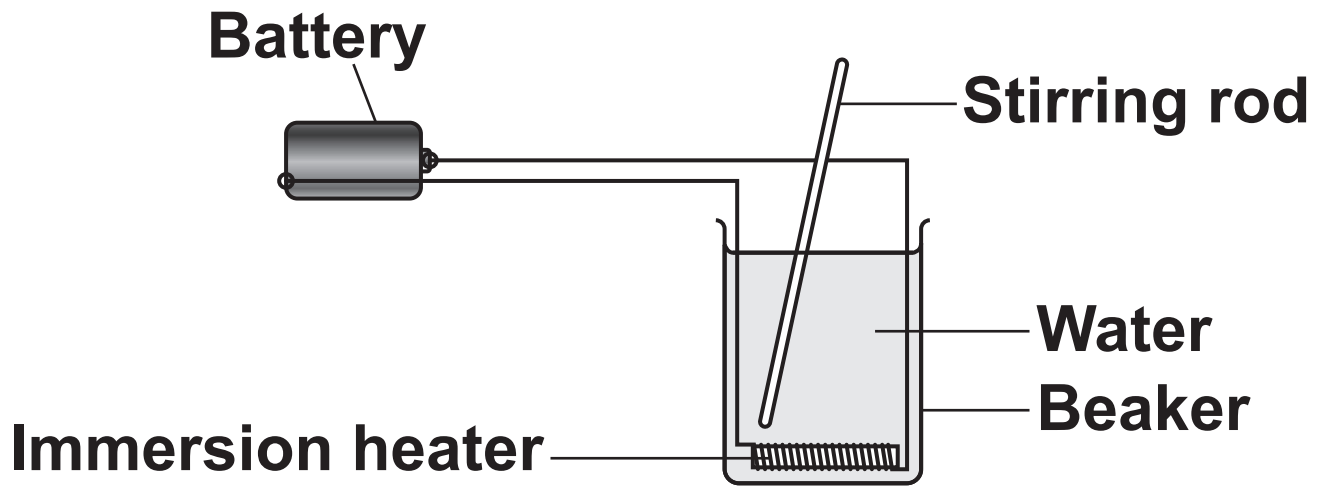
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[2]

**14 A scientist does an experiment to measure the energy transferred to water.**



**She uses an immersion heater to increase the temperature of the water.**

**The scientist uses this apparatus:**

**A beaker**

**An immersion heater**

**A stirring rod**

**A 12V battery and wires.**

**(a) What two OTHER pieces of apparatus does the scientist need for this experiment? [2]**

**1. \_\_\_\_\_**

**2. \_\_\_\_\_**

**(b) (i) Explain how the scientist could reduce energy transfer to the surroundings.**

\_\_\_\_\_

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

**(ii) The immersion heater is placed at the bottom of the beaker.**

**Suggest why.**

\_\_\_\_\_

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

**(c) The heater is connected to a battery.  
When the heater is turned on,  
energy is transferred.**

**Describe this energy transfer.**

**Use ideas about energy stores.**

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**[2]**

- (d) (i) The current through the heater is 3.8 A. The potential difference across the heater is 9.0 V.**

**Use the equation: Power =  
Potential difference  $\times$  Current**

**Calculate the power of the  
immersion heater.**

**Answer = \_\_\_\_\_ W [2]**

- (ii) The scientist writes down more information about her experiment.

Mass of water = 150 g

Specific heat capacity of water  
= 4200 J / kg °C

Temperature increase of water  
= 10 °C

Calculate the change in thermal energy of the water.

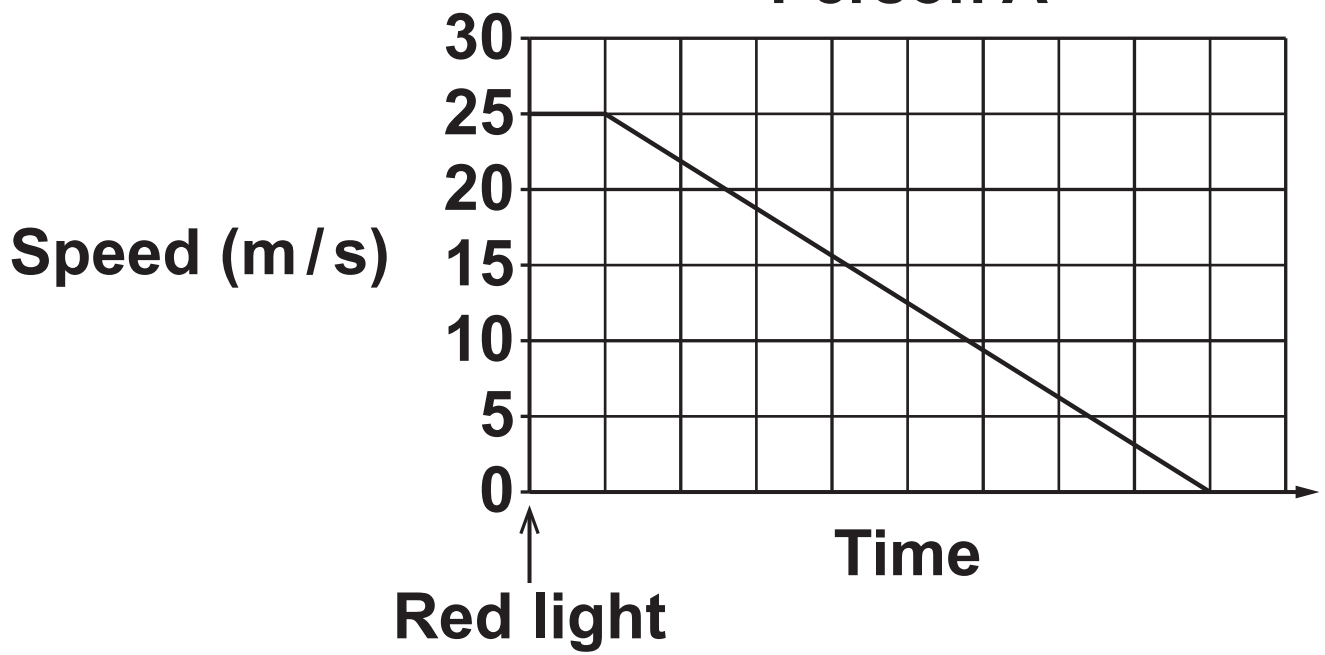
Answer = \_\_\_\_\_ J [3]

**15\* Person A and person B drive their cars along the same road on different days. Both cars travel at 25 m/s.**

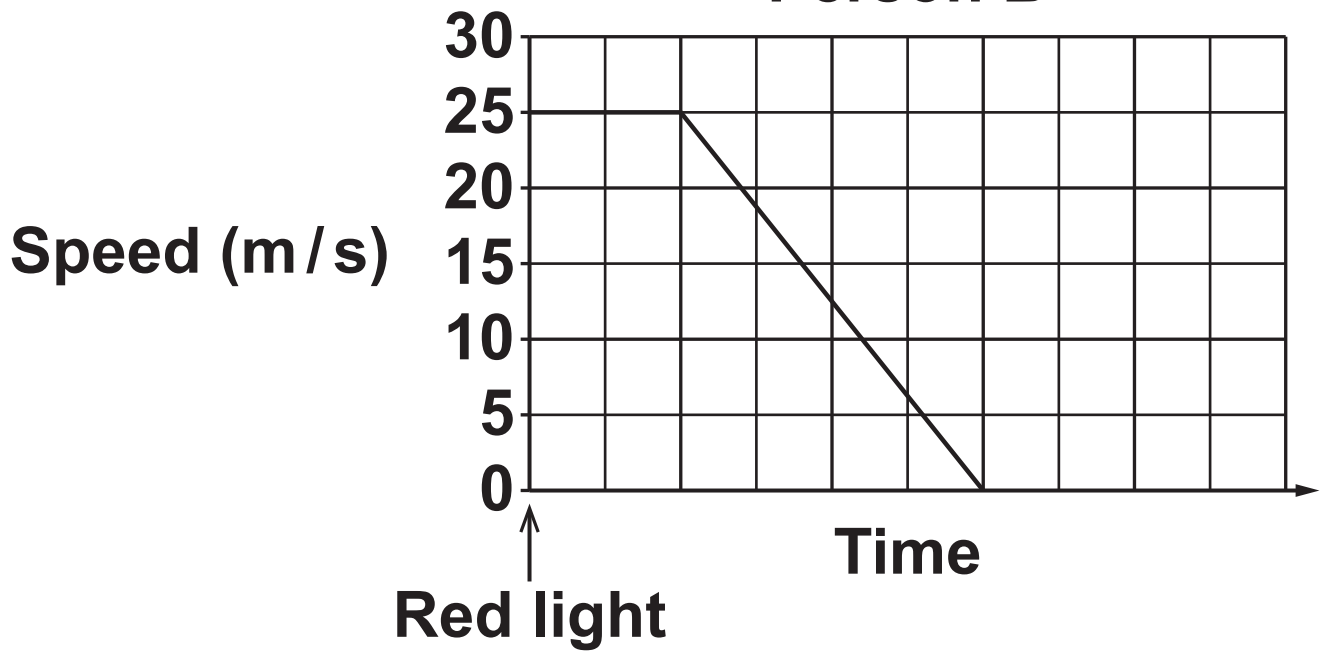
**The traffic lights along the road change to red. Person A and person B see the red light and press the brakes in their car.**

**The graphs on the next page show the speed of each car AFTER person A and person B see the red light.**

**Person A**



**Person B**





**The graphs are drawn using the same scale.**

**Describe the different ways the cars come to a stop.**

**In your answer:**

**Suggest reasons why the cars take different times to stop**

**Write about thinking and braking. [6]**

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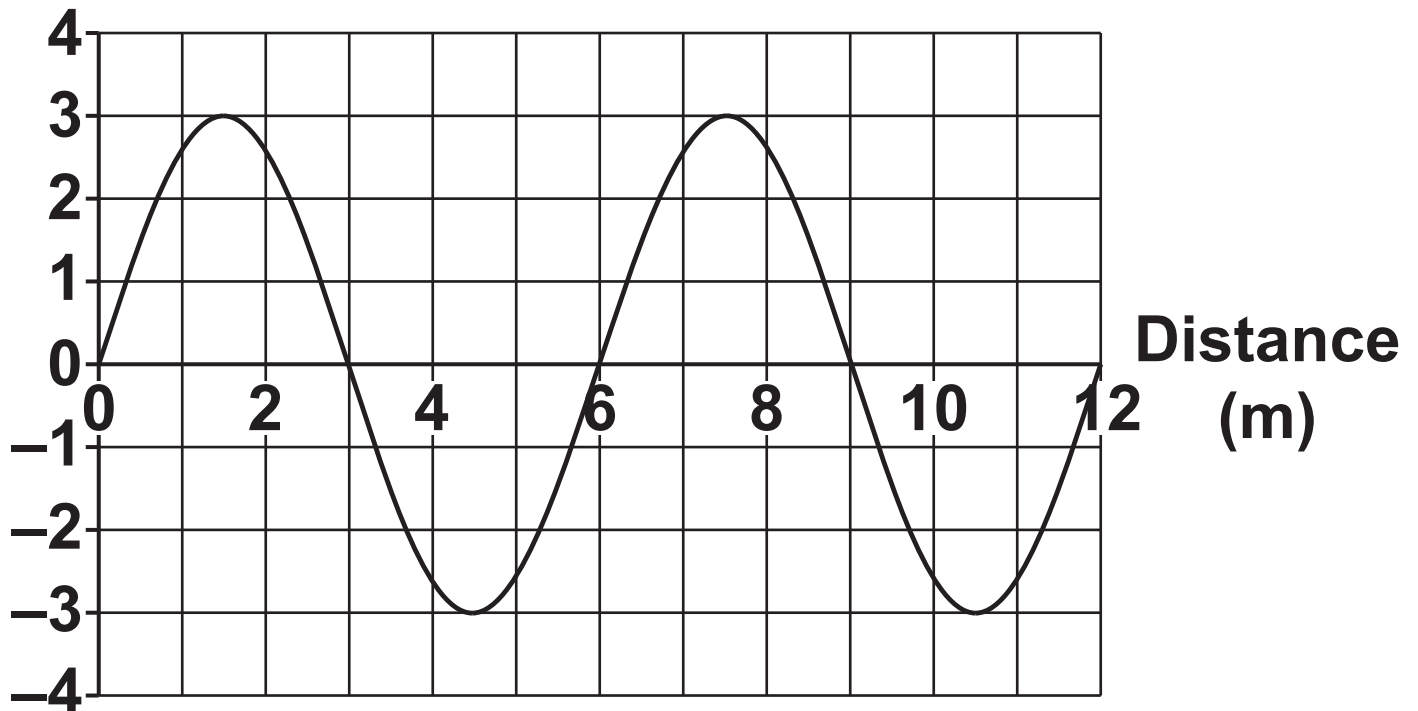
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**16 The graph shows how the height of a water wave changes with distance.**

**Height**

**(m)**



**(a) The water wave has a wavelength of 6 m.**

**Describe how the graph shows this.**

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**[1]**

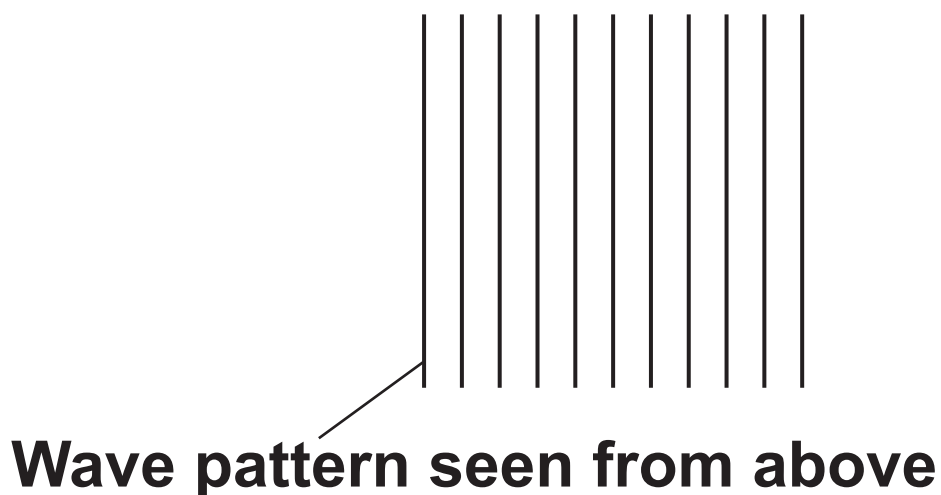
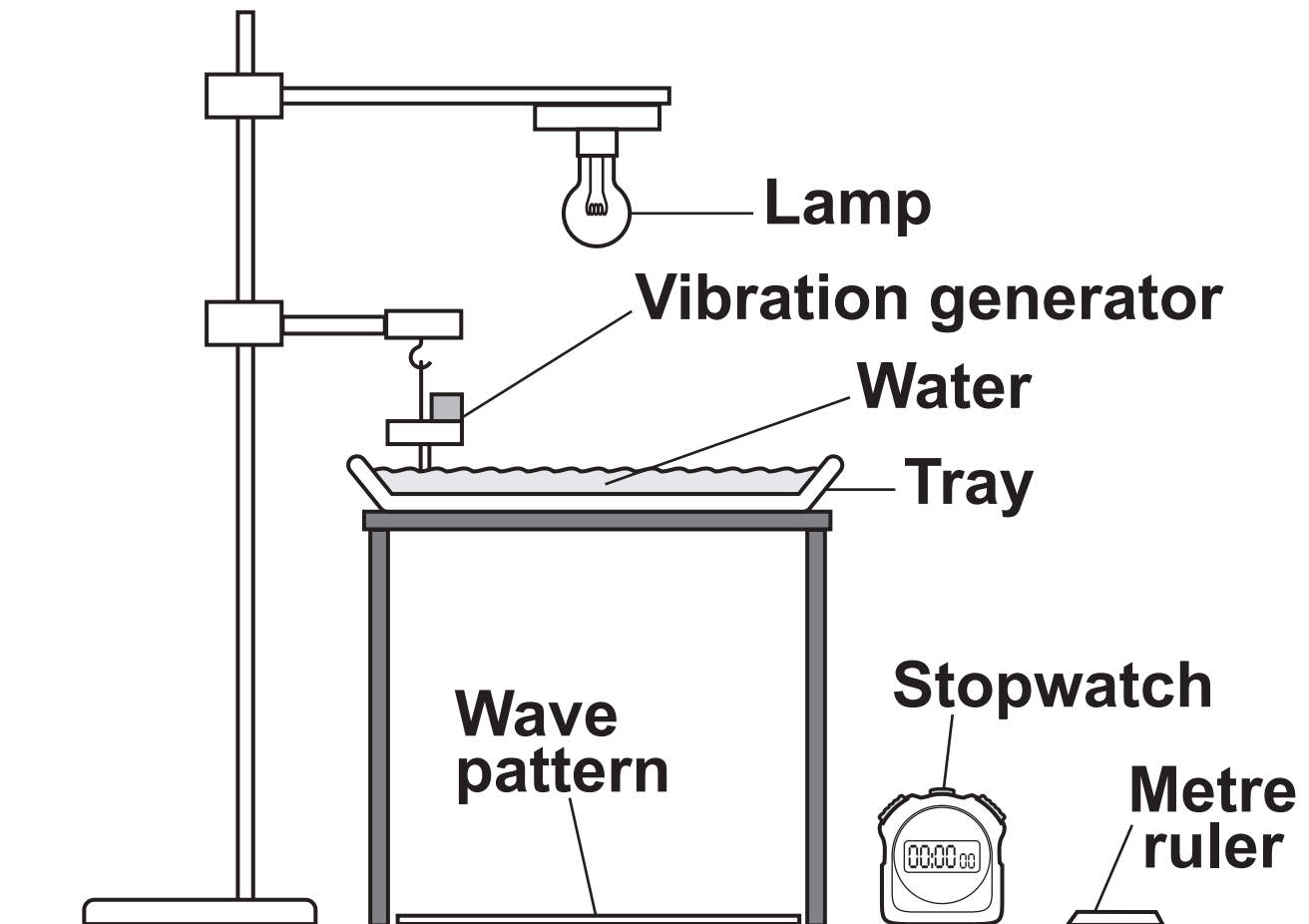
**(b) The frequency of the water wave is 0.5 Hz.**

**Calculate the speed of this water wave.**

**Answer = \_\_\_\_\_ m/s [3]**

(c) A group of students use a ripple tank, a metre ruler and a stopwatch.

They draw a diagram of this equipment.



**Explain how this equipment is used to measure the frequency of water waves.**

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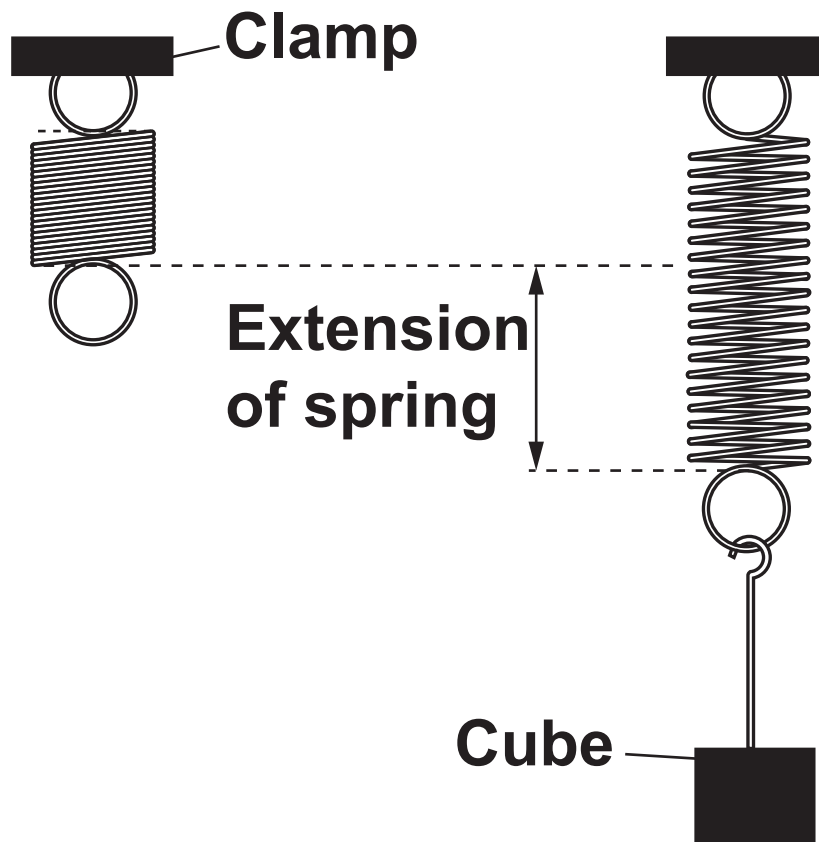
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**[2]**

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**17 A student measures the extension of a spring when it is stretched.**

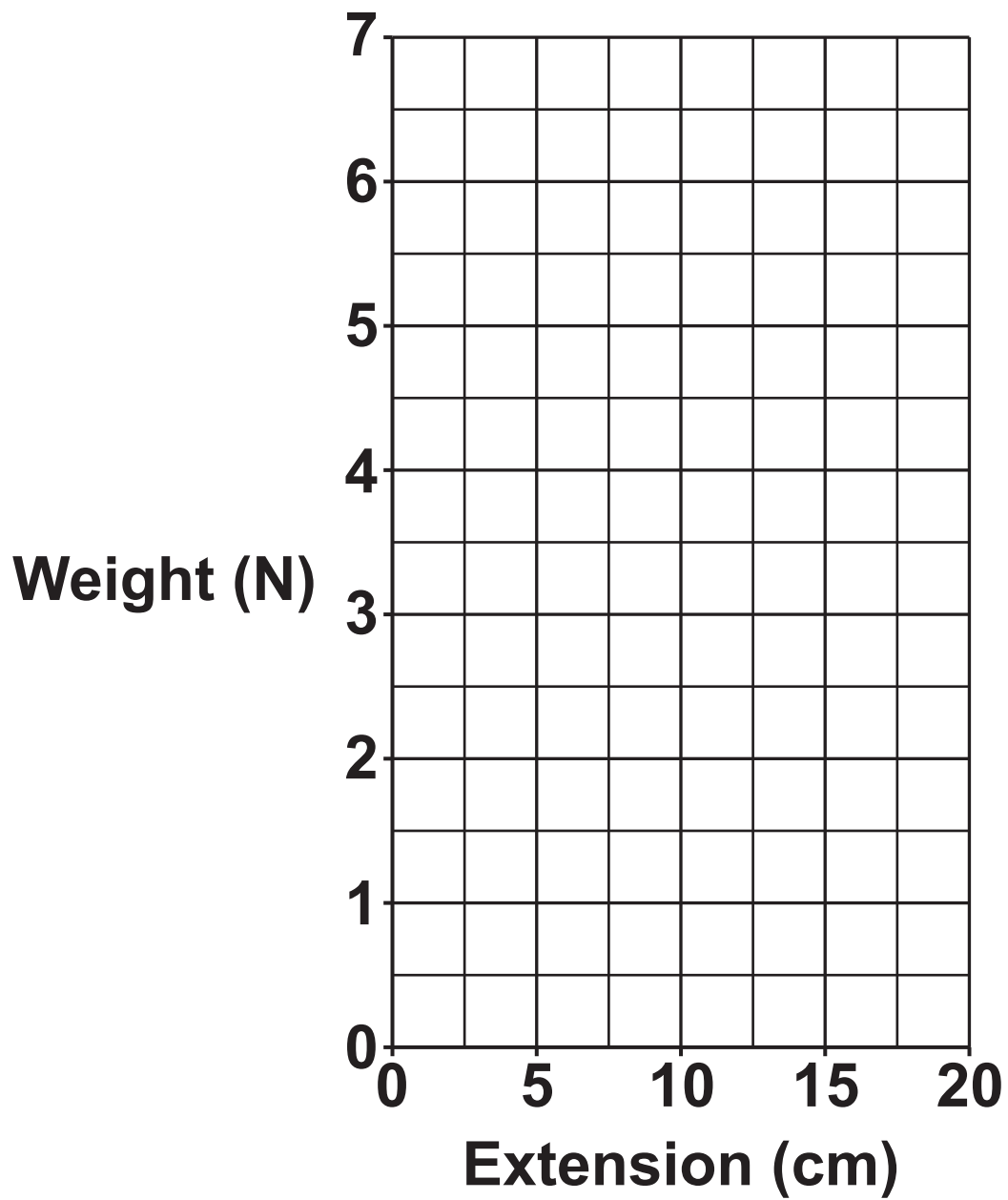


**He hangs different cubes from the spring. He measures the extension of the spring for each cube.**

**Look at his results.**

<b>Weight of cube (N)</b>	<b>Extension of spring (cm)</b>
<b>1.0</b>	<b>2.9</b>
<b>3.0</b>	<b>8.4</b>
<b>4.0</b>	<b>11.4</b>
<b>5.0</b>	<b>14.4</b>
<b>7.0</b>	<b>20.0</b>

**(a) Plot a graph of the results on the grid. [1]**



**(b) Use the results and the graph to show the spring constant is 35 N/m.**

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**[3]**

**(c) The spring constant is 35 N/m.**

**Calculate the energy transferred to this spring when the extension is 0.2 m.**

**Answer = \_\_\_\_\_ J [2]**

**END OF QUESTION PAPER**

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