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GCSE (9–1) Combined Science (Physics) A (Gateway Science)

J250/06 Paper 6, P4–P6 and CS7 (PAGs P1–P6)

(Foundation Tier)

Friday 15 June 2018 – Morning

Time allowed: 1 hour 10 minutes

You must have:
- a ruler (cm/mm)
- the Data Sheet (inserted for GCSE Combined Science A (Physics))

You may use:
- a scientific or graphical calculator
- an HB pencil

First name	
Last name	
Centre number	Candidate number

INSTRUCTIONS
- The Data Sheet will be found inside this document.
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above 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).
- Do **not** write in the barcodes.

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 (*).
- This document consists of **24** pages.

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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?

Your answer ☐ **[1]**

2 Which of these electromagnetic waves has the **smallest** wavelength?

A Gamma-ray

B Micro-wave

C Radio wave

D X-ray

Your answer ☐ **[1]**

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

What is this process called?

A Friction

B Ionisation

C Radiation

D Radioactive decay

Your answer ☐ **[1]**

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.

A 0

B 0.25

C 0.75

D 750

Your answer ☐ **[1]**

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5 What is the speed of sound in air?

A 30 m/s

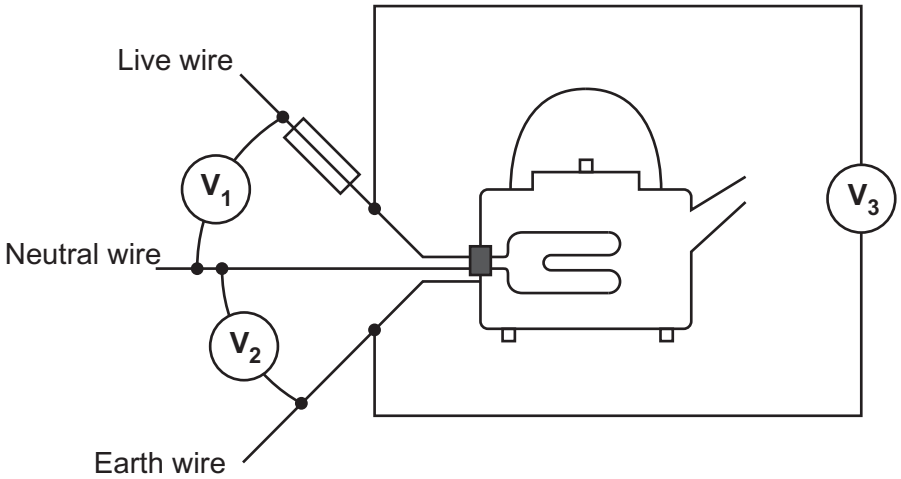
B 100 m/s

C 340 m/s

D 300 000 000 m/s

Your answer ☐ **[1]**

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



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?

	$\mathbf{V_1}$ (V)	$\mathbf{V_2}$ (V)	$\mathbf{V_3}$ (V)
A	0	230	230
B	230	0	230
C	230	230	0
D	0	0	230

Your answer ☐ **[1]**

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7 An element gives out a beta (β) particle.

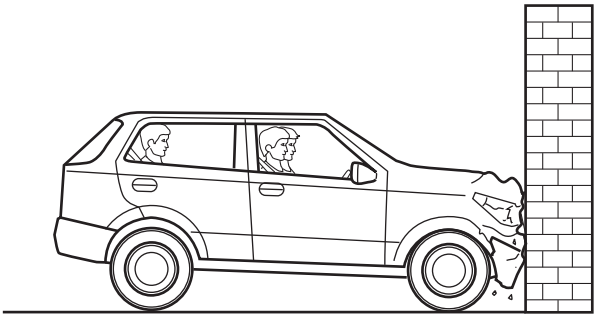
The table shows how the atomic number and mass number of the element change.

	Atomic number	**Mass number**
A	Decreases by 2	Decreases by 4
B	Decreases by 4	Decreases by 2
C	Increases by 1	Stays the same
D	Stays the same	Increases by 1

Which row of the table is correct?

Your answer ☐ **[1]**

8 A moving car crashes into a wall.



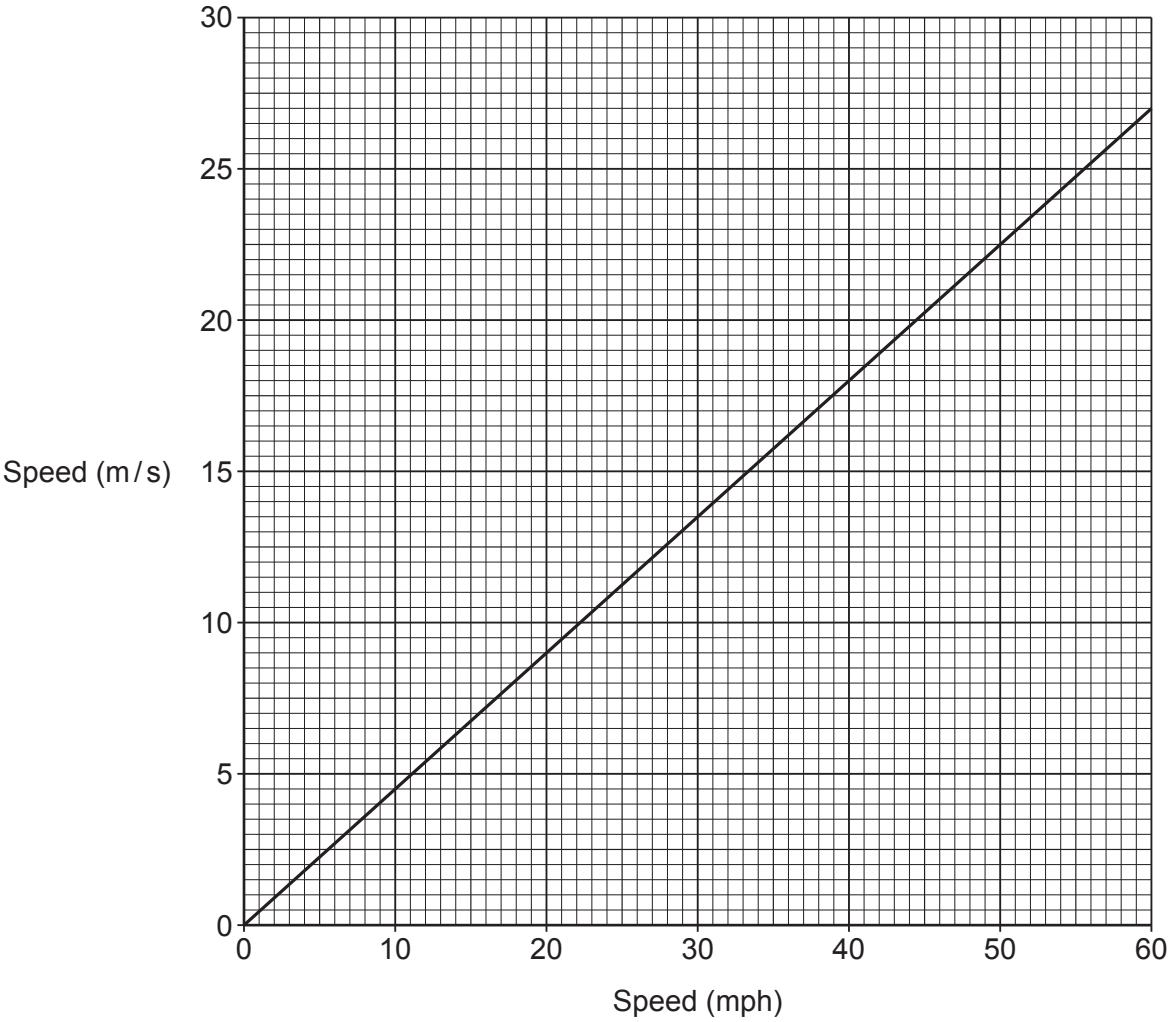
Which row in the table describes one of the energy transfers?

	Energy store before crash	**Energy store after crash**
A	Chemical	Electrical
B	Gravitational	Electrical
C	Kinetic	Gravitational
D	Kinetic	Thermal

Your answer ☐ **[1]**

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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?

A 8 m/s

B 9 m/s

C 43 m/s

D 45 m/s

Your answer ☐ **[1]**

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

Use the equation: Kinetic energy = 0.5 × Mass × Speed^2

What is the kinetic energy of this car?

A 4000 J

B 8000 J

C 40 000 J

D 80 000 J

Your answer ☐ **[1]**

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SECTION B

Answer **all** the questions.

11 This question is about radioactivity.

(a) Two isotopes of nitrogen are shown below.

$^{14}_{7}N$ $^{15}_{7}N$

Explain what is meant by the term **isotopes**.

.....

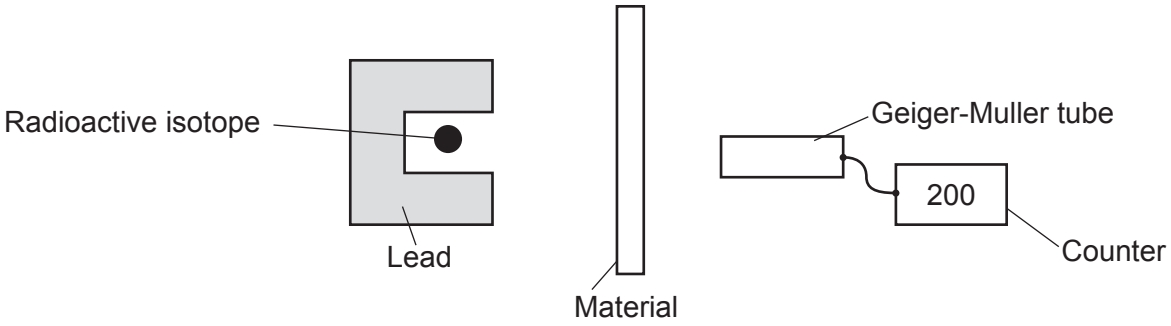
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(b) A teacher shows his class an experiment. The teacher wants to identify the type of radiation given out by a radioactive isotope.

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

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

.....

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

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

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

.....

Explain your answer.

Use the data in the table to help.

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.....

..... **[3]**

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

Appliance	Power (W)	Current (A)	Resistance (Ω)
Hairdryer	1800	7.8	29.6
Heater	800	3.5	66.1
Iron	2000	8.7	26.4
Kettle	2500	10.9	21.0

(a) A teacher says: 'As power increases, resistance increases'

Is she correct? .....

Use data from the table to explain your answer.

.....

.....

..... **[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.

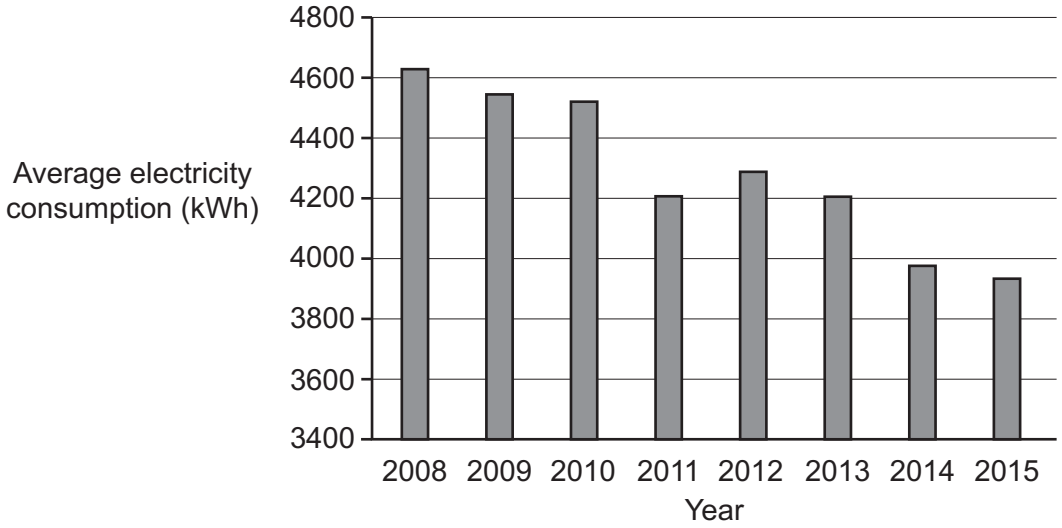
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(d) The average electricity consumption per household changes every year.

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



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

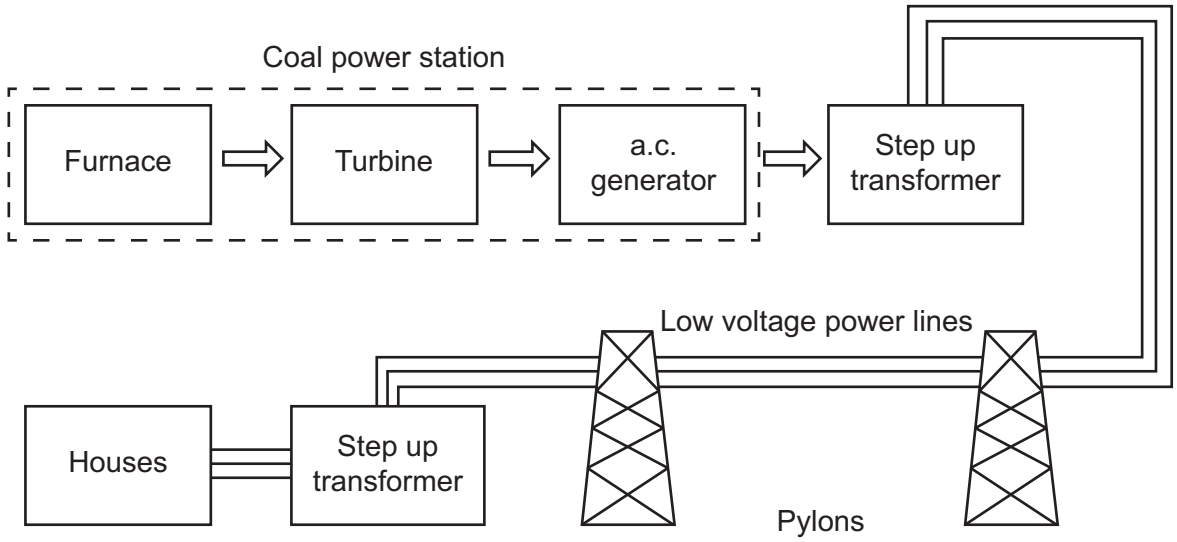
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13 A student draws a diagram to show the national grid.



(a) State the **two** mistakes in the diagram.

1. .....

.....

2. .....

.....

[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]**

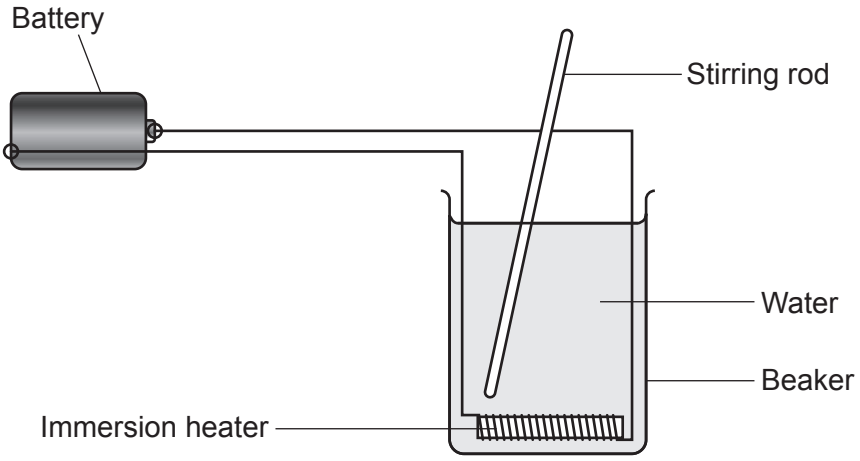
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14 A scientist does an experiment to measure the energy transferred to water.



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 12 V battery and wires.

(a) What two **other** pieces of apparatus does the scientist need for this experiment?

1. .....

2. .....

[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.

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

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(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 3.8A. The potential difference across the heater is 9.0V.

Use the equation: Power = Potential difference × Current

Calculate the power of the immersion heater.

Answer = ... W **[2]**

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(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]**

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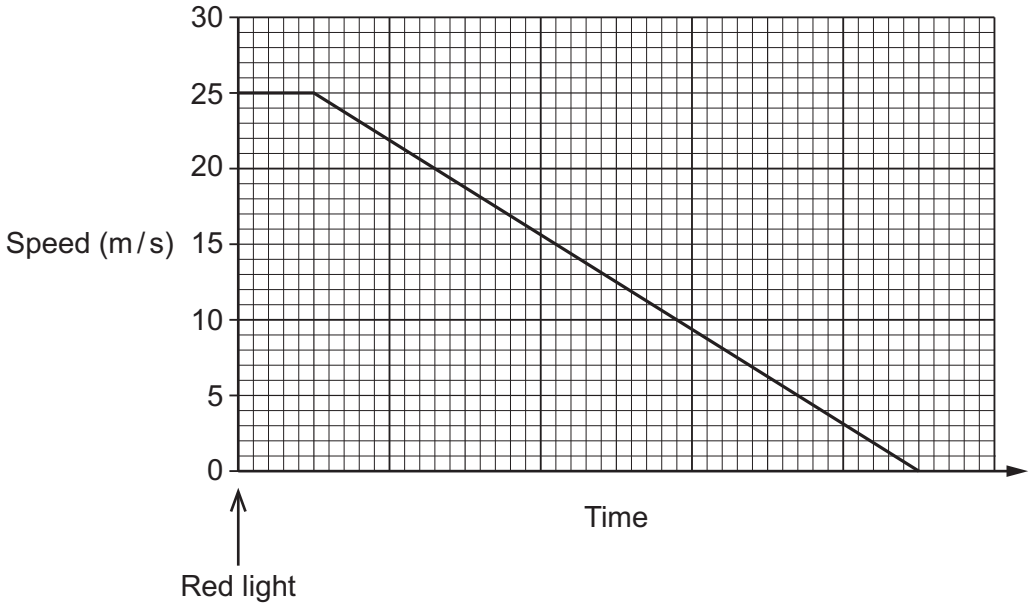
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15* Person **A** and person **B** drive their cars along the same road on different days. Both cars travel at 25 m / s.

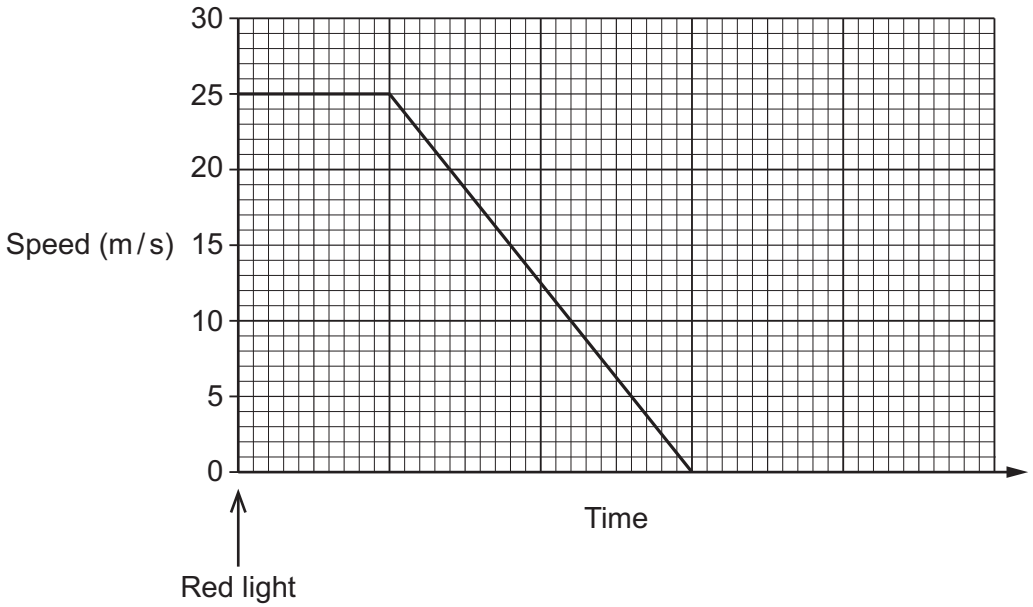
The traffic lights along the road change to red. Person **A** and person **B** see the red light and press the brakes in their car.

The graphs show the speed of each car **after** person **A** and person **B** see the red light.

Person **A**



Person **B**



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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.

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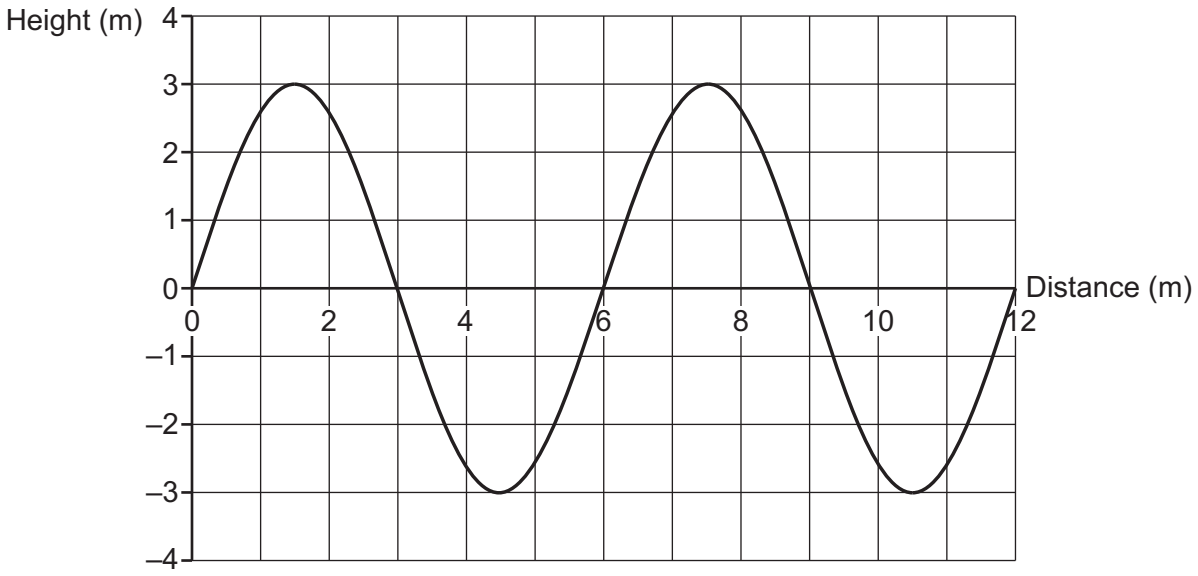
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..... **[6]**

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



(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.

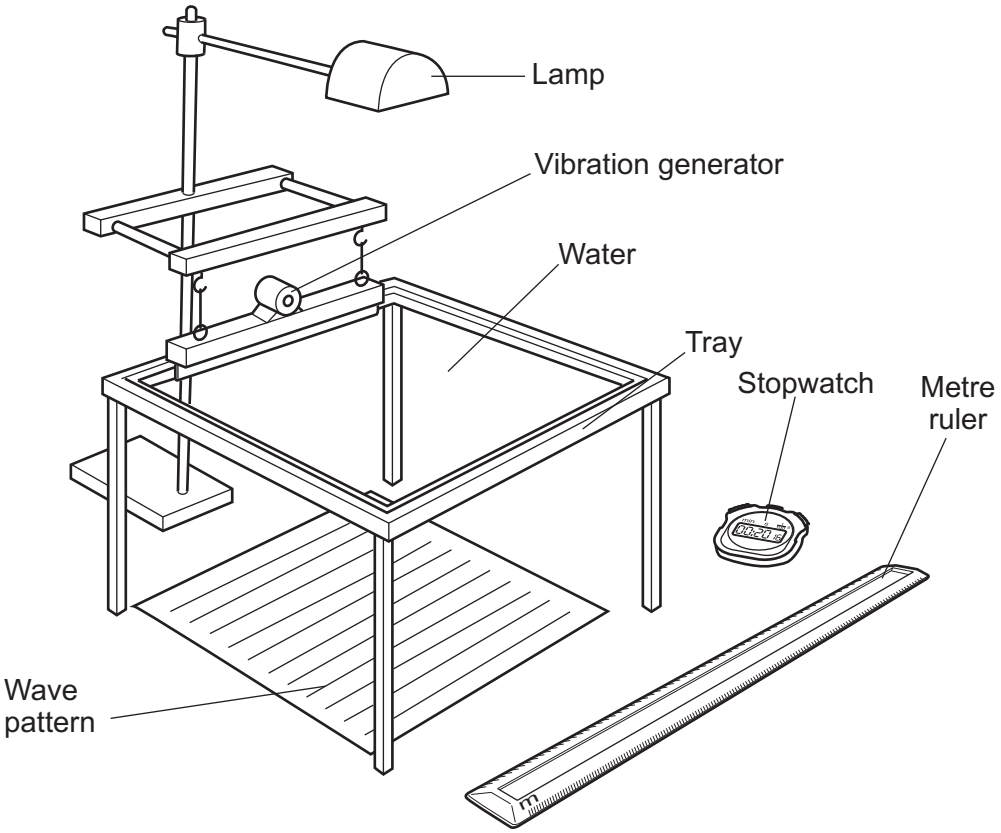
Calculate the speed of this water wave.

Answer = ... m/s **[3]**

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(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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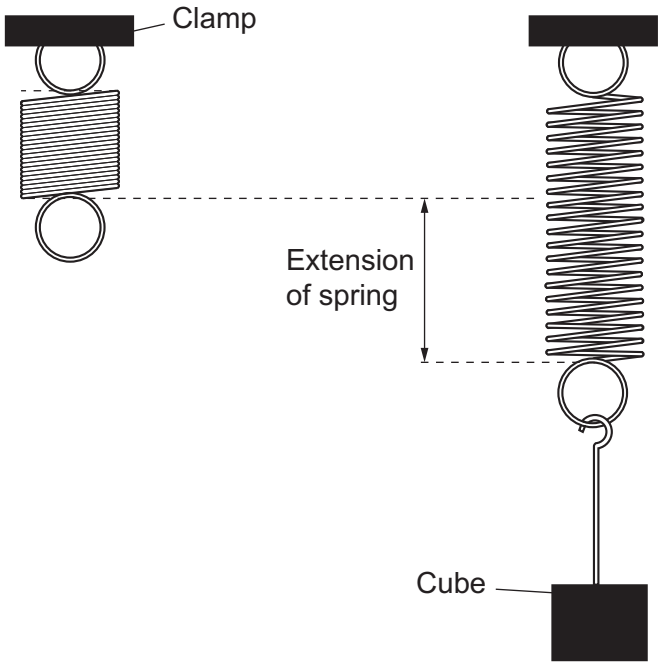
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..... **[2]**

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



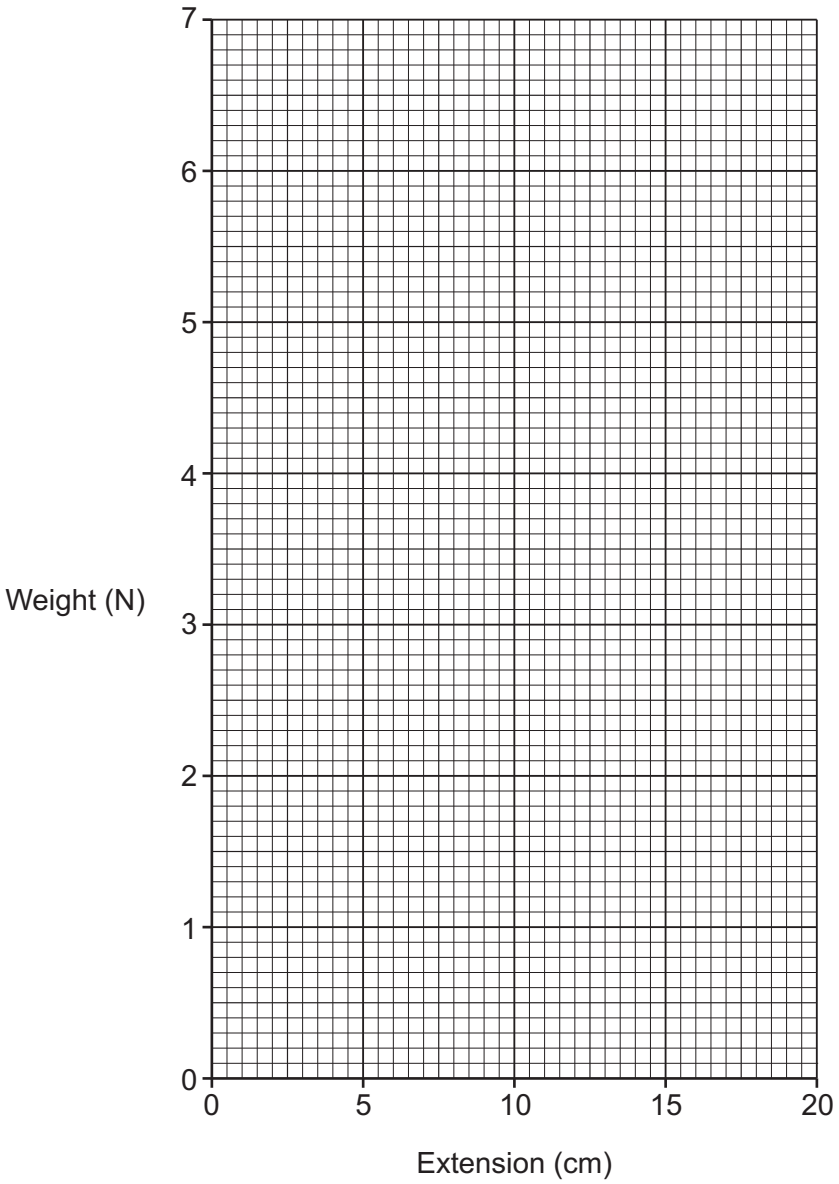
He hangs different cubes from the spring. He measures the extension of the spring for each cube.

Look at his results.

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

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(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.

.....

.....

..... **[3]**

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(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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