A

Surname ______________________________

Other Names ______________________________

Centre Number ______________________________

Candidate Number ______________________________

Candidate Signature ______________________________

I declare this is my own work.

GCSE

PHYSICS

F

Foundation Tier Paper 1

8463/1F

Time allowed: 1 hour 45 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

For this paper you must have:
- **a ruler**
- **a scientific calculator**
- **the Physics Equations Sheet (enclosed).**

INSTRUCTIONS

- **Use black ink or black ball-point pen. Pencil should only be used for drawing.**
- **Answer ALL questions in the spaces provided.**
- **Do not write on blank pages.**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**
- **If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).**

- In all calculations, show clearly how you work out your answer.

INFORMATION

- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

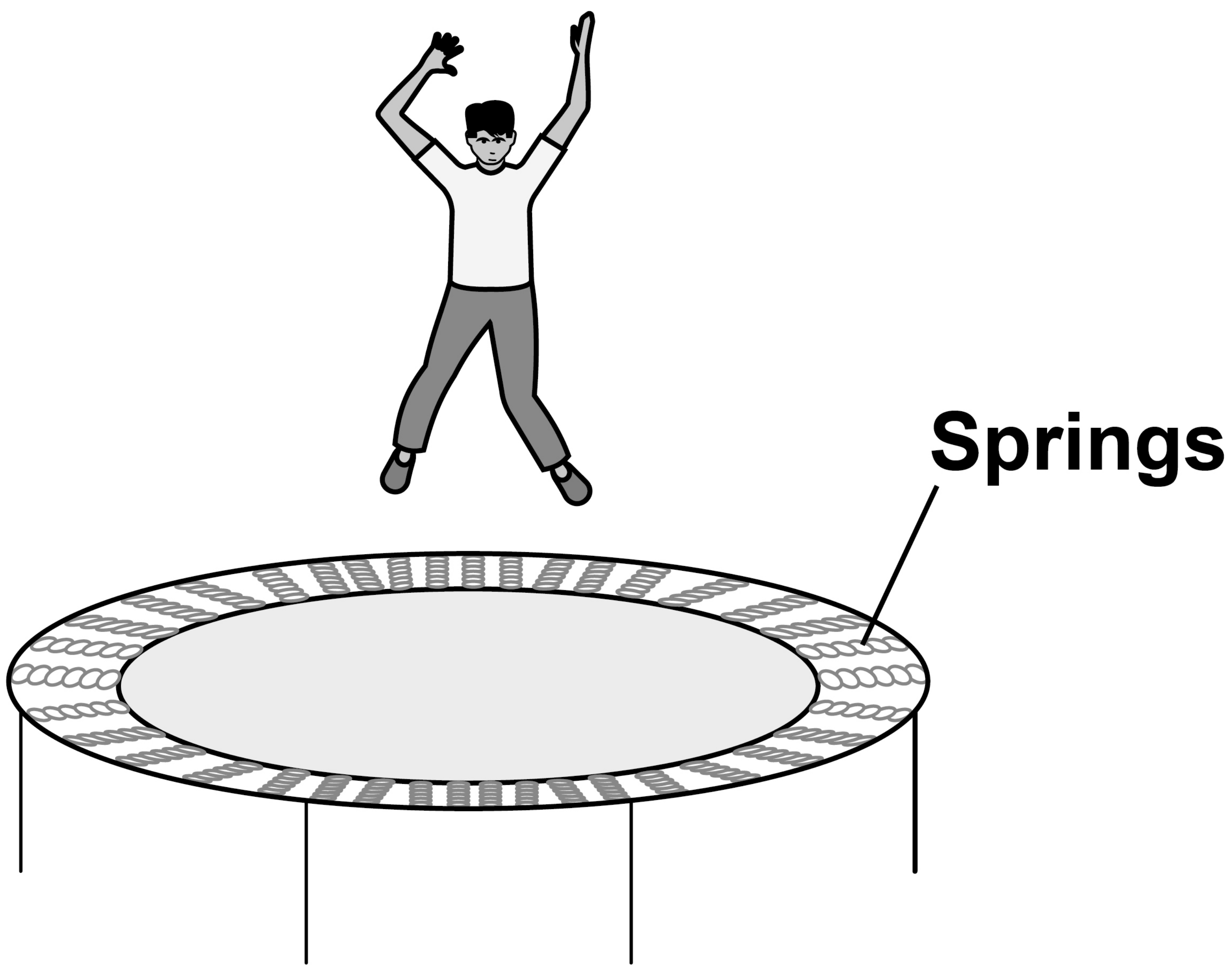
DO NOT TURN OVER UNTIL TOLD TO DO SO

Answer ALL questions in the spaces provided.

0 1

FIGURE 1 shows a boy bouncing on a trampoline.

FIGURE 1



0 1 . 1

The boy falls from the position in FIGURE 1, on the opposite page, towards the trampoline.

Complete the sentences.

Choose answers from the list. [2 marks]

- **chemical**
- **elastic potential**
- **gravitational potential**
- **kinetic**
- **nuclear**

As the boy falls, there is a decrease in

his ______________________ energy.

As the boy falls, there is an increase in

his ______________________ energy.

[Turn over]

0 1 . 2

As the boy lands on the trampoline, each spring stretches 0.015 m.

spring constant of each spring = 120 000 N/m

Calculate the energy stored by each spring.

Use the equation:

elastic potential energy = 0.5 × spring constant × (extension)^2
[2 marks]

____

____

____

____

Elastic potential energy = ______________ J

01.3

There are 40 springs on the trampoline.

Calculate the total energy stored by the 40 springs when each spring is stretched by 0.015 m.

Use your answer from Question 01.2
[1 mark]

____

____

____

____

Total energy stored = ________________ J

[Turn over]

0 1 . 4

The kinetic energy of the boy as he lands on the trampoline is 600 J.

The maximum kinetic energy of the boy after he bounces is 45% of his kinetic energy as he lands.

Calculate the maximum kinetic energy of the boy after he bounces. [2 marks]

____

____

____

____

____

Maximum kinetic energy = ____________ J

01.5

Why is the kinetic energy of the boy after he bounces less than his kinetic energy as he lands? [1 mark]

Tick (✓) ONE box.

☐ **Energy is not conserved.**

☐ **Energy is transferred to the surroundings.**

☐ **The springs transfer energy to the boy.**

8

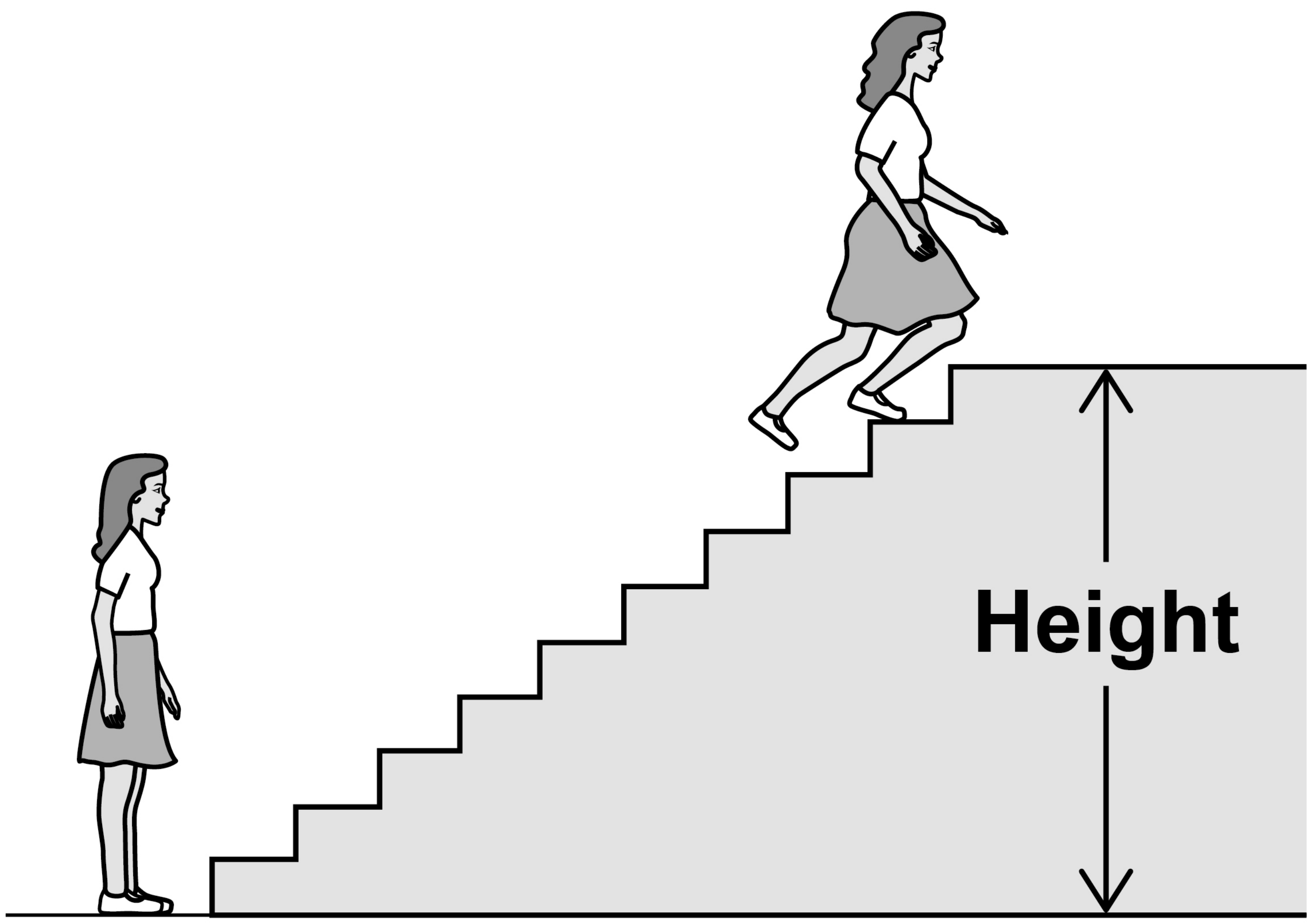
[Turn over]

0 2

A girl ran to the top of some stairs.

FIGURE 2 shows the stairs.

FIGURE 2



0 2 . 1

The girl measured the height of the stairs.

What measuring instrument should she have used? [1 mark]

[Turn over]

0 2 . 2

The height of the stairs was 1.7 m.

The mass of the girl was 50 kg.

gravitational field strength = 9.8 N/kg

Calculate the change in gravitational potential energy of the girl.

Use the equation:

gravitational potential energy =
mass × gravitational field strength × height
[2 marks]

____

____

____

____

____

Gravitational potential energy =

_________________________ J

[Turn over]

0 2 . 3

A boy ran up the same stairs and did 1800 J of work.

The time it took the boy to run up the stairs was 1.44 s.

Calculate the power of the boy.

Use the equation:

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

[2 marks]

____

____

____

____

Power = ______________________ W

BLANK PAGE

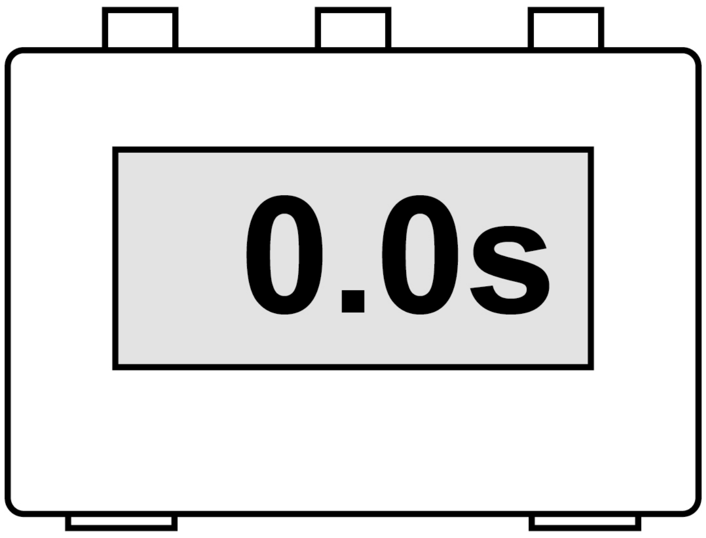
[Turn over]

0 2 . 4

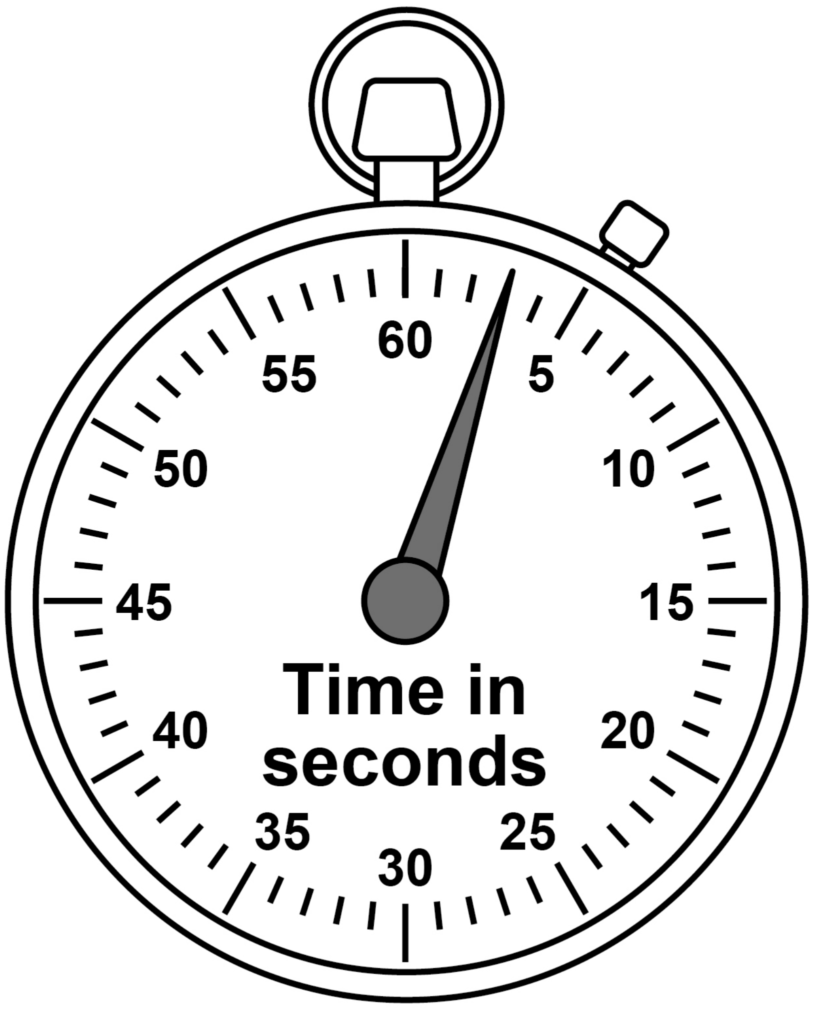
Which stop-clock, below and on the opposite page, was used to measure the time the boy took to run up the stairs?
[1 mark]

Tick (✓) ONE box.

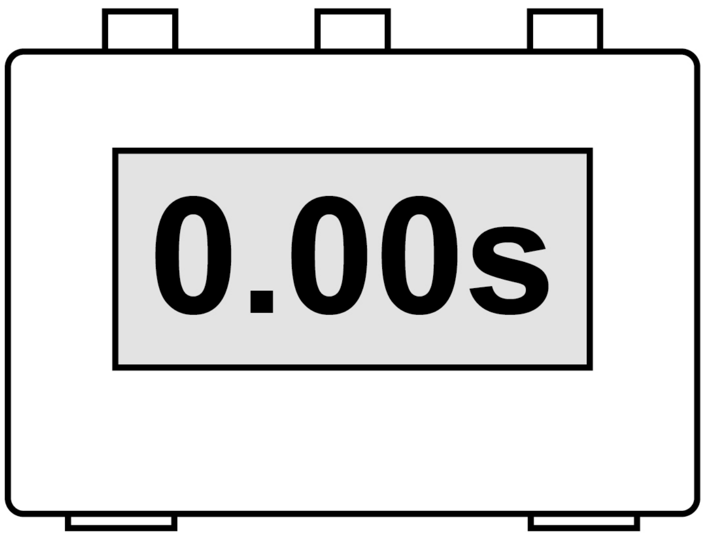
☐ **STOP–CLOCK A**



☐ **STOP–CLOCK B**



☐ **STOP –CLOCK C**



[Turn over]

0 2 . 5

The boy had a speed of 2.0 m/s at the top of the stairs.

The mass of the boy was 70 kg.

Calculate the kinetic energy of the boy at the top of the stairs.

Use the equation:

kinetic energy = 0.5 × mass × $(\text{speed})^2$

[2 marks]

Kinetic energy = ____________________ J

___
8

BLANK PAGE

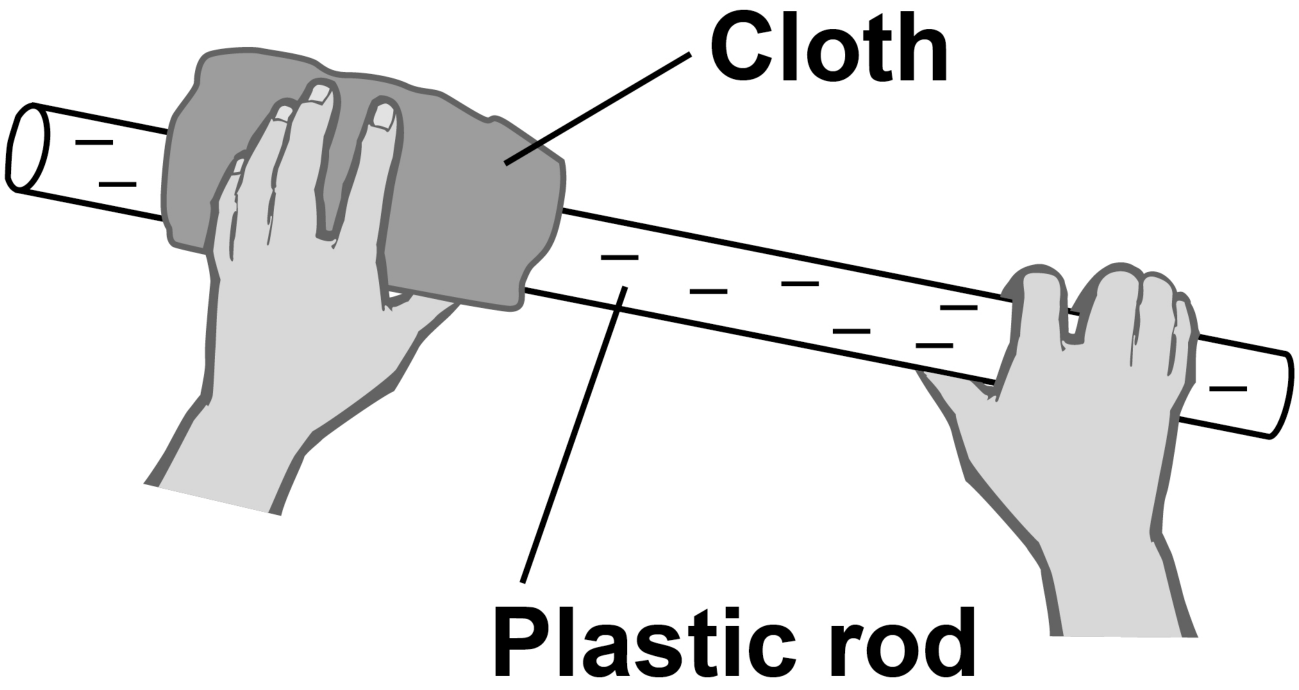
[Turn over]

0 3

FIGURE 3 shows a plastic rod being rubbed with a cloth.

The plastic rod becomes negatively charged.

FIGURE 3



0 3 . 1

Complete the sentences.

Choose answers from the list.

Each answer may be used once, more than once or not at all. [2 marks]

- **electrons**
- **neutrons**
- **protons**

The plastic rod becomes charged because it gains ________________________ .

The cloth also becomes charged because it loses ________________________ .

[Turn over]

0 3 . 2

What charge is left on the cloth?
[1 mark]

Tick (✓) ONE box.

- [ ] **A negative charge**
- [ ] **A neutral charge**
- [ ] **A positive charge**

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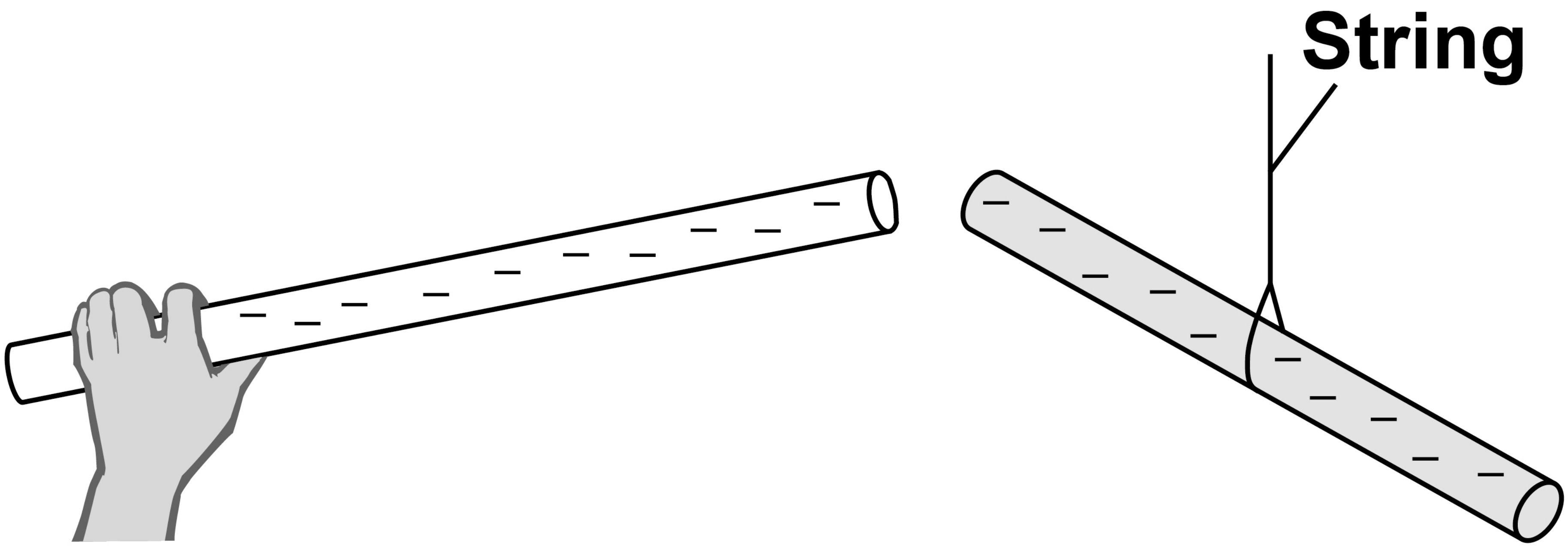
[Turn over]

0 3 . 3

The negatively charged plastic rod is put near another negatively charged plastic rod that is hanging from a string.

FIGURE 4 shows the two rods.

FIGURE 4



What force is exerted on the two rods?

Tick (✓) ONE box.

Give a reason for your answer. [2 marks]

- [ ] **A force of attraction**
- [ ] **A force of repulsion**
- [ ] **There is no force**

Reason ______________________________

____

____

____

____

[Turn over]

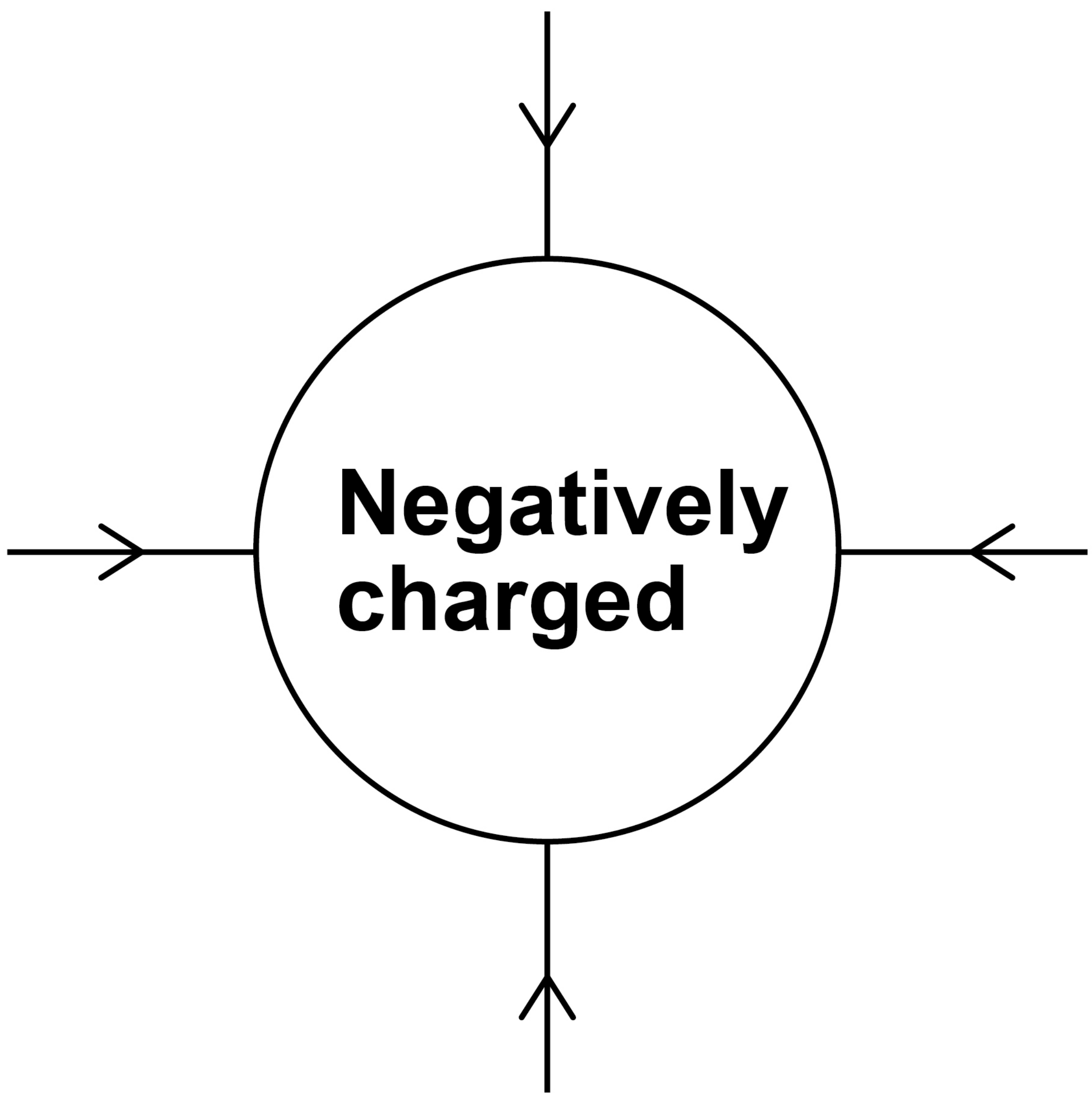
0 3 . 4

There is an electric field around any charged object.

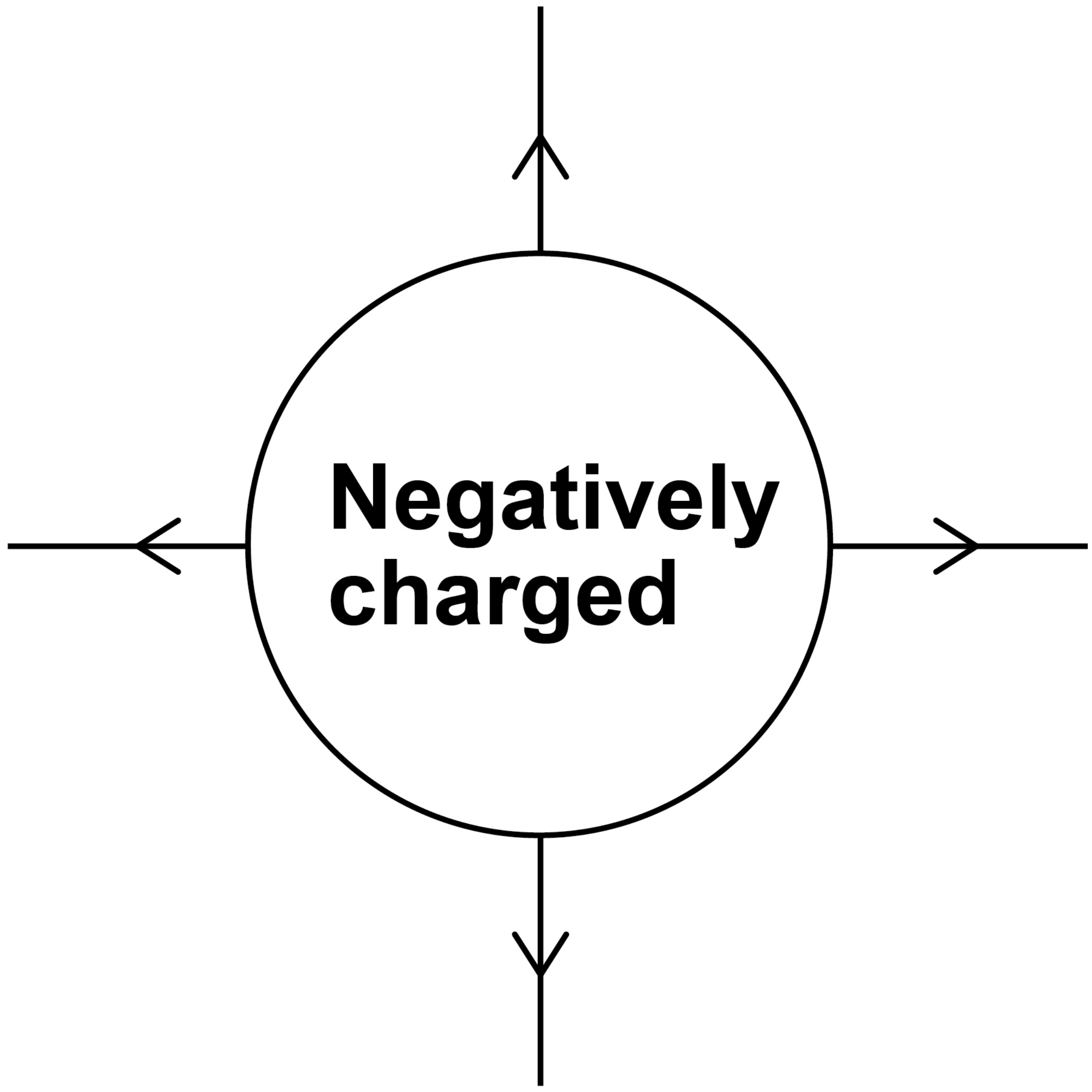
Which diagram, below and on the opposite page, shows the electric field pattern around a negatively charged sphere? [1 mark]

Tick (✓) ONE box.

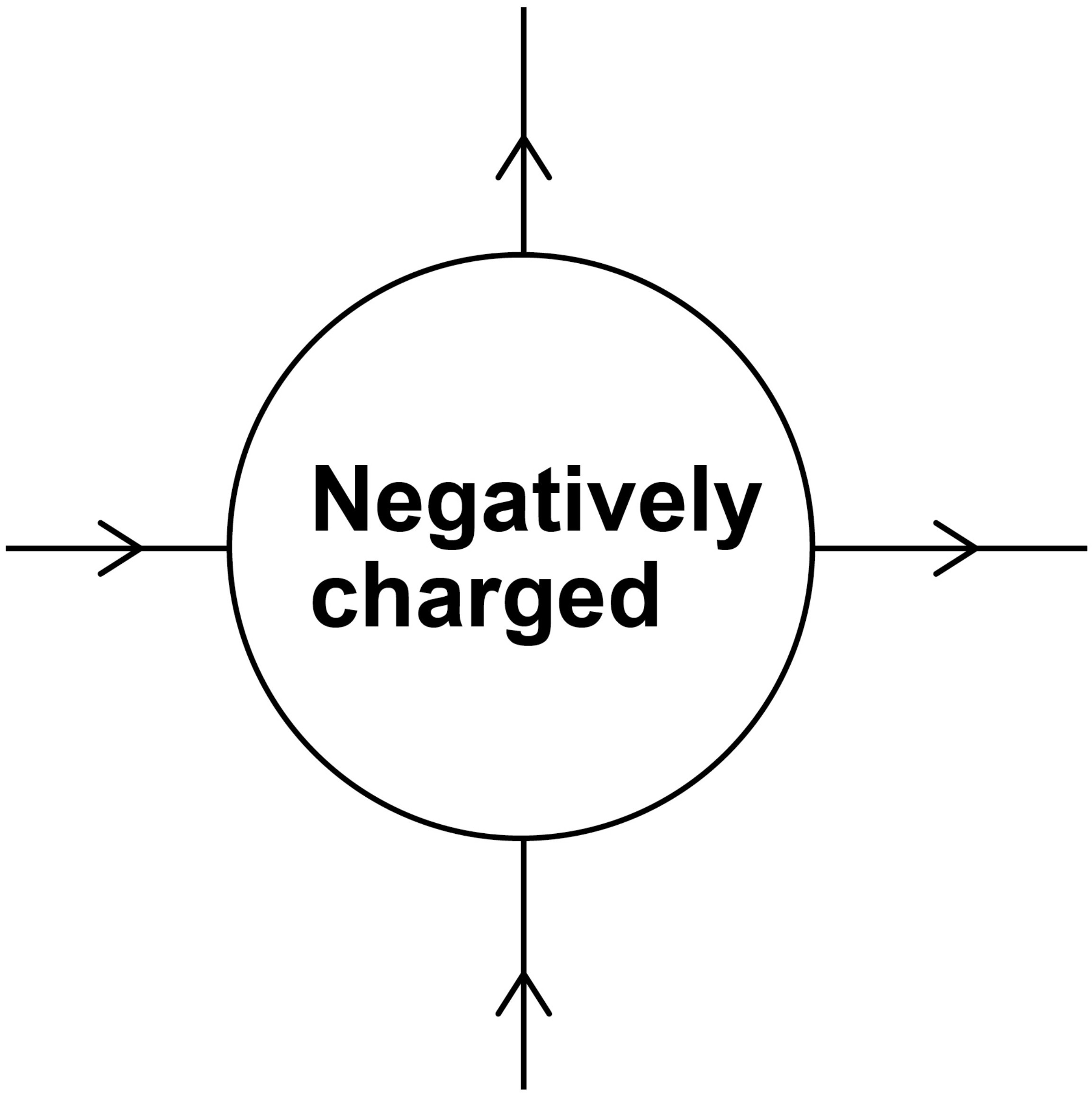
☐



☐


Negatively
charged

☐

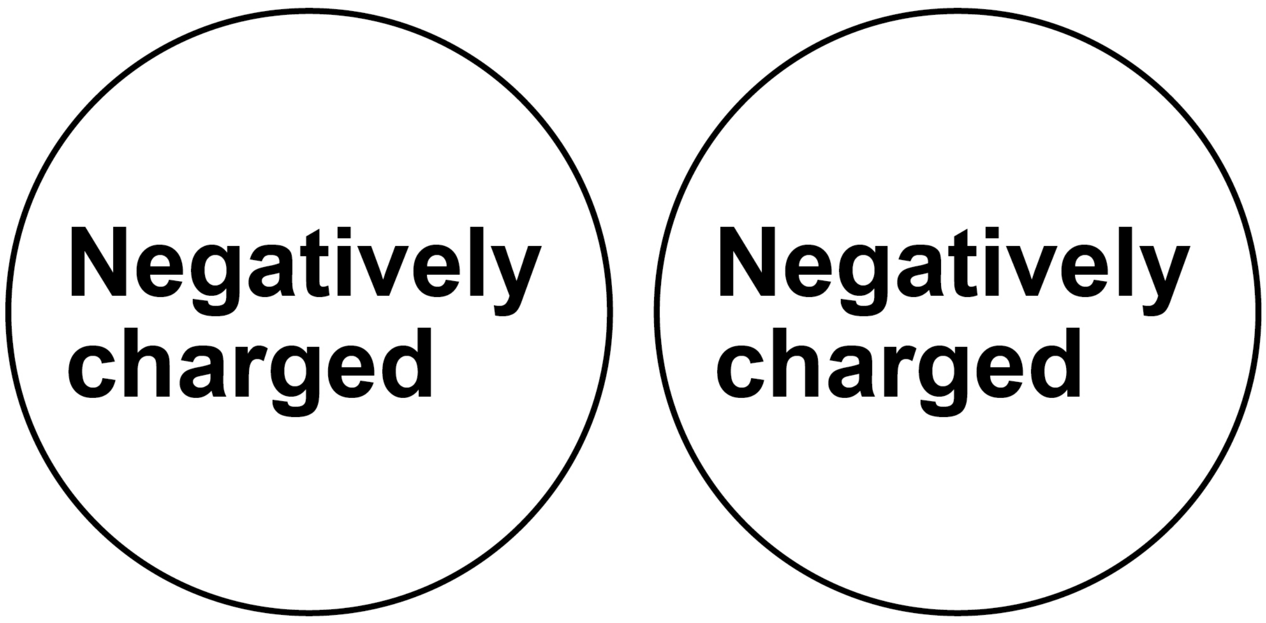

Negatively
charged

0 3 . 5

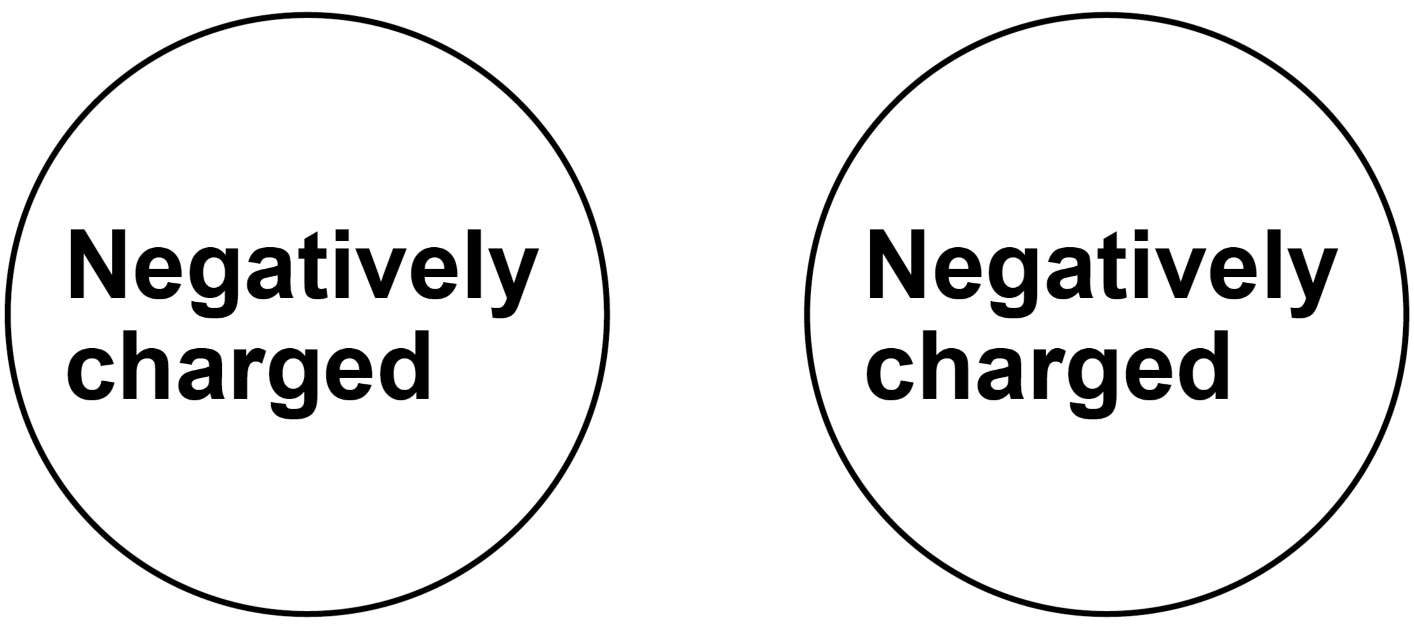
In which position do two charged spheres, below and on the opposite page, experience the greatest electrostatic force? [1 mark]

Tick (✓) ONE box.

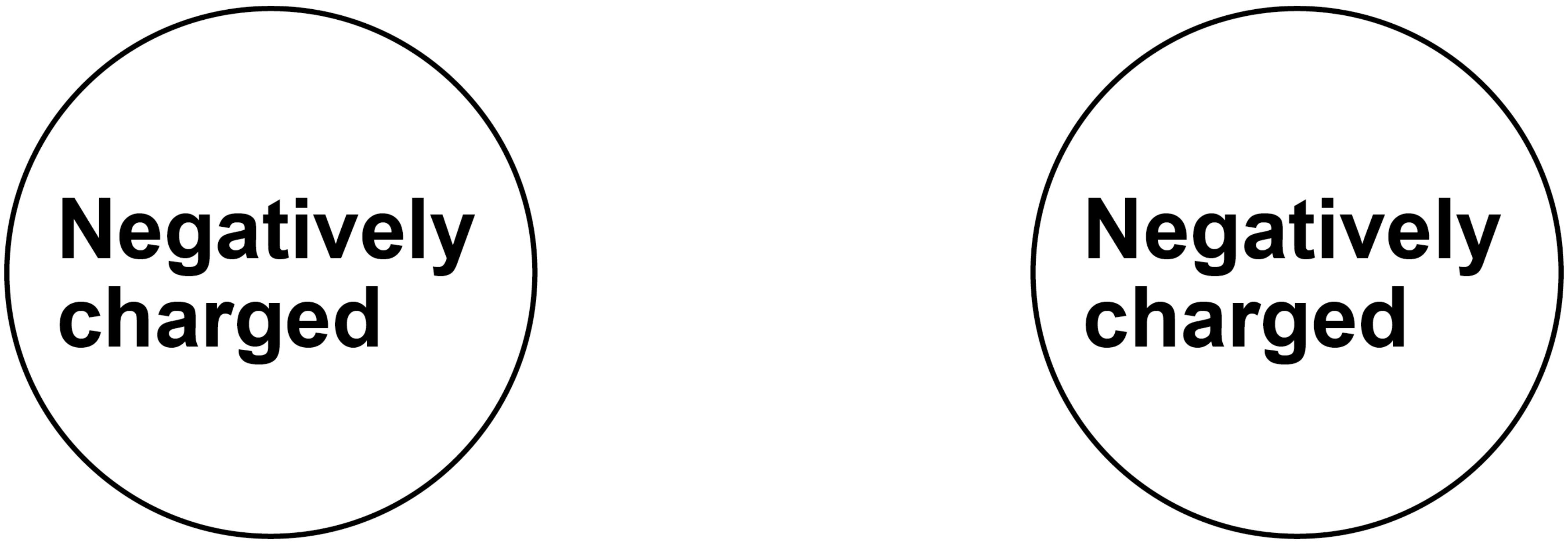
☐ **A**



☐ **B**



☐ **C**



[Turn over]

/7

0 4

Radioactive isotopes emit different types of nuclear radiation.

0 4 . 1

What does an alpha particle consist of?
[1 mark]

Tick (✓) ONE box.

- [ ] 2 protons and 2 electrons
- [ ] 2 protons and 2 neutrons
- [ ] 4 protons
- [ ] 4 neutrons

0 4 . 2

What is a beta particle? [1 mark]

Tick (✓) ONE box.

- [ ] **An electron**
- [ ] **A neutron**
- [ ] **Electromagnetic radiation**

[Turn over]

0 4 . 3

A krypton (Kr) nucleus decays into a rubidium (Rb) nucleus by emitting a beta particle.

What is the correct equation for this decay? [1 mark]

Tick (✓) ONE box.

☐ $^{85}_{36}\mathrm{Kr} + ^{0}_{-1}\mathrm{e} \longrightarrow ^{85}_{37}\mathrm{Rb}$

☐ $^{85}_{36}\mathrm{Kr} \longrightarrow ^{85}_{37}\mathrm{Rb} + ^{0}_{-1}\mathrm{e}$

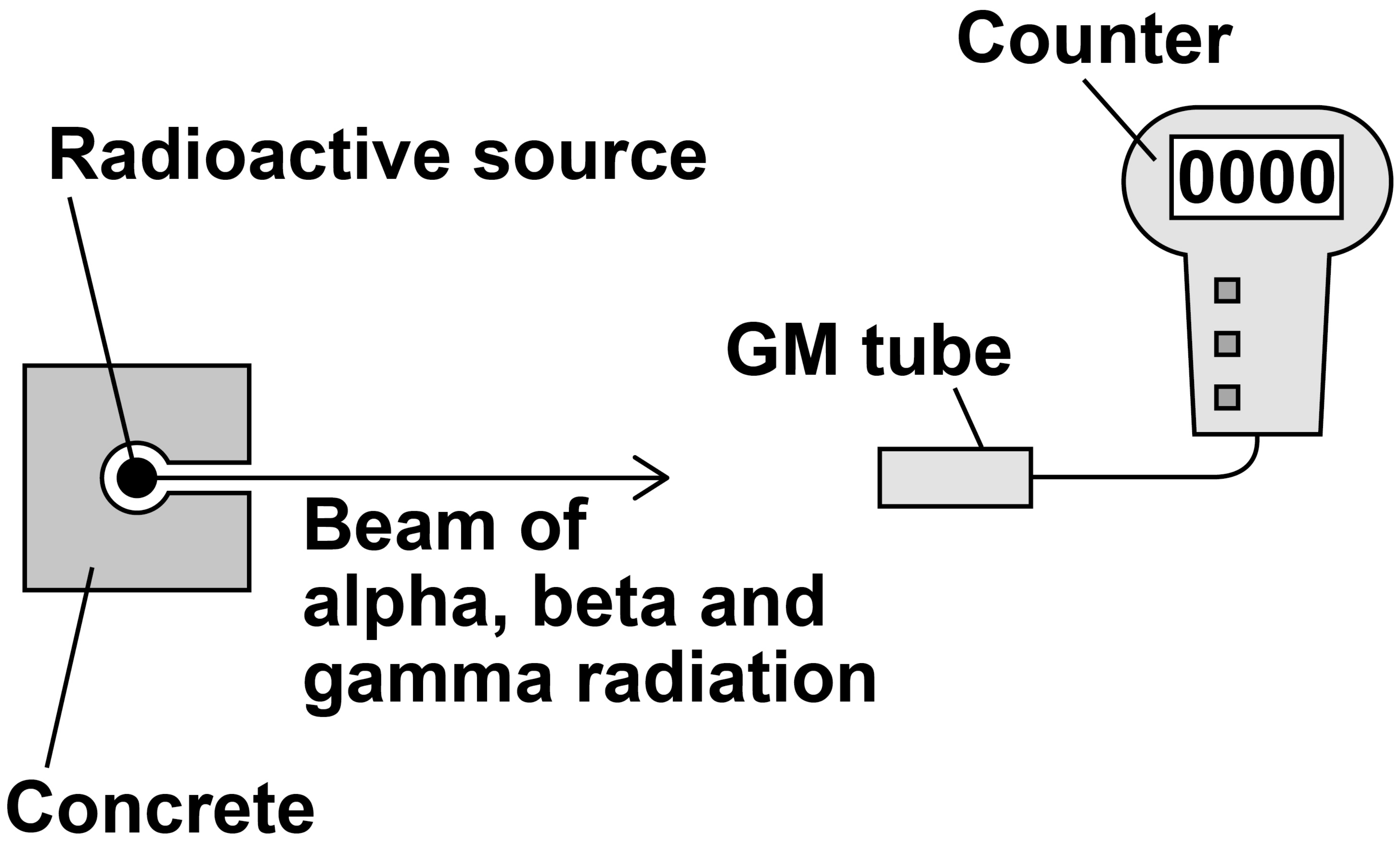
☐ $^{85}_{37}\mathrm{Rb} \longrightarrow ^{85}_{36}\mathrm{Kr} + ^{0}_{-1}\mathrm{e}$

0 4 . 4

FIGURE 5 shows an experiment to demonstrate how alpha, beta and gamma radiation penetrate different materials.

The experiment takes place in a vacuum.

FIGURE 5



[Turn over]

Three different materials are used:

- a sheet of paper
- a 0.5 cm thick sheet of aluminium
- a 10 cm block of lead.

Each material is placed one at a time between the radioactive source and the GM tube.

The GM tube and counter show whether the material has stopped the radiation.

Complete TABLE 1, on the opposite page, to show how alpha, beta and gamma radiation penetrate the materials in FIGURE 5, on page 33.

Use the words YES and NO.

Part of TABLE 1 has been completed for you. [3 marks]

TABLE 1

Type of radiation	Most radiation is stopped by:		
	the sheet of paper	the sheet of aluminium	the block of lead
Alpha			Yes
Beta	No		
Gamma		No	

[Turn over]

0 4 . 5

Alpha, beta and gamma radiation have different ionising powers.

Draw ONE line from each radiation type to the correct ionising power. [3 marks]

Radiation type	Ionising power
Alpha	Zero
Beta	Low
Gamma	Medium
	High

0 4 . 6

Some sources of background radiation are natural and other sources are man-made.

Which of the following is a man-made source of background radiation?
[1 mark]

Tick (✓) ONE box.

☐ **Cosmic rays**

☐ **Nuclear accidents**

☐ **Rocks**

[Turn over]

0 4 . 7

The average background radiation dose per year in the UK is 2.0 millisieverts.

A dental X-ray gives a patient a radiation dose of 0.005 millisieverts.

Calculate how many dental X-rays would be the same as the average background radiation dose per year. [2 marks]

____

____

____

____

Number of dental X-rays = ________________

12

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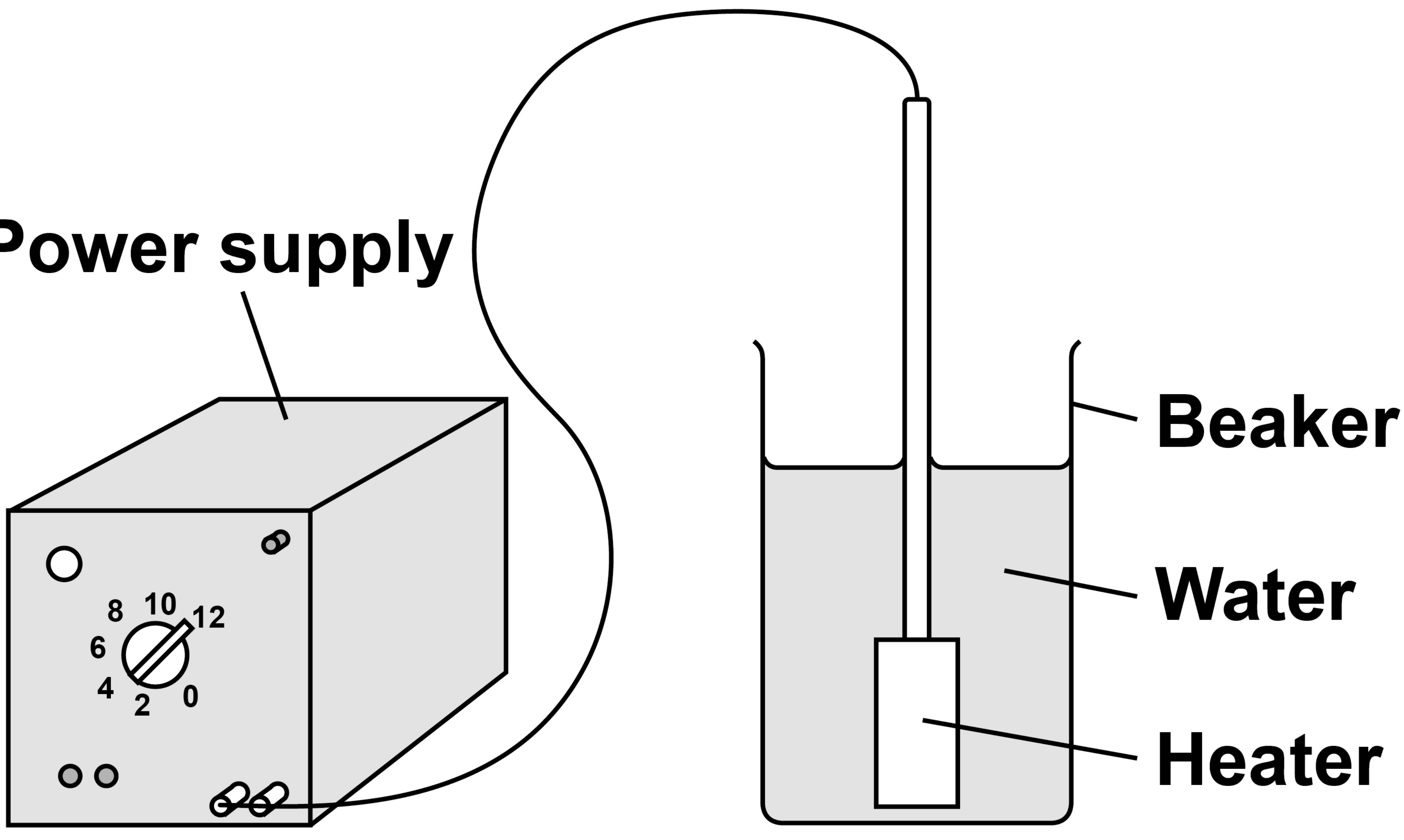
[Turn over]

0 5

A student determined the specific latent heat of vaporisation of water.

FIGURE 6 shows some of the equipment used.

FIGURE 6



0 5 . 1

The student measured a mass of water and put it into the beaker.

What measuring instrument should the student have used to measure the mass of the water? [1 mark]

Tick (✓) ONE box.

- [ ] **balance**
- [ ] **joulemeter**
- [ ] **newtonmeter**
- [ ] **thermometer**

[Turn over]

0 5 . 2

The power output of the heater stayed the same throughout the experiment.

What type of variable was the power output of the heater? [1 mark]

Tick (✓) ONE box.

- [ ] **Categoric variable**
- [ ] **Control variable**
- [ ] **Dependent variable**
- [ ] **Independent variable**

05.3

The student turned on the heater and heated the water until it reached boiling point.

The student continued to heat the water so that it boiled for several minutes.

The mass of the water remaining in the beaker was measured again.

Give ONE way the beaker of boiling water could be moved safely to measure its new mass. [1 mark]

05.4

The mass of water that turned into steam was 0.0090 kg.

The heater transferred 25 200 J of energy to the water to turn it into steam.

Calculate the specific latent heat of vaporisation of water given by the student's data.

Use the Physics Equations Sheet.

Choose the unit from the list. [4 marks]

- **J**
- **kg**
- **J/kg**

Specific latent heat of vaporisation = ______________________

Unit ______________________

[Turn over]

0 5 . 5

What was a source of error in the student's experiment? [1 mark]

Tick (✓) ONE box.

- [ ] **The transfer of thermal energy from the heater to the water**
- [ ] **The transfer of thermal energy from the surroundings to the water**
- [ ] **The transfer of thermal energy from the water to the heater**
- [ ] **The transfer of thermal energy from the water to the surroundings**

8

BLANK PAGE

[Turn over]

0 6

A hair dryer contains three heating elements.

FIGURE 7, on the opposite page, shows the circuit diagram for the heating elements in the hair dryer.

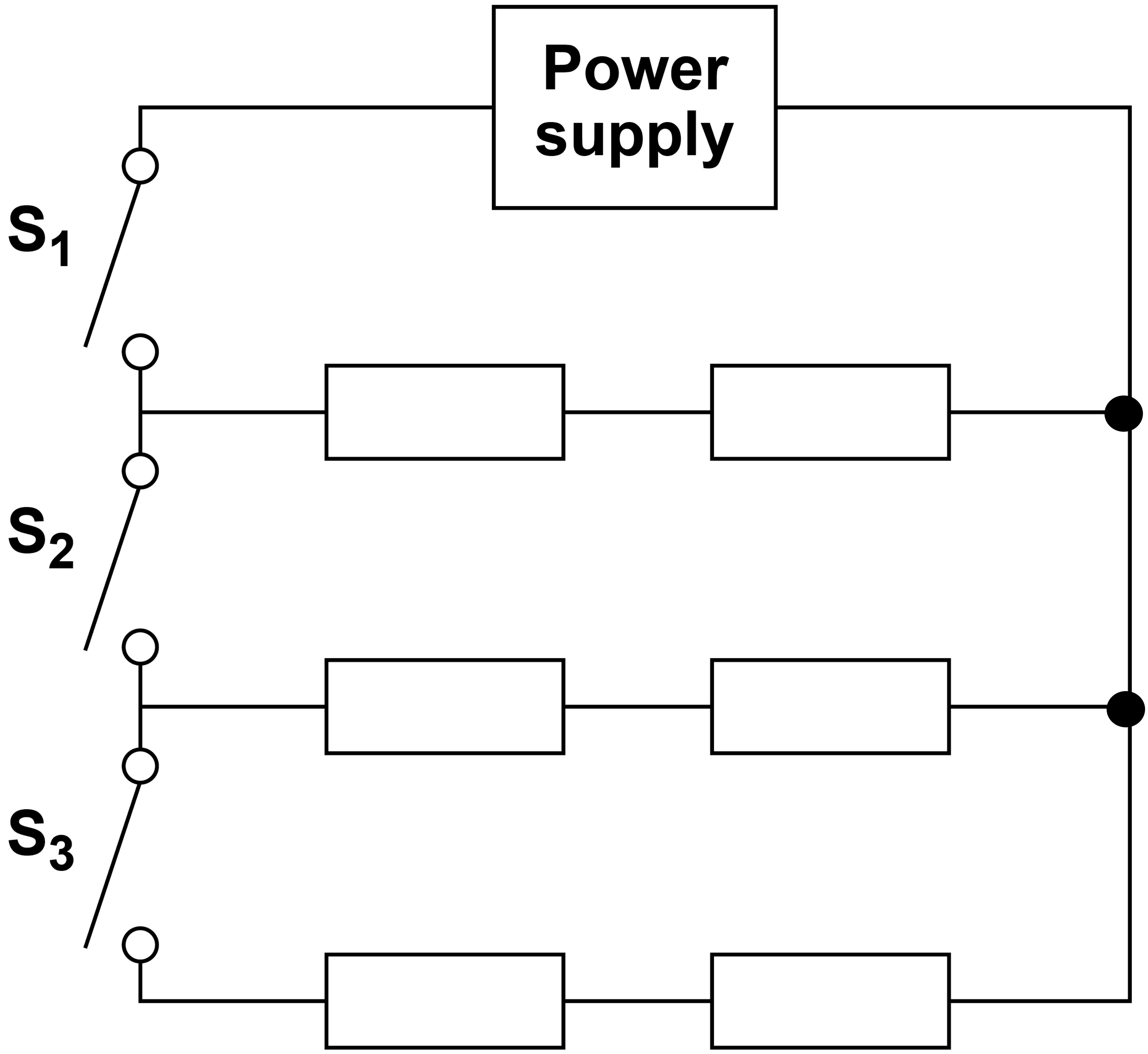
In FIGURE 7 the heating elements are represented by resistor symbols.

0 6 . 1

Complete the sentence. [1 mark]

The three resistors in FIGURE 7 are connected in ____________________ with the power supply.

FIGURE 7



[Turn over]

0 6 . 2

Which switch must always be closed for the hair dryer to work? [1 mark]

Tick (✓) ONE box.

☐ S_1

☐ S_2

☐ S_3

0 6 . 3

Which switches must be closed for the hair dryer to work at maximum power output? [1 mark]

Tick (✓) ONE box.

☐ S_1 and S_2

☐ S_1 and S_3

☐ S_1, S_2 and S_3

[Turn over]

Use the Physics Equations Sheet to answer questions 06.4 and 06.5.

06.4

Write down the equation which links energy transferred (*E*), power (*P*) and time (*t*). [1 mark]

___

06.5

The heating elements have a maximum power output of 1200 W.

The energy transferred to the heating elements to reach normal operating temperature is 3600 J.

Calculate the time taken for the heating elements to reach normal operating temperature at maximum power output. [3 marks]

Time = ______________________ s

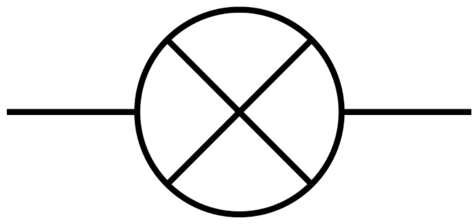
[Turn over]

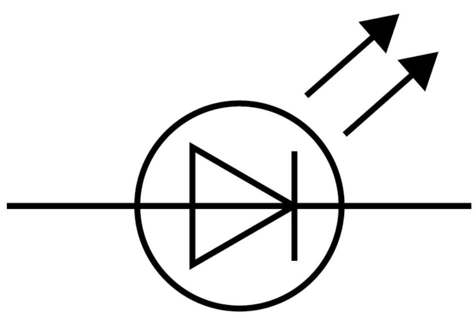
0 6 . 6

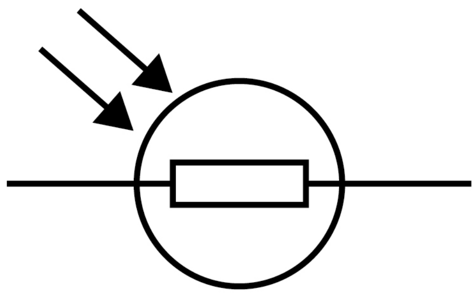
The hair dryer has LEDs to indicate the power setting.

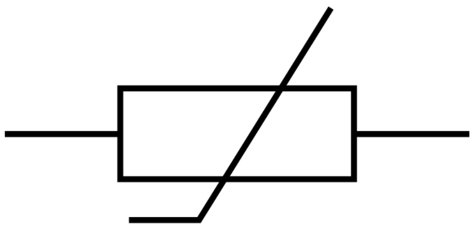
What is the circuit symbol for an LED?
[1 mark]

Tick (✓) ONE box.

☐ 

☐ 

☐ 



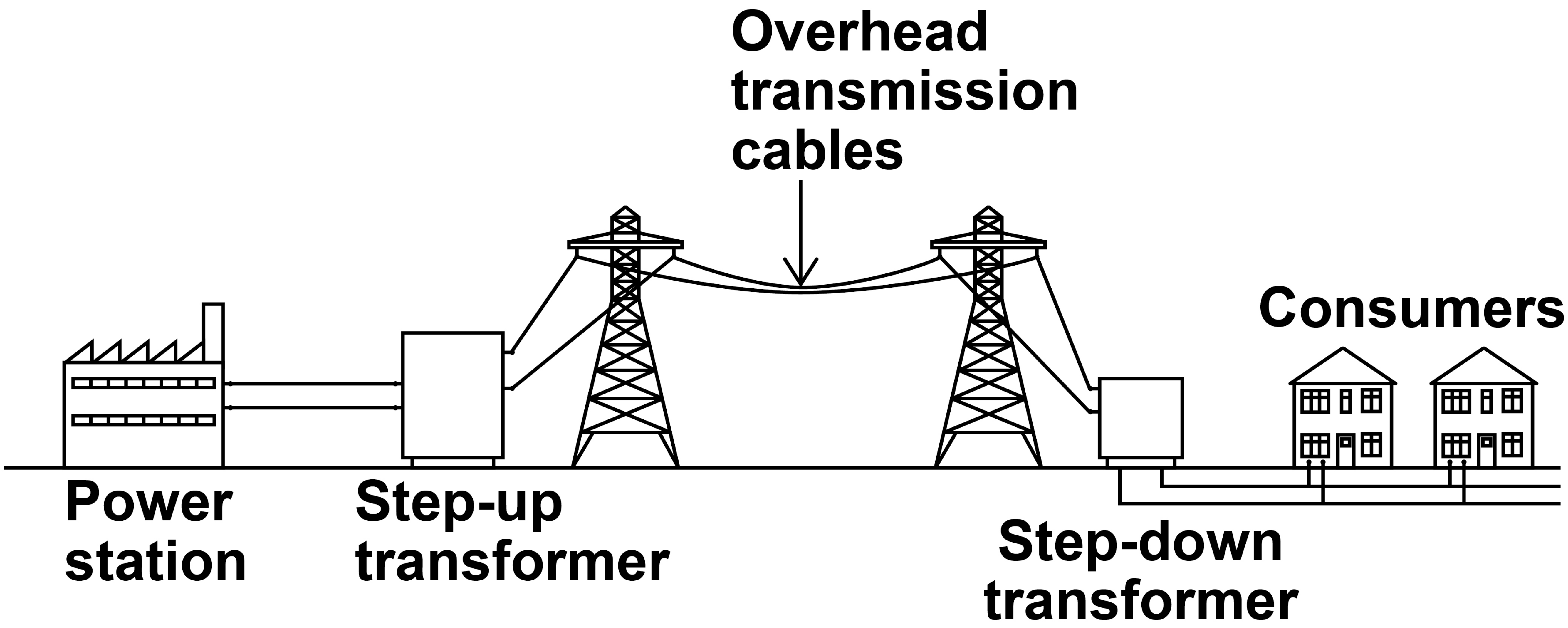
8

[Turn over]

0 7

FIGURE 8 shows how electricity is supplied to consumers.

FIGURE 8



0 7 . 1

Electricity from the power station can be generated using renewable or non-renewable energy resources.

Complete TABLE 2 to show which energy resources are renewable and which are non-renewable. [2 marks]

Tick (✓) ONE box in EACH row.

TABLE 2

ENERGY RESOURCE	RENEWABLE	NON-RENEWABLE
biofuel		
coal		
nuclear		
tides		

[Turn over]

0 7 . 2

Transformers are used to make power transmission an efficient process.

Complete the sentences on the opposite page.

Choose answers from the list.

Each answer may be used once, more than once or not at all. [4 marks]

- **charge**
- **current**
- **energy**
- **potential difference**
- **resistance**

The step-up transformer increases the ____________________ and decreases the ______________________ .

Using the transformers decreases the ____________________ transfer from the overhead transmission cables to the surroundings.

The step-down transformer decreases the

____________________________ .

[Turn over]

Use the Physics Equations Sheet to answer questions 07.3 and 07.4.

0 7 . 3

Write down the equation which links charge flow (*Q*), current (*I*) and time (*t*).
[1 mark]

____

0 7 . 4

The town of Hornsdale in Australia has electricity supplied by a huge battery.

The battery supplies a current of 130 000 A.

Calculate the charge flow from the battery in 5 minutes.

Choose the unit from the list. [4 marks]

- **coulombs**
- **newtons**
- **watts**

____

____

____

____

____

____

Charge flow = ________________________

Unit _________________

11

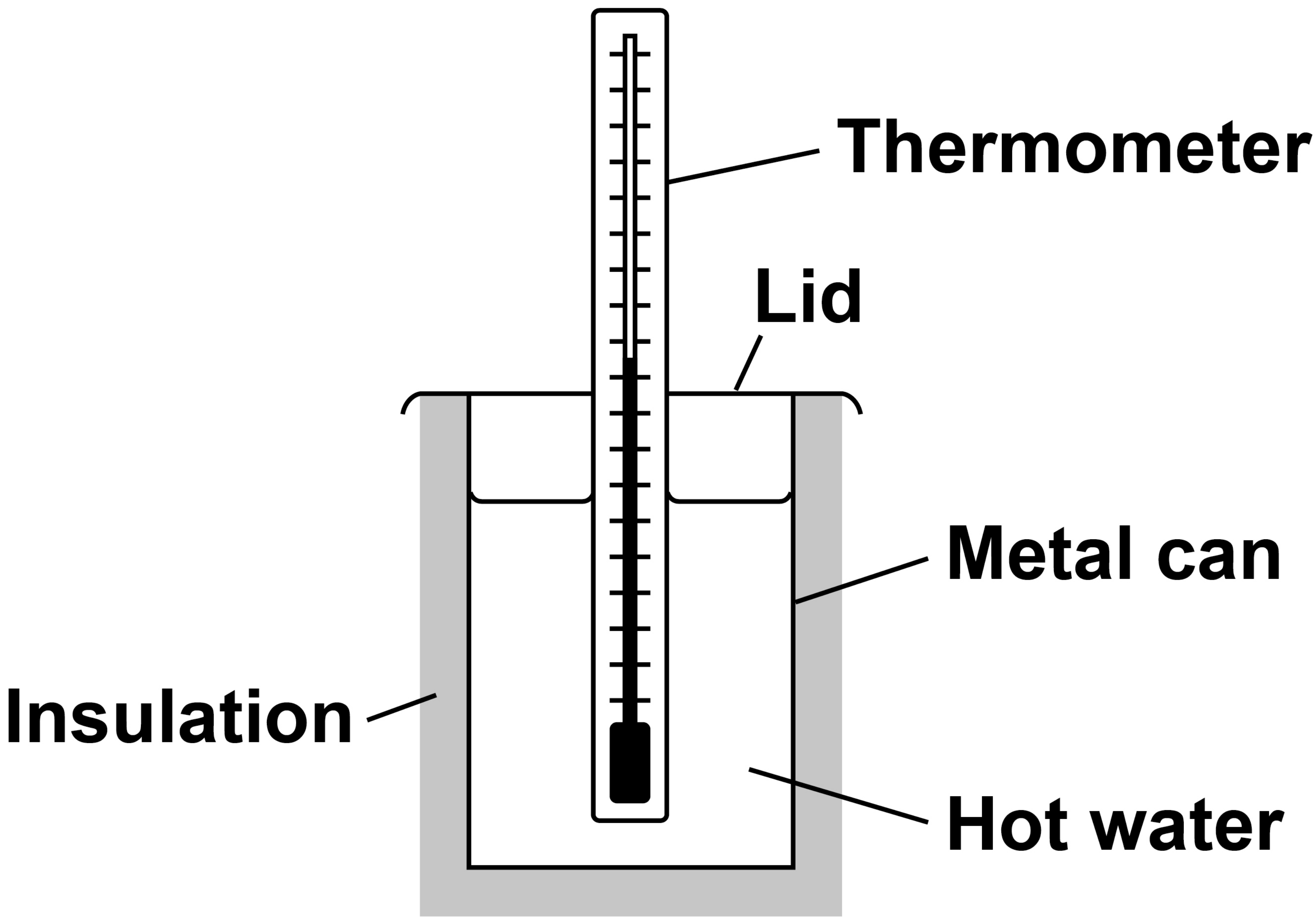
0 8

A student investigated the insulating properties of two different materials.

The same thickness of each material was used.

FIGURE 9 shows some of the equipment used by the student.

FIGURE 9



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[Turn over]

The student used two different types of thermometer to measure the temperature changes.

FIGURE 10 shows a reading on each thermometer.

FIGURE 10

Thermometer A   Thermometer B

08.1

What is the resolution of thermometer B?
[1 mark]

Tick (✓) ONE box.

☐ **0.1 °C**

☐ **0.4 °C**

☐ **67.0 °C**

☐ **67.4 °C**

[Turn over]

REPEAT OF FIGURE 10

Thermometer A **Thermometer B**

08.2

Complete the sentence, on the opposite page.

Choose the answer from the list.
[1 mark]

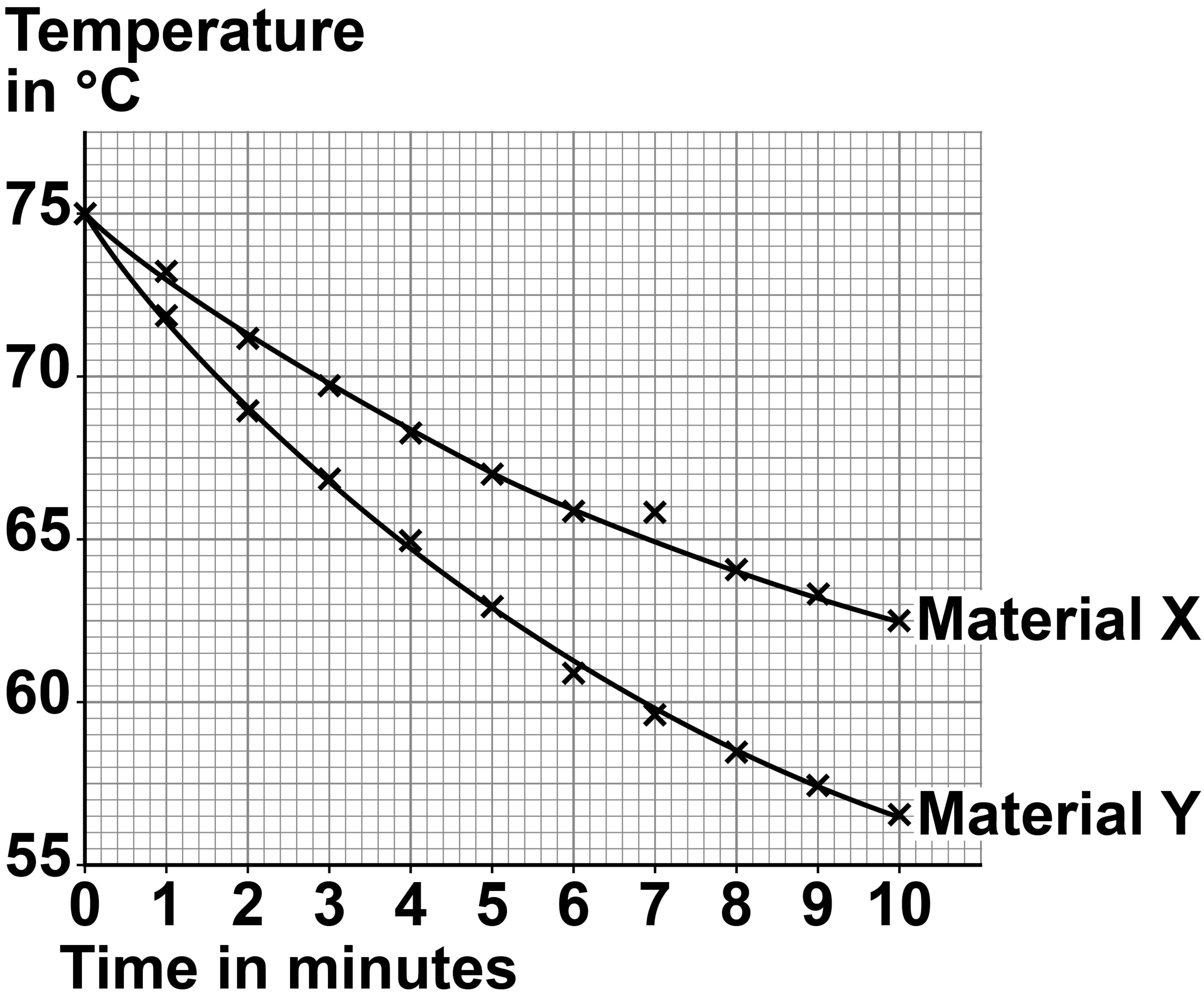
- a smaller
- the same
- a bigger

Thermometer A has ____________________ chance of being misread than thermometer B.

[Turn over]

FIGURE 11 shows the results.

FIGURE 11



0 8 . 3

The mass of water used was 0.12 kg.

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

Determine the total change in thermal energy of the water when Material X was used.

Use values from FIGURE 11, on the opposite page.

Use the Physics Equations Sheet.
[4 marks]

____

____

____

____

____

____

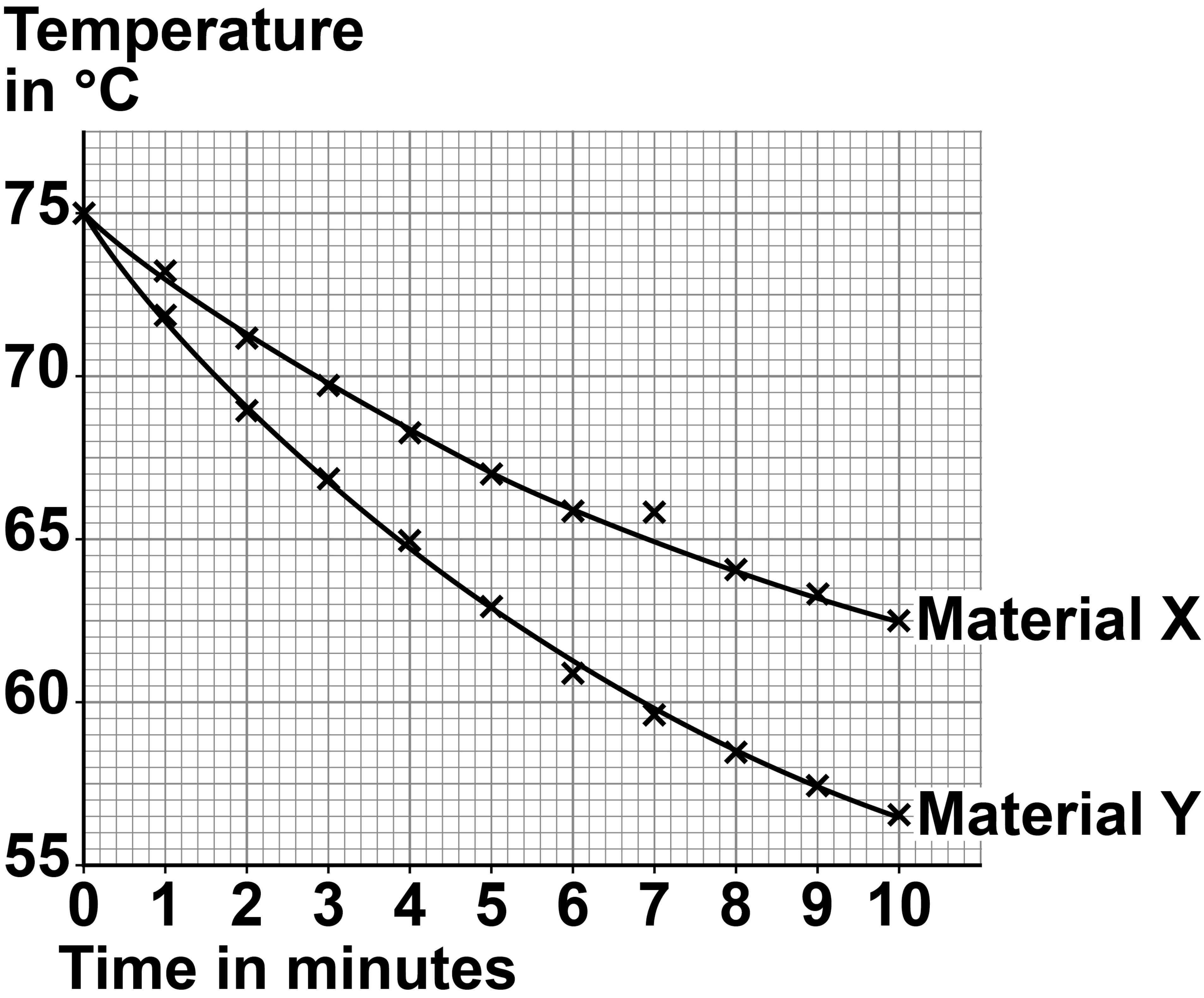
____

____

Total change in thermal energy =

____________________ **J**

REPEAT OF FIGURE 11



0 8 . 4

There is an anomalous result on FIGURE 11.

Draw a ring around the anomalous result, on FIGURE 11 above. [1 mark]

08.5

Give TWO conclusions that can be made from FIGURE 11. [2 marks]

1 ______________________________________

____

____

____

____

2 ______________________________________

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____

____

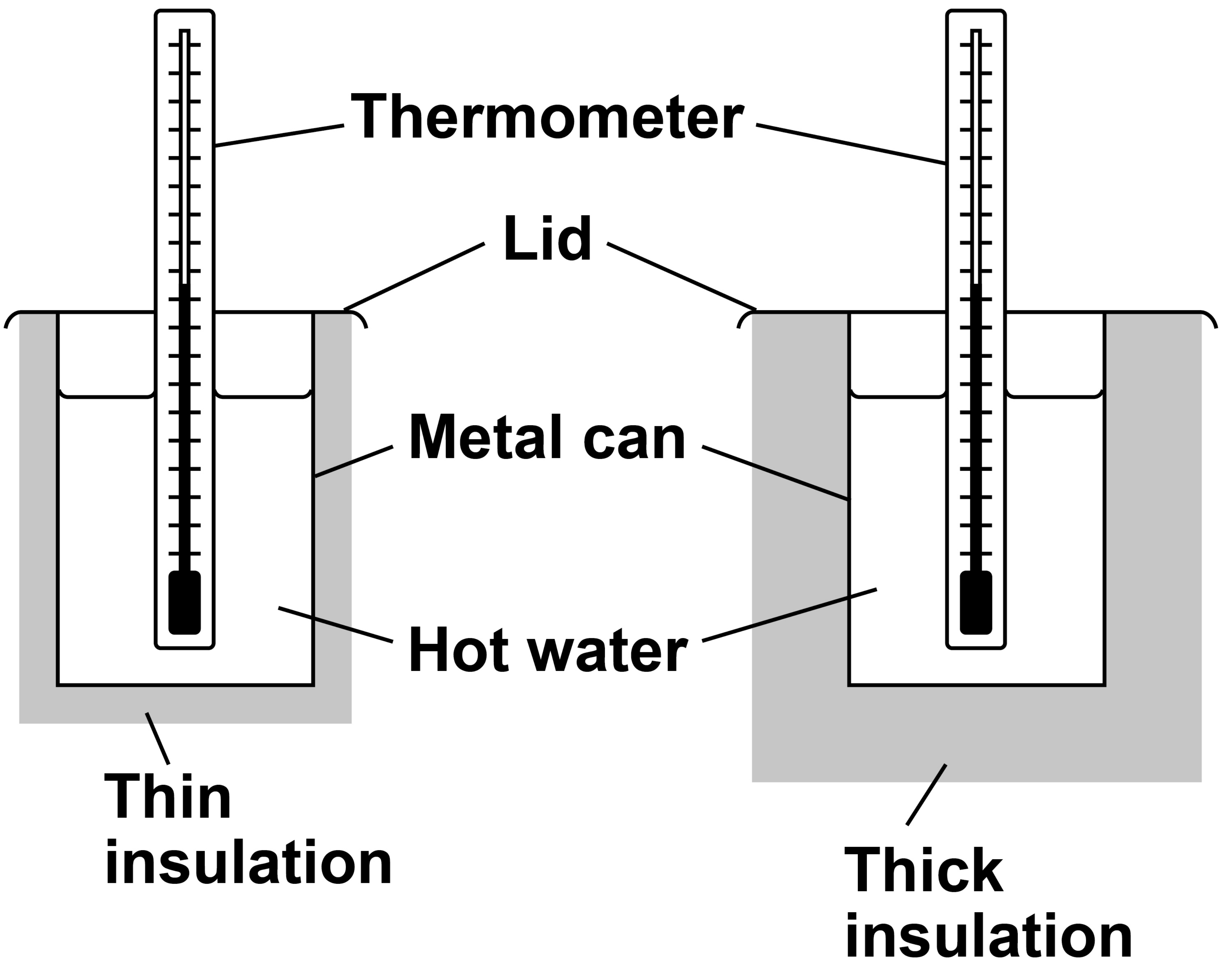
____

[Turn over]

Another student investigated how the thickness of the insulation affected the rate of cooling of hot water.

FIGURE 12 shows some of the equipment used.

FIGURE 12



0 8 . 6

How would using thick insulation affect the rate of cooling of hot water compared with using thin insulation? [1 mark]

Tick (✓) ONE box.

☐ **The rate of cooling would be higher.**

☐ **The rate of cooling would be lower.**

☐ **The rate of cooling would not change.**

[Turn over]

0 8 . 7

Predict how using thick insulation would affect the temperature of the water after 10 minutes compared with using thin insulation. [1 mark]

Tick (✓) ONE box.

- [ ] **The temperature would be higher.**
- [ ] **The temperature would be lower.**
- [ ] **The temperature would be the same.**

11

BLANK PAGE

[Turn over]

0 9

FIGURE 13 shows a large wind farm off the coast of the UK.

FIGURE 13

The mean power output of the wind farm is 696 MW, which is enough power for 580 000 homes.

0 9 . 1

Calculate the mean power needed for 1 home.

Give your answer in watts. [2 marks]

____

____

____

____

____

____

____

____

Mean power needed for 1 home =

________________________________ **W**

[Turn over]

0 9 . 2

On one day the demand for electricity in the UK was 34 000 MW.

Suggest TWO reasons why wind power was not able to meet this demand.
[2 marks]

1 ____

____

____

____

2 ____

____

____

____

0 9 . 3

Some of the energy from the wind used to rotate a wind turbine is wasted.

An engineer oils the mechanical parts of a wind turbine.

Explain how oiling would affect the efficiency of the wind turbine. [3 marks]

[Turn over]

0 9 . 4

In most homes in the UK there are many different electrical devices.

Explain why people should be encouraged to use energy efficient electrical devices. [2 marks]

___

___

___

___

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___

___

9

1 0

FIGURE 14 shows a rock found by a student on a beach.

To help identify the type of rock, the student took measurements to determine its density.

FIGURE 14

[Turn over]

10.1

Describe a method the student could use to determine the density of the rock.
[6 marks]

[Turn over]

The student determined the density of the rock to be 2.55 ± 0.10 g/cm^3.

10.2

What are the maximum and minimum values for the density of the rock?
[1 mark]

Maximum density = ________________ g/cm^3

Minimum density = ________________ g/cm^3

BLANK PAGE

[Turn over]

10.3

TABLE 3 gives the density of five different types of rock.

TABLE 3

Type of rock	Density in g/cm^3
Basalt	2.90 ± 0.10
Chalk	2.35 ± 0.15
Flint	2.60 ± 0.10
Sandstone	2.20 ± 0.20
Slate	2.90 ± 0.20

Which two types of rock in TABLE 3, on the opposite page, could be the type of rock the student had? [1 mark]

Tick (✓) ONE box.

- ☐ **Basalt or chalk**
- ☐ **Chalk or flint**
- ☐ **Flint or sandstone**
- ☐ **Sandstone or slate**

[Turn over]

10.4

The student only took one set of measurements to determine the density of the rock.

Explain why taking the measurements more than once may improve the accuracy of the density value. [2 marks]

10

11

An engineering company has invented pavement tiles that generate electricity as people walk on them.

FIGURE 15 shows someone walking on the pavement tiles.

FIGURE 15

[Turn over]

Use the Physics Equations Sheet to answer questions 11.1 and 11.2.

11.1

What equation links current (I), potential difference (V) and power (P)? [1 mark]

Tick (✓) ONE box.

☐ $P = \frac{V}{I}$

☐ $P = V \times I$

☐ $I = P \times V$

☐ $V = I^2 \times P$

11.2

When a person walks on a tile, a potential difference of 40 V is induced across the tile.

The power output of the tile is 4.4 W.

Calculate the current in the tile.
[3 marks]

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Current = ______________________ A

[Turn over]

Use the Physics Equations Sheet to answer questions 11.3 and 11.4.

11.3

**What equation links efficiency, total power input and useful power output?
[1 mark]**

Tick (✓) ONE box.

☐ $$\text{Efficiency} = \frac{\text{useful power output}}{\text{total power input}}$$

☐ $$\text{Efficiency} = \frac{\text{total power input}}{\text{useful power output}}$$

☐ **Efficiency =
useful power output ×
total power input**

11.4

The tiles are used to power LED lights in the pavement.

An LED light has a total power input of 4.0 W.

The efficiency of the LED light is 0.85

Calculate the useful power output of the LED light. [3 marks]

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Useful power output = ______________ W

8

END OF QUESTIONS

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

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For Examiner's Use	
Question	Mark
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