Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2018–2019

Single Award Science: Physics

Unit 3

Foundation Tier

MV24

[GSA31]

WEDNESDAY 22 MAY 2019, AFTERNOON

Time

1 hour, plus your additional time allowance.

Instructions to Candidates

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Do not write on blank pages.

Complete in black ink only.

Answer **all ten** questions.

Information for Candidates

The total mark for this paper is 60.
Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **9**.

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(Questions start overleaf)

1 Shown opposite are some common devices which convert energy. Complete the diagrams to name the **main** form of energy that each device produces. [2 marks]

Choose from:

heat

electrical

sound

light

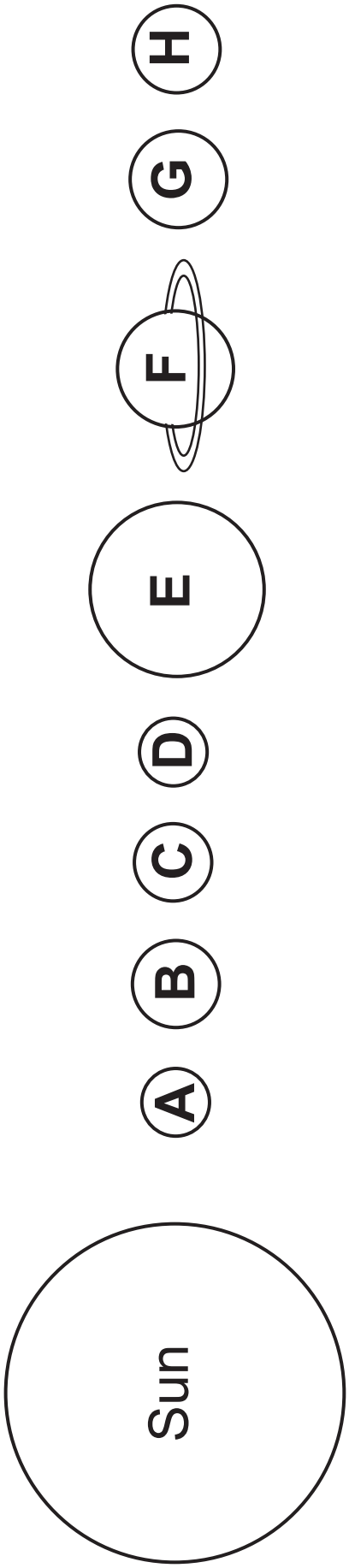
Loud speaker

electrical energy → _____ energy

Bunsen burner

chemical energy → _____ energy

2 (a) The diagram below represents the Sun and its eight planets.



(i) Complete the following sentence. [1 mark]

The Sun and its eight planets are known as the

_____

(ii) Name the planets labelled **C** and **H**. [2 marks]

Planet **C** _____

Planet **H** _____

(iii) Which planet would you expect to be the coldest? [1 mark]

Choose from:

A

B

E

G

H

_____

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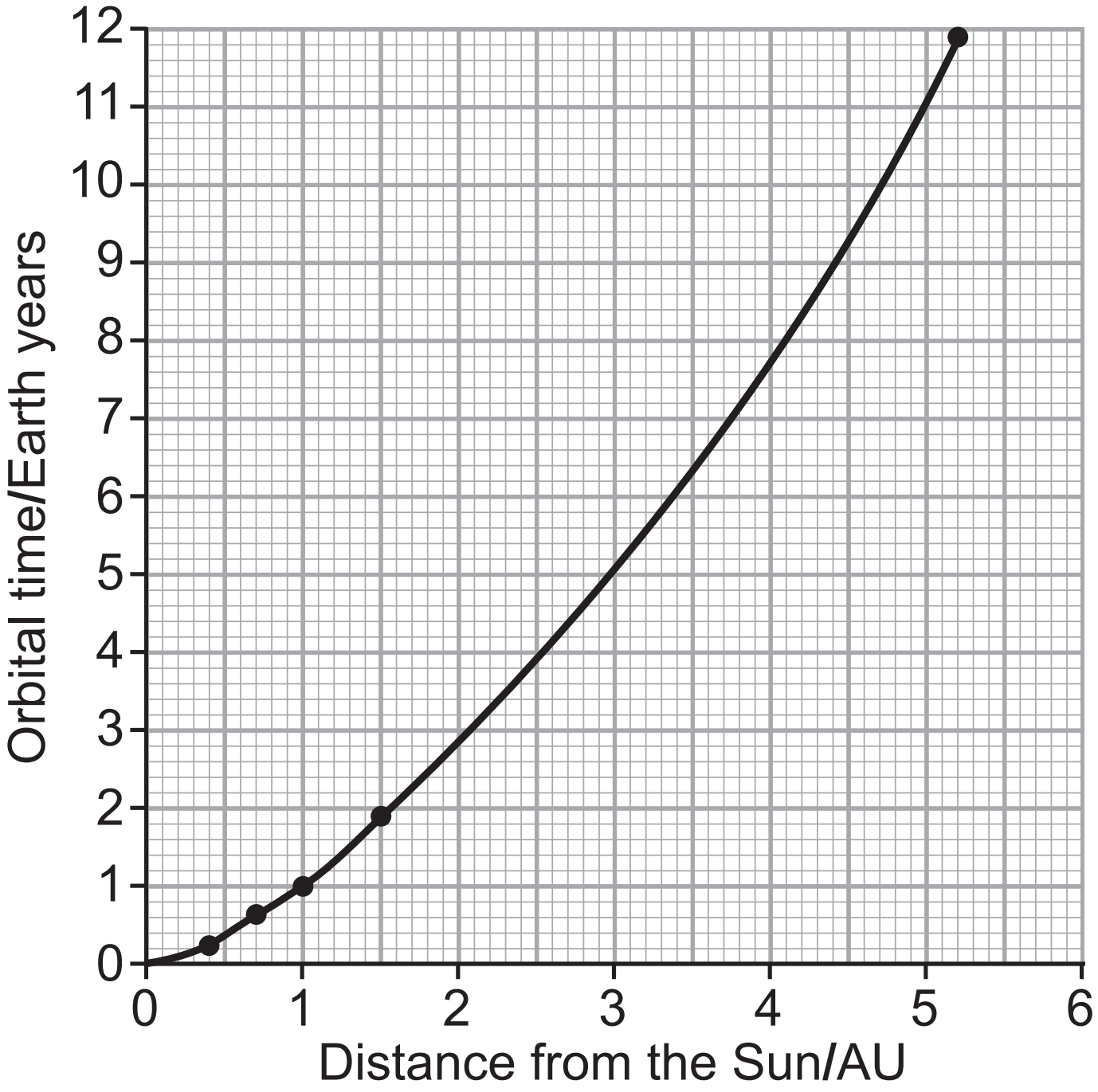
(Questions continue overleaf)

(b) The graph below shows the orbital time (time to go round the Sun) and the distance from the Sun for some planets.



(i) Name the force which keeps the planets in their orbits around the Sun. [1 mark]

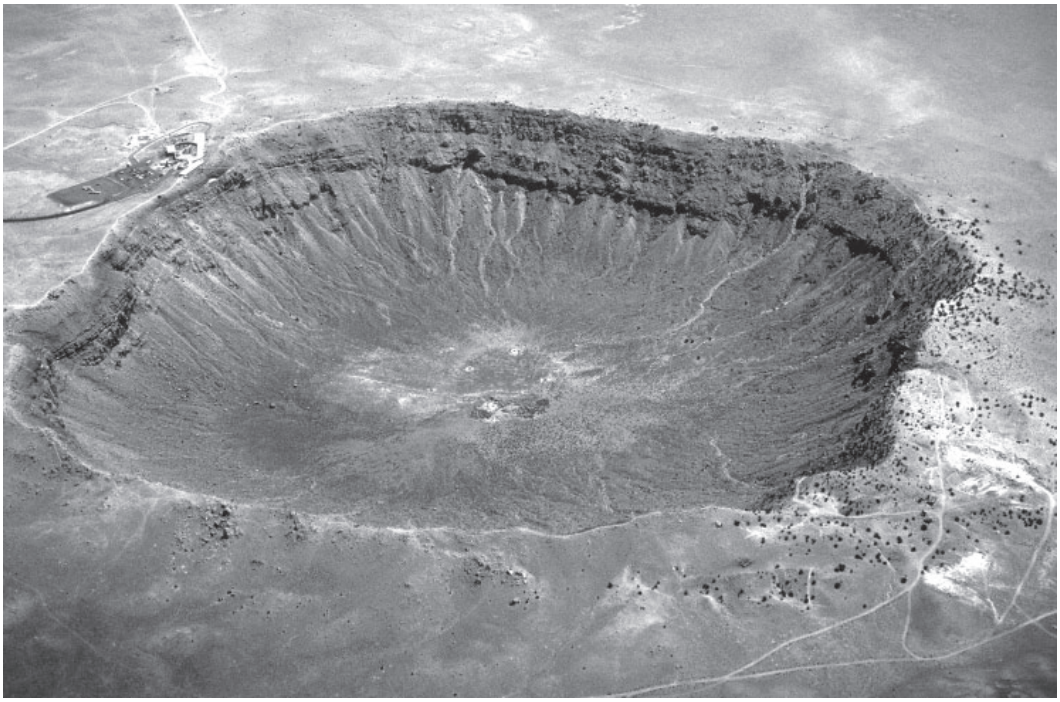
_____

(ii) Complete the following sentence to describe the trend shown in the graph. [1 mark]

As the distance from the Sun increases _____

_____ .

The photograph below shows the Barringer crater in Arizona.



(c) Name the type of object which collided with Earth to make a crater like this.
[1 mark]

_____

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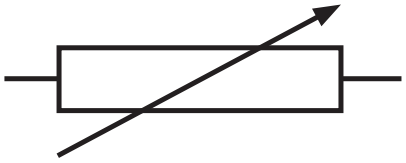
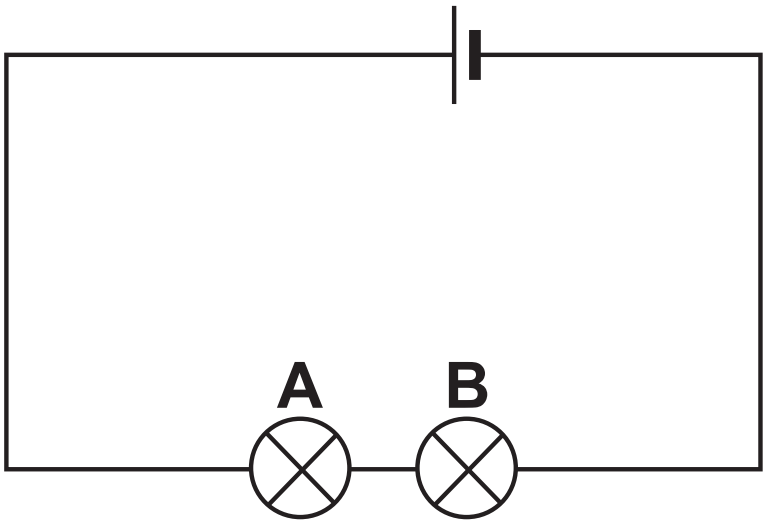
(Questions continue overleaf)

3 Below are some electrical symbols.

(a) Using lines, match each symbol with its name. [2 marks]

Symbol	Name
	cell
	variable resistor
	lamp

The diagram below shows two bulbs (**A** and **B**) in a circuit.



(b) Complete the following sentence.
[1 mark]

Choose from:

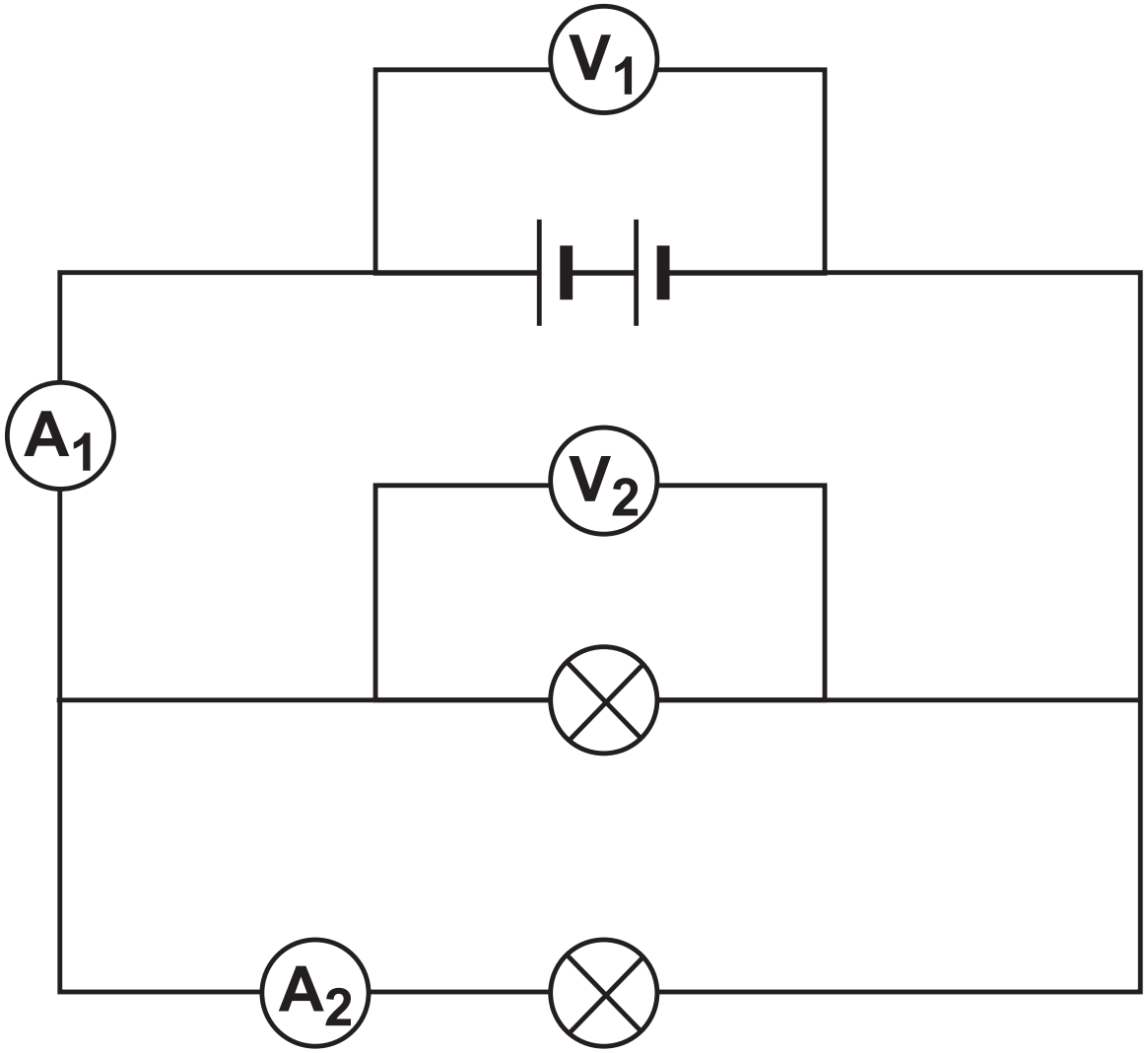
series

short

parallel

The diagram above shows two bulbs connected in a _____ circuit.

(c) Below is another electrical circuit, containing two identical bulbs.



The reading on ammeter $\mathbf{A_1}$ is 2 A and the reading on voltmeter $\mathbf{V_1}$ is 6 V.

(i) What will be the reading on ammeter A_2? [1 mark]

Choose from:

1 A

2 A

4 A

_____

(ii) What will be the reading on voltmeter V_2? [1 mark]

_____ V

(d) The table below gives information about two different types of light bulb.

	Low-energy bulb	**Ordinary bulb**
electrical power input	15 W	60 W
light power output	3 W	3 W
cost to buy	£3.50	£0.50
expected lifetime	8 years	1 year
annual running cost	£1.00	£4.00

(i) Give **one** reason for choosing the low-energy light bulb. [1 mark]

_____

_____

(ii) Give **one** reason for choosing the ordinary light bulb. [1 mark]

_____

_____

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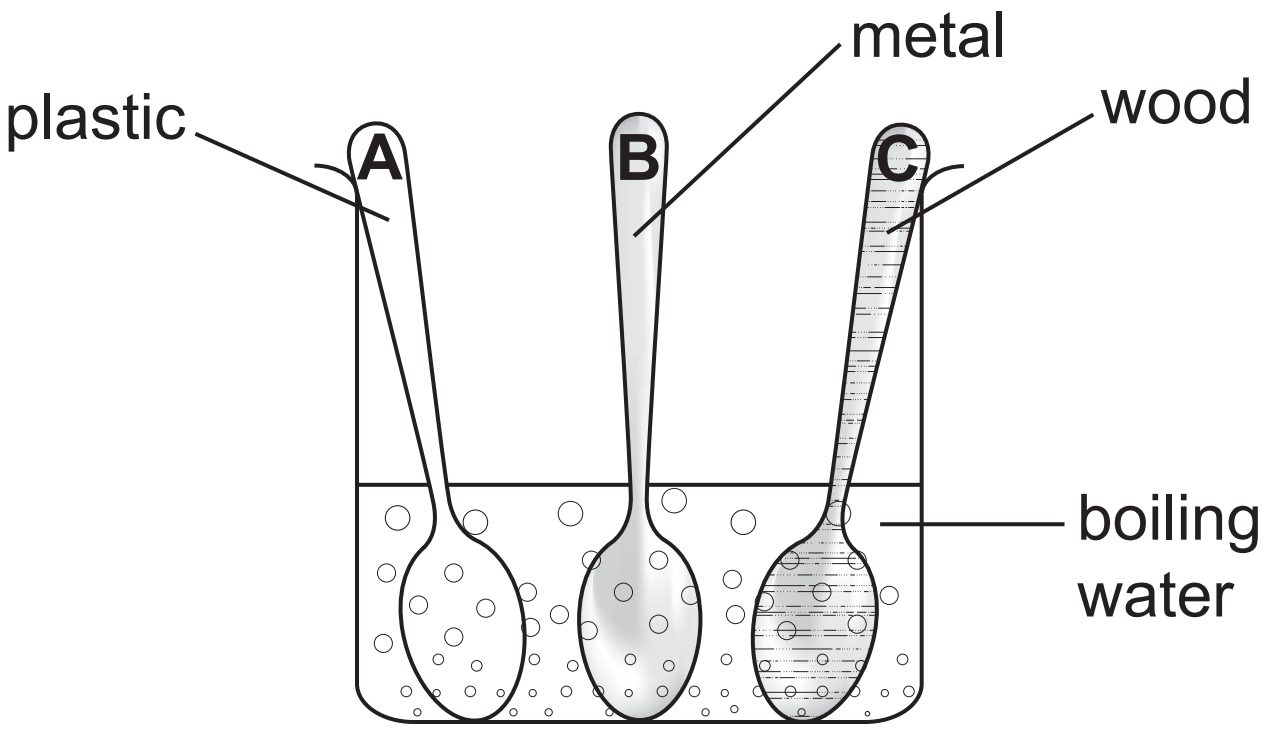
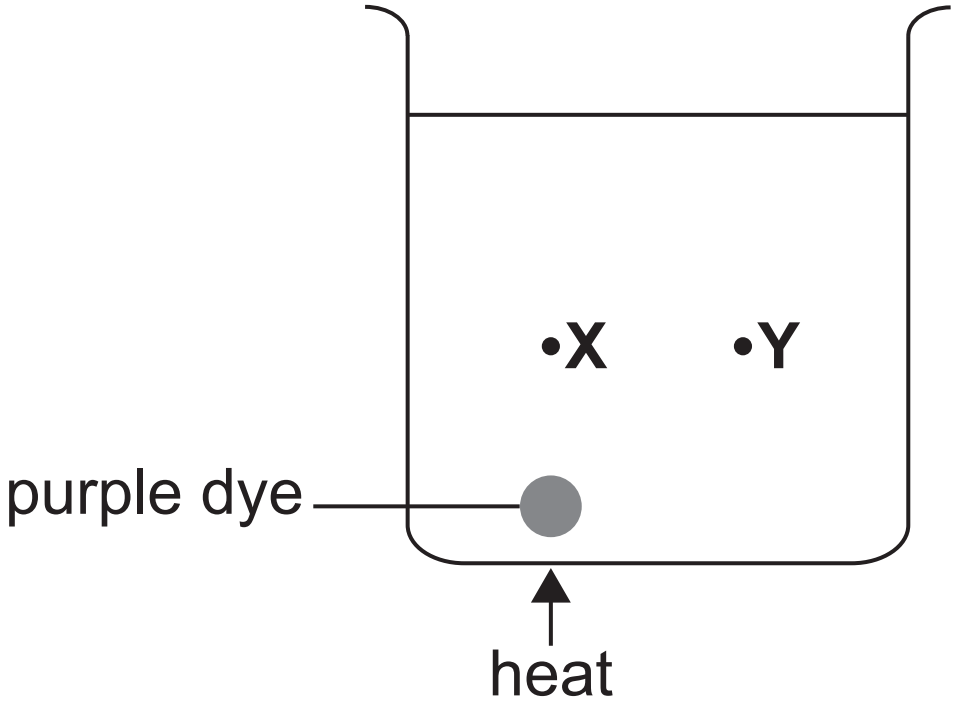
(Questions continue overleaf)

4 The diagram below shows three spoons made of different materials which have been in boiling water for 3 minutes.



(a) A student touched the end of each spoon at **A**, **B** and **C**.
Which spoon will feel the warmest?
Explain your answer.
[2 marks]

(b) In the experiment below, purple dye is used to show heat transfer in water.



(i) Draw **two** arrows, one at **X** and one at **Y**, to show the direction of heat flow at these points. [1 mark]

(ii) Name the main process by which heat travels through water.
[1 mark]

_____

5 **(a)** The table below shows the rate of heat loss from different parts of three houses. Each house has different insulation.

	Rate of heat loss/arbitrary units		
Part	**House X**	**House Y**	**House Z**
windows	4.3	3.2	3.6
walls	0.6	1.6	1.2
roofs	0.6	1.9	1.3
floors	0.5	0.5	0.5
total	6.0	7.2	6.6

(i) Which house **X**, **Y** or **Z** has the best insulated walls? [1 mark]

_____

(ii) After the heating is switched off, which house **X**, **Y** or **Z** will stay warm for the longest time? [1 mark]

_____

(b) The table below shows some information about methods of reducing heat loss from a house.

Method	**Cost to install/£**	**Money saved per year/£**
loft insulation	300	180
double glazing	5000	245
cavity wall insulation	500	200
draught excluders	15	45

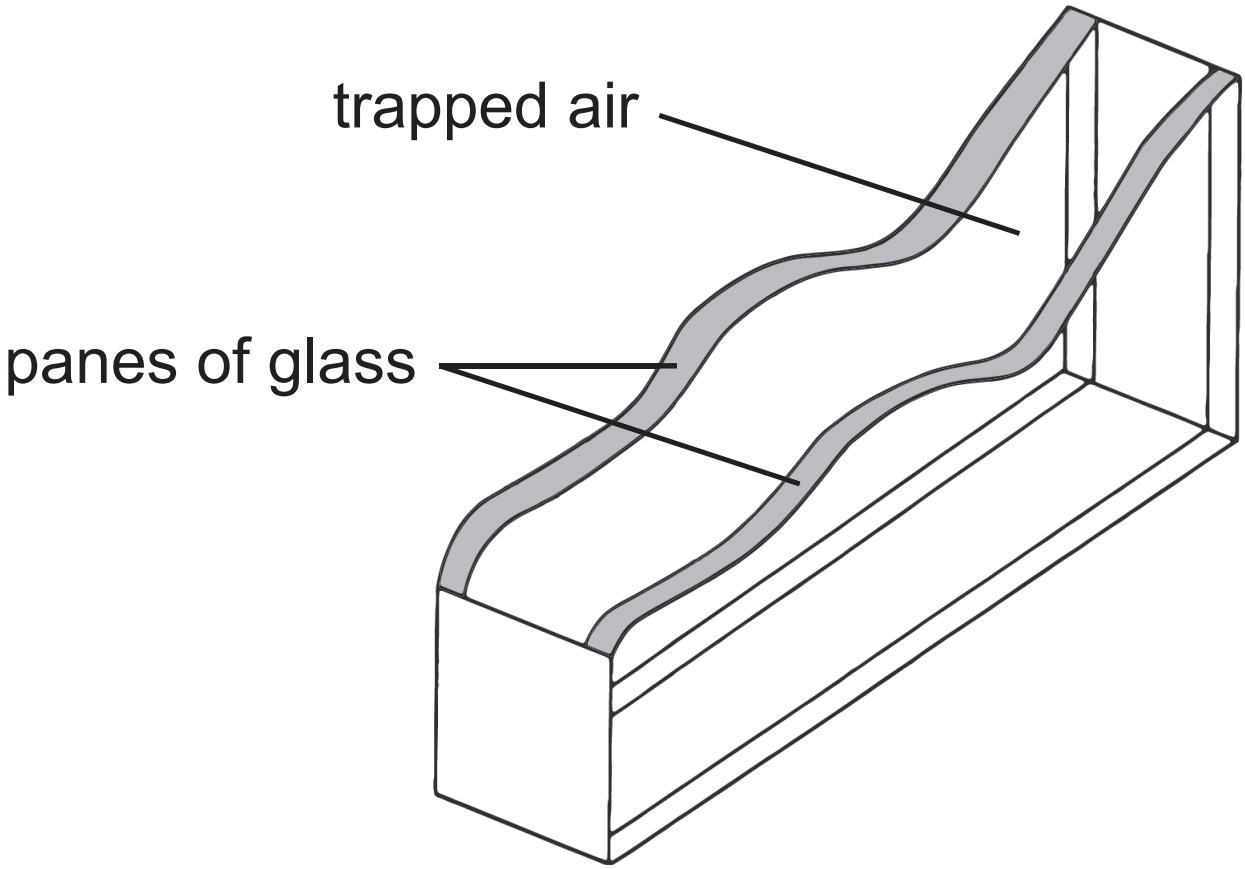
(i) Which method of reducing heat loss is the best value for money?
[1 mark]

_____

(ii) Having **cavity wall insulation** saves money on heating bills. Calculate the number of years it will take to save the cost of its installation.
[2 marks]
(Show your working out.)

_____ years

The diagram below shows a section through a double glazed window.



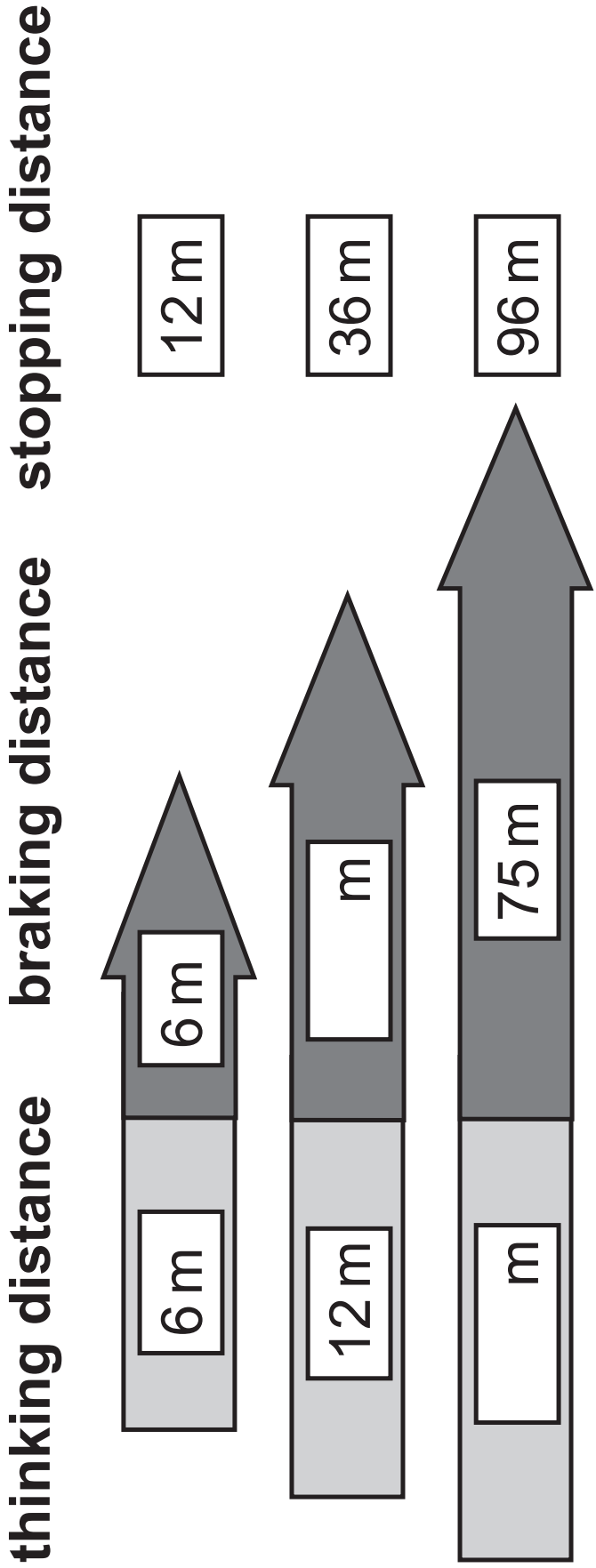
(c) Suggest **one** reason why the heat loss through a double glazed window is less than the heat loss through a single glazed window. [1 mark]

(d) Suggest **one** reason why houses in very hot countries are often painted white.
[1 mark]

_____

_____

6 The diagram below gives some information about thinking, braking and stopping distances for a car travelling at different speeds.



(a) Complete the diagram opposite by giving the missing braking and thinking distances. [2 marks]

The table below shows some data on braking and thinking distances.

Speed km/hr	Braking distance/m		Thinking distance/m	
	car and driver	car, driver and passengers	car and driver	car, driver and passengers
15	1	3	3	3
30	5	7	6	6
45	12	14	8	8
60	21	23	11	11

(b) What effect, if any, does having passengers in a car have on the braking distance and the thinking distance? [2 marks]

Braking distance _____

_____

Thinking distance _____

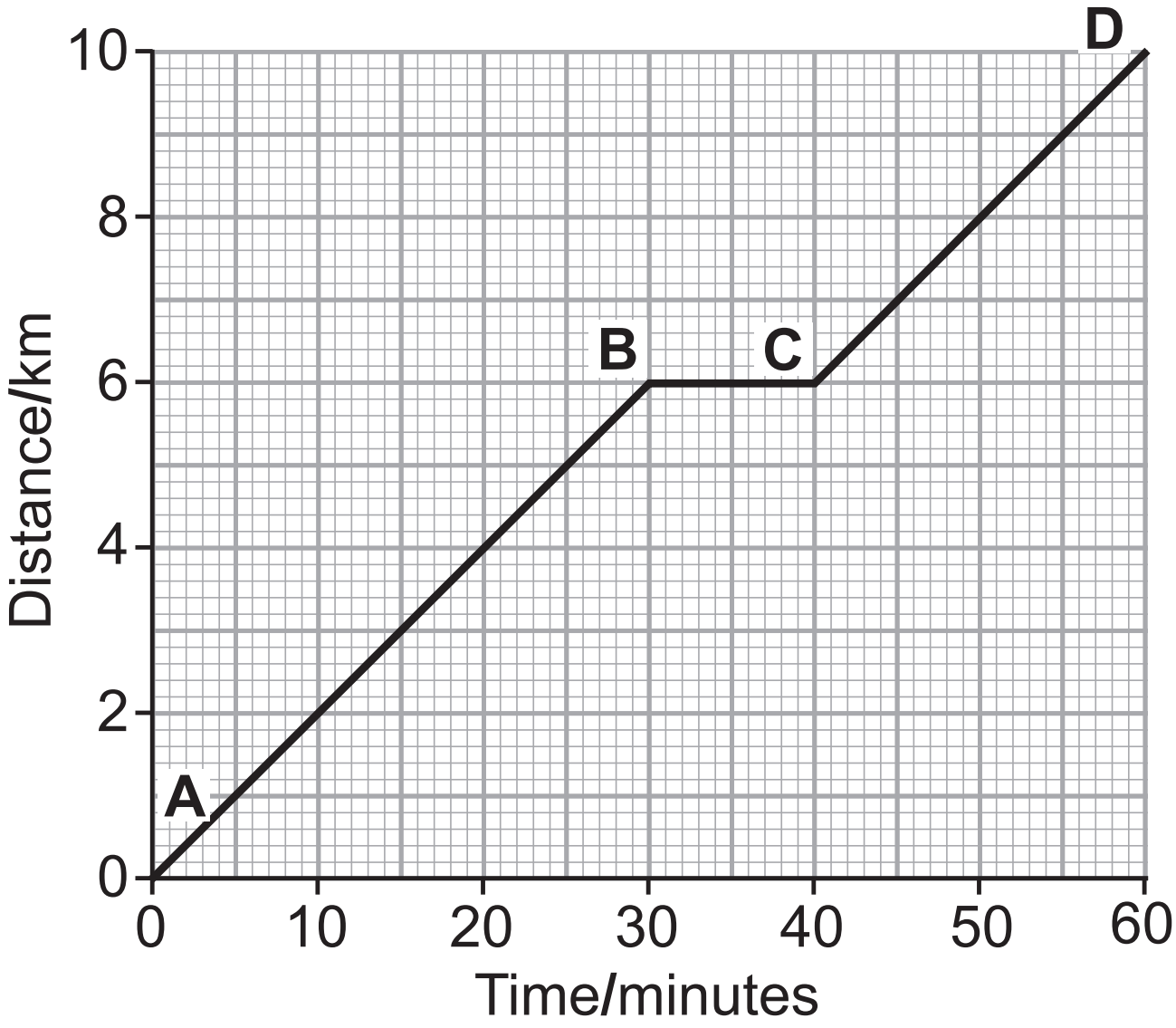
_____

(c) Calculate the increased **stopping distance** that a car travelling at 60 km/hr with passengers has compared to a car travelling at the same speed without passengers. [2 marks]

(Show your working out.)

Answer _____ m

7 A distance-time graph for a runner is shown below.



(a) Describe the motion, if any, of the runner between 30 and 40 minutes. [1 mark]

_____

(b) Compare the runner's speed between **A** and **B** to his speed between **C** and **D**.

Circle the correct answer. [1 mark]

faster

slower

the same

(c) Use the equation:

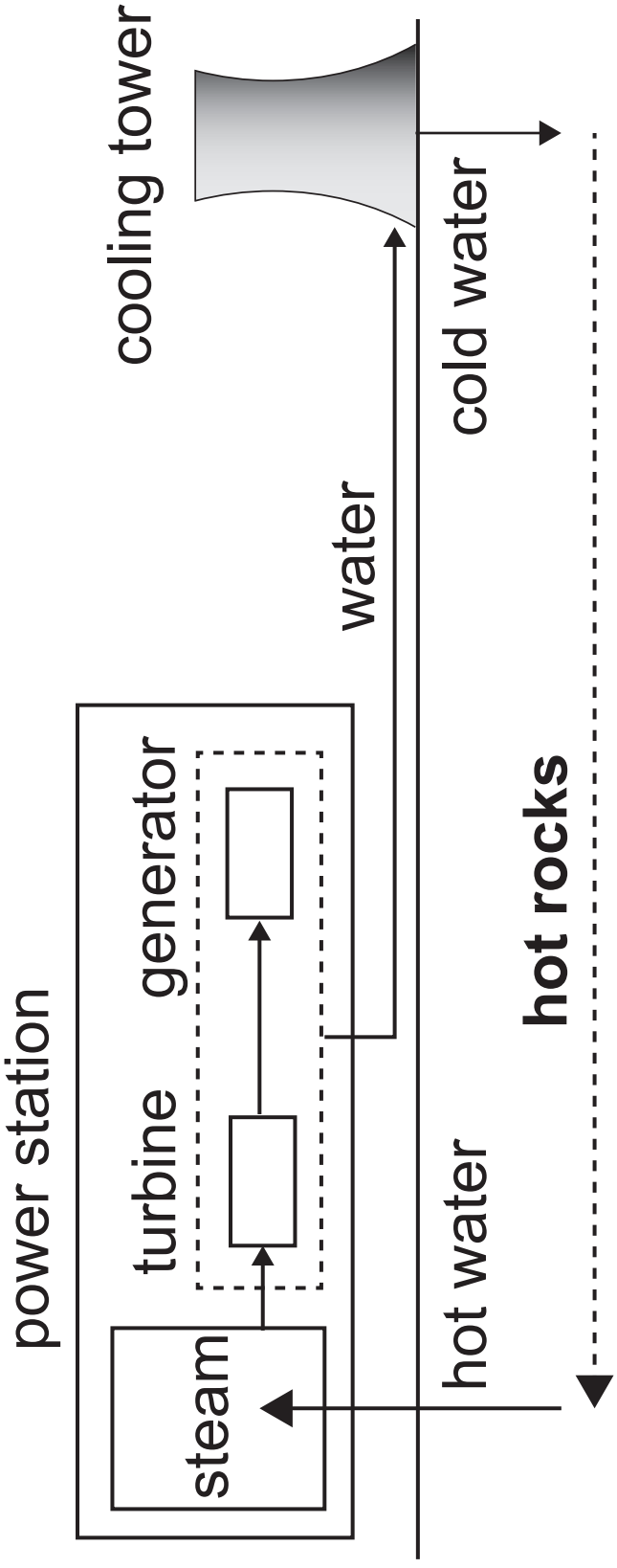
$$\textbf{average speed} = \frac{\textbf{distance travelled}}{\textbf{time taken}}$$

to calculate the average speed of the runner between **A** and **D**. [2 marks]

(Show your working out.)

Answer _____ km/min

8 **(a)** The diagram below shows a geothermal power station. Water at high pressure is pumped underground where it gets heated by hot rocks. It then returns to the power station.



When the hot water returns to the surface it changes into steam and turns a turbine.

(i) Explain fully how this produces electricity in a generator. [2 marks]

_____

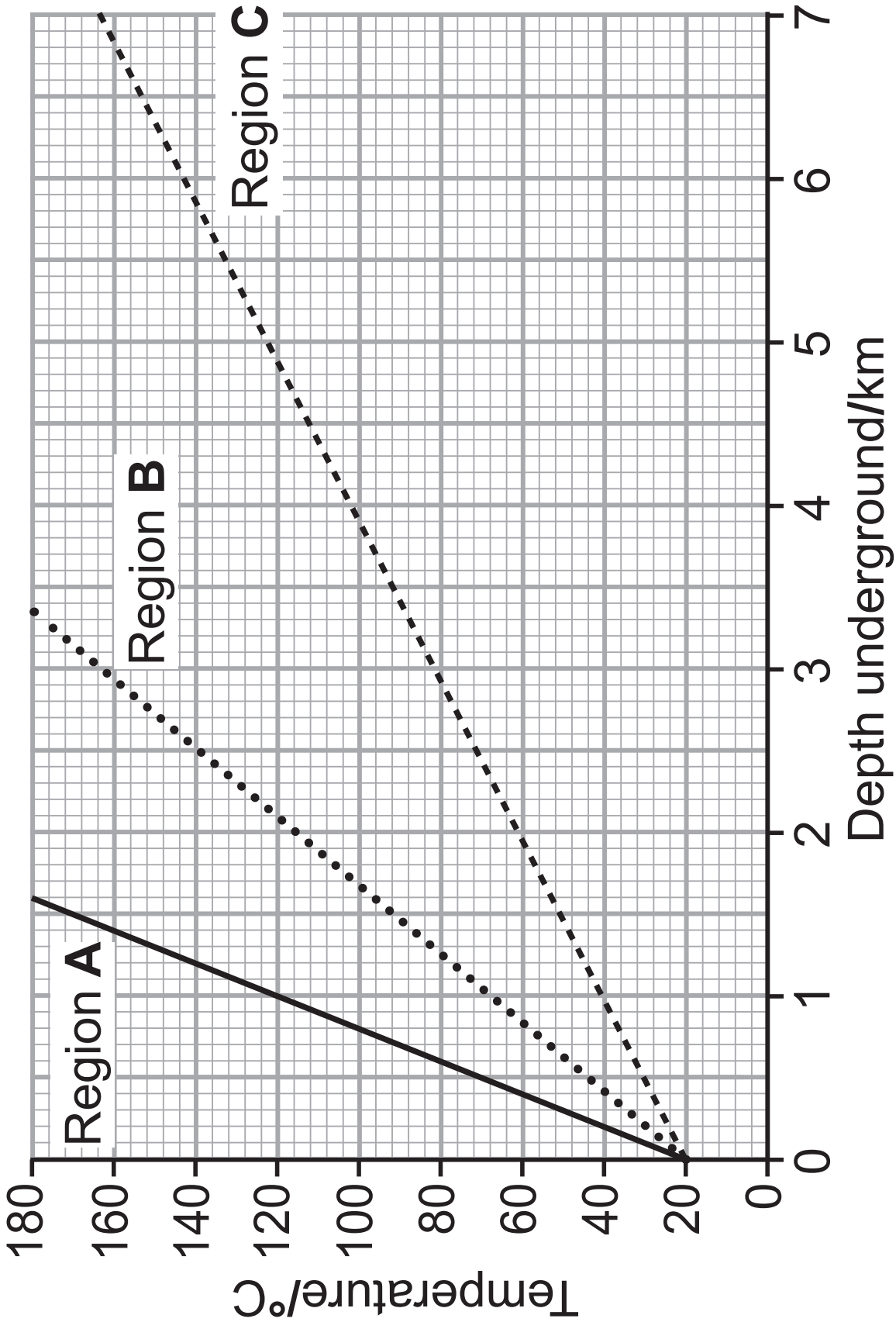
_____

(ii) Geothermal power stations use renewable energy. What does the term **renewable** mean? [1 mark]

_____

_____

(b) The graph below shows how the temperature changes as the depth underground increases in three different regions.



(i) In region **A** what depth will the pipe need to be to produce a temperature of 120 °C? [1 mark]

_____ km

(ii) Suggest **one** reason why it may **not** be economical to build a geothermal power station in region **C**.
[1 mark]

_____

_____

(c) A coal-fired power station burns coal containing 300 MJ of energy and produces 102 MJ of electricity.

Use the equation:

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

to calculate the efficiency of the power station. [2 marks]

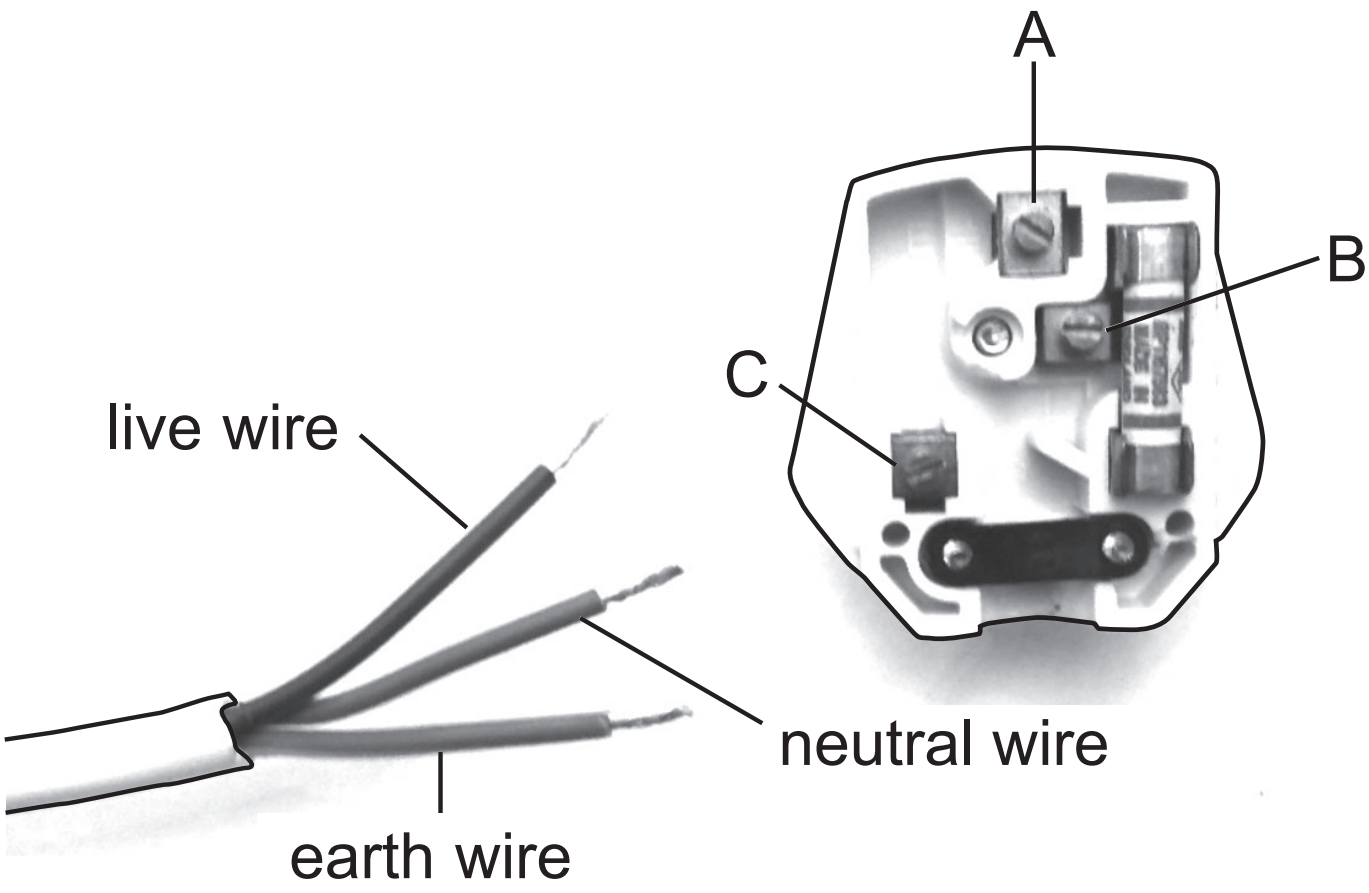
(Show your working out.)

Answer _____

Blank Page

(Questions continue overleaf)

9 The photograph below shows a 3-pin plug about to be wired.



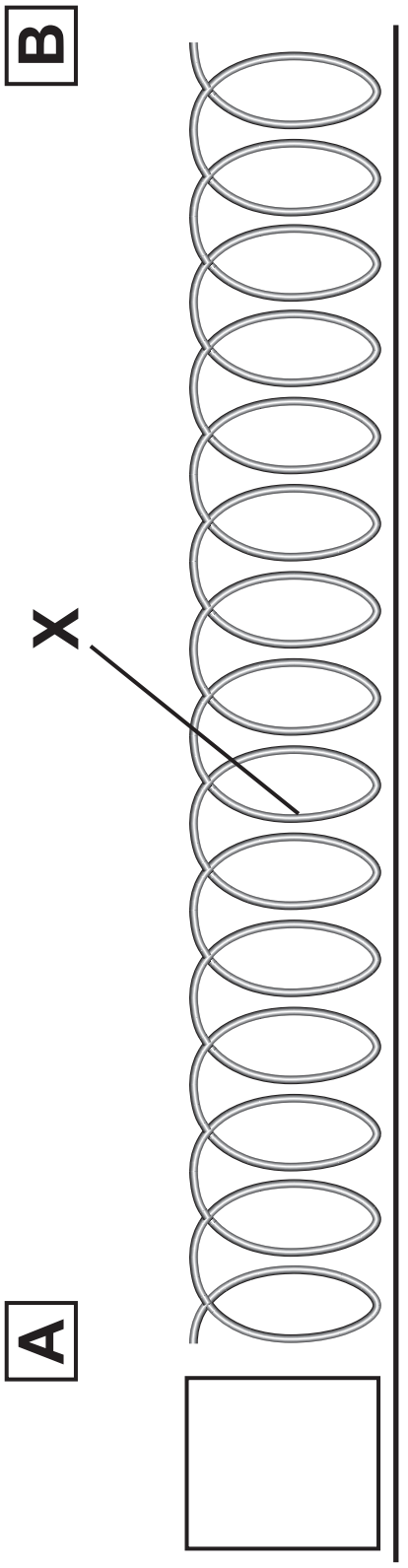
Describe fully how this plug should be wired correctly. [6 marks]

Your answer should include:

- the colour(s) of each named wire
- an explanation of one safety feature found in the plug.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

10 (a) The diagram below shows a slinky spring which can be used to demonstrate a **longitudinal** wave travelling from **A** to **B**.



(i) In the box at end **A**, draw an arrow to show the direction of energy flow. [1 mark]

(ii) Describe the motion of a particle at **X** in a **longitudinal** wave. [2 marks]

The table below shows the speed of sound in air at different temperatures.

Temperature/°C	Speed of sound/m/s
20	343
10	337
0	331
–10	325
–20	319

(b) State the trend shown by this data. [1 mark]

Shown below are recommended maximum listening times at different sound levels.

Sound level/dB	Maximum time/hours
88	4
91	2
94	1
97	0.5
100	

(c) Use the trend shown by this data to calculate the recommended maximum time for a sound level of 100 dB.
[1 mark]

Answer _____ hours

(d) The table below shows the percentage of sound reflected from different materials at four different frequencies.

	Percentage of sound reflected/%			
Material	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**
brick	98	97	96	95
carpet	76	43	31	29
curtains	65	45	30	28
glass	75	82	88	90

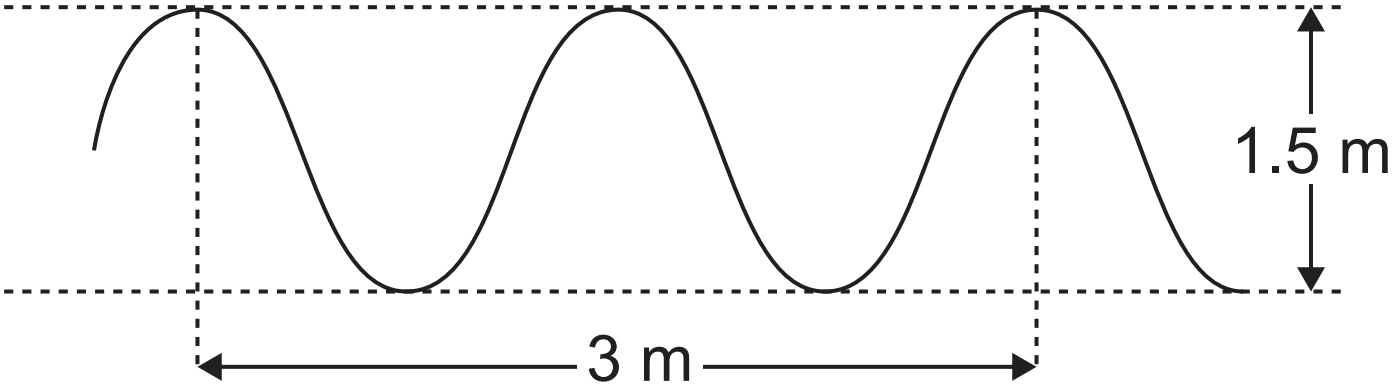
(i) Which material shows the biggest difference in the percentage of sound reflected across this range of frequencies? [1 mark]

_____

(ii) Which material is the **worst absorber** of sound across this range of frequencies? [1 mark]

_____

(e) The diagram below represents a transverse wave.



(i) What is the amplitude of this wave? [1 mark]

_____ m

(ii) Use the equation:

wave speed (v) = frequency (f) × wavelength (λ)

to calculate the speed of a wave which has a frequency of 30 Hz and a wavelength of 150 cm.
Give your answer in metres per second (m/s). [2 marks]

(Show your working out.)

Answer _____ m/s

This is the end of the question paper

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Q8(a) .....Source: Principal Examiner
Q9.....Source: Principal Examiner
Q10(a) ...Source: Principal Examiner

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Question Number	**Marks**
1	
2	
3	
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10	
Total Marks	

Examiner Number