A

Surname ______________________

Other Names ______________________

Centre Number ______________________

Candidate Number ______________________

Candidate Signature ______________________

GCSE
PHYSICS

F

Foundation Tier   Paper 1

8463/1F

Wednesday 22 May 2019   Afternoon

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]

JUN1984631F01

For this paper you must have:

- **a ruler**
- **a scientific calculator**
- **a protractor**
- **the Physics Equations Sheet (enclosed).**

INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **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.**
- **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.

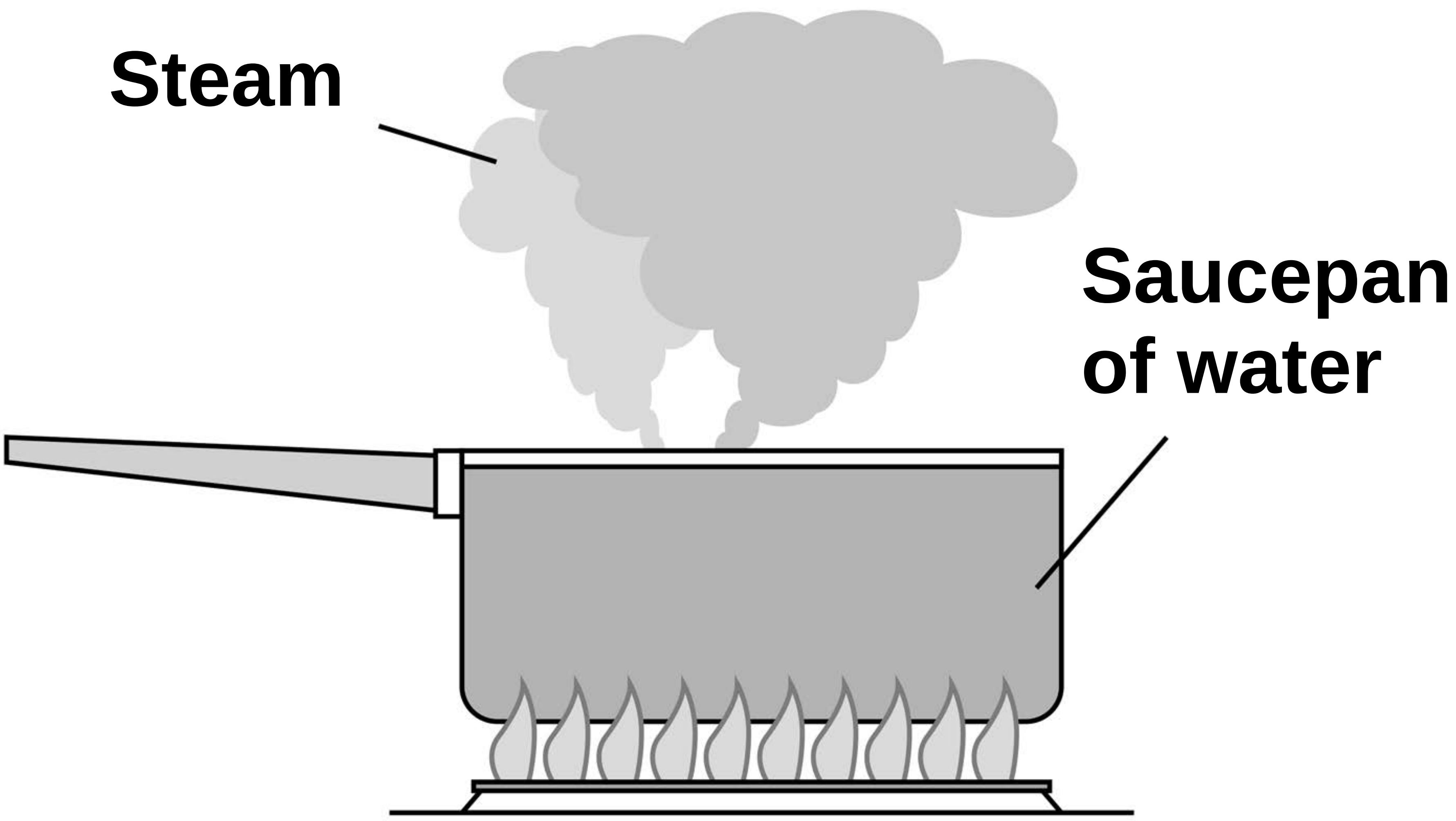
DO NOT TURN OVER UNTIL TOLD TO DO SO

Answer ALL questions in the spaces provided.

0 1

FIGURE 1 shows water being heated. Eventually the water changed into steam.

FIGURE 1



0 1 . 1

Complete the sentences.

Choose answers from the list below.

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

- **greater than**
- **less than**
- **the same as**

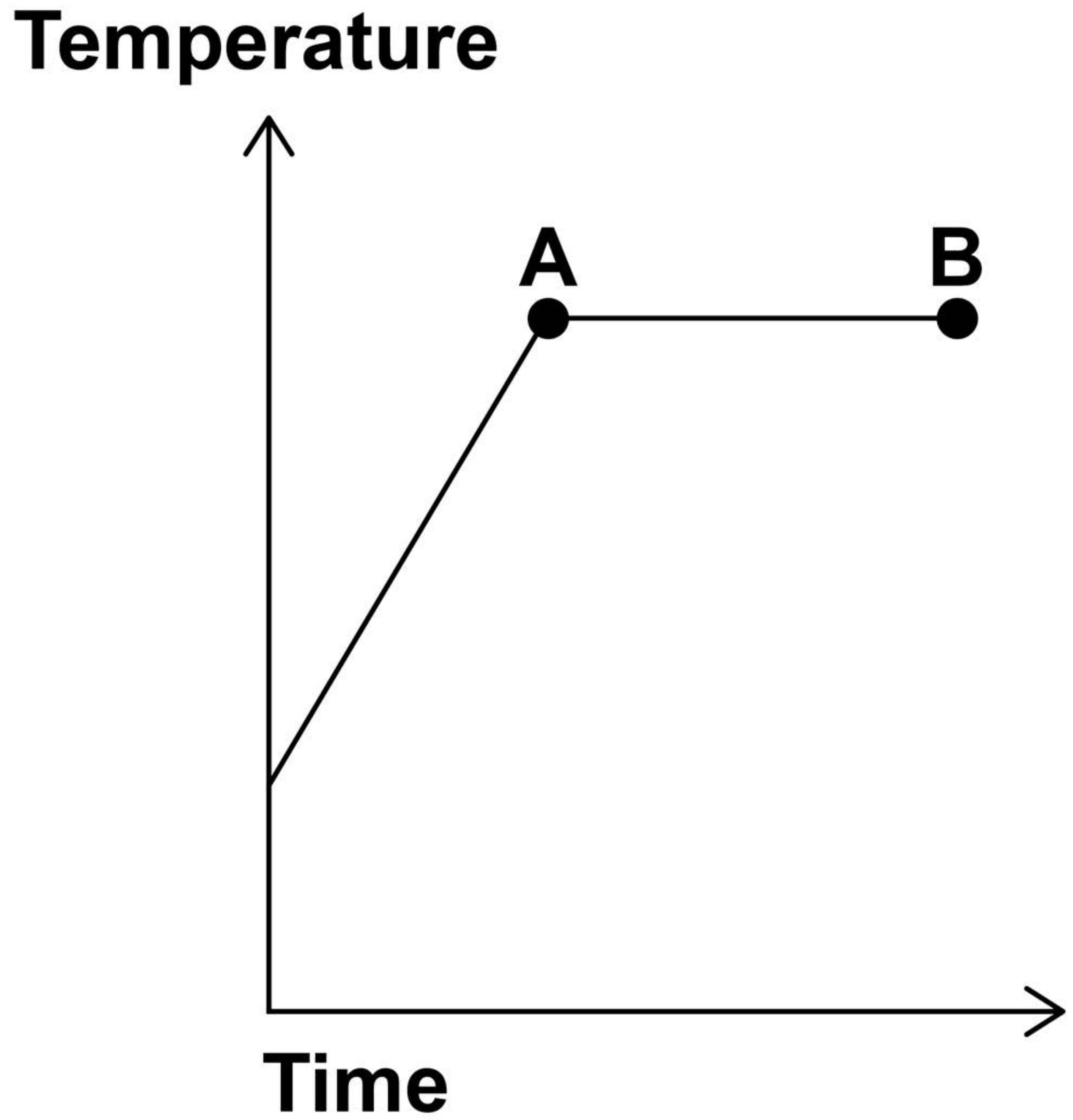
The distance between the particles in steam is ________________ the distance between the particles in liquid water.

The density of steam is ________________ the density of liquid water.

[Turn over]

FIGURE 2 shows how the temperature of the water varied with time.

FIGURE 2



0 1 . 2

What is the name of the process that is taking place between points A and B?

Give a reason for your answer.
[2 marks]

Process ______________________________

____

Reason ______________________________

____

____

[Turn over]

0 1 . 3

A mass of 0.063 kg of water was turned into steam.

The specific latent heat of vaporisation of water is 2 260 000 J/kg

Calculate the thermal energy transferred to the water to turn it into steam.

Use the equation:

thermal energy for a change of state = mass × specific latent heat
[2 marks]

Energy = ______________________________ J

[Turn over]

0 1 . 4

The mass of the steam was 0.063 kg

The volume of the steam was 0.105 m^3

Calculate the density of steam.

Use the equation:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Choose the unit from the list below.
[3 marks]

- **kg**
- **m^3 / kg**
- **kg / m^3**

Density = ________________ Unit ____________

9

[Turn over]

0 2

Polonium-210 ($^{210}_{84}Po$) is a radioactive isotope that decays by emitting alpha radiation.

0 2 . 1

Which is the correct decay equation for polonium-210? [1 mark]

Tick (✓) ONE box.

☐ $$^{210}_{84}Po \longrightarrow {}^{214}_{86}X + {}^{4}_{2}He$$

☐ $$^{210}_{84}Po \longrightarrow {}^{206}_{86}X + {}^{4}_{2}He$$

☐ $$^{210}_{84}Po \longrightarrow {}^{206}_{82}X + {}^{4}_{2}He$$

0 2 . 2

Why is alpha radiation dangerous inside the human body? [1 mark]

Tick (✓) ONE box.

☐ **Alpha radiation is electromagnetic radiation.**

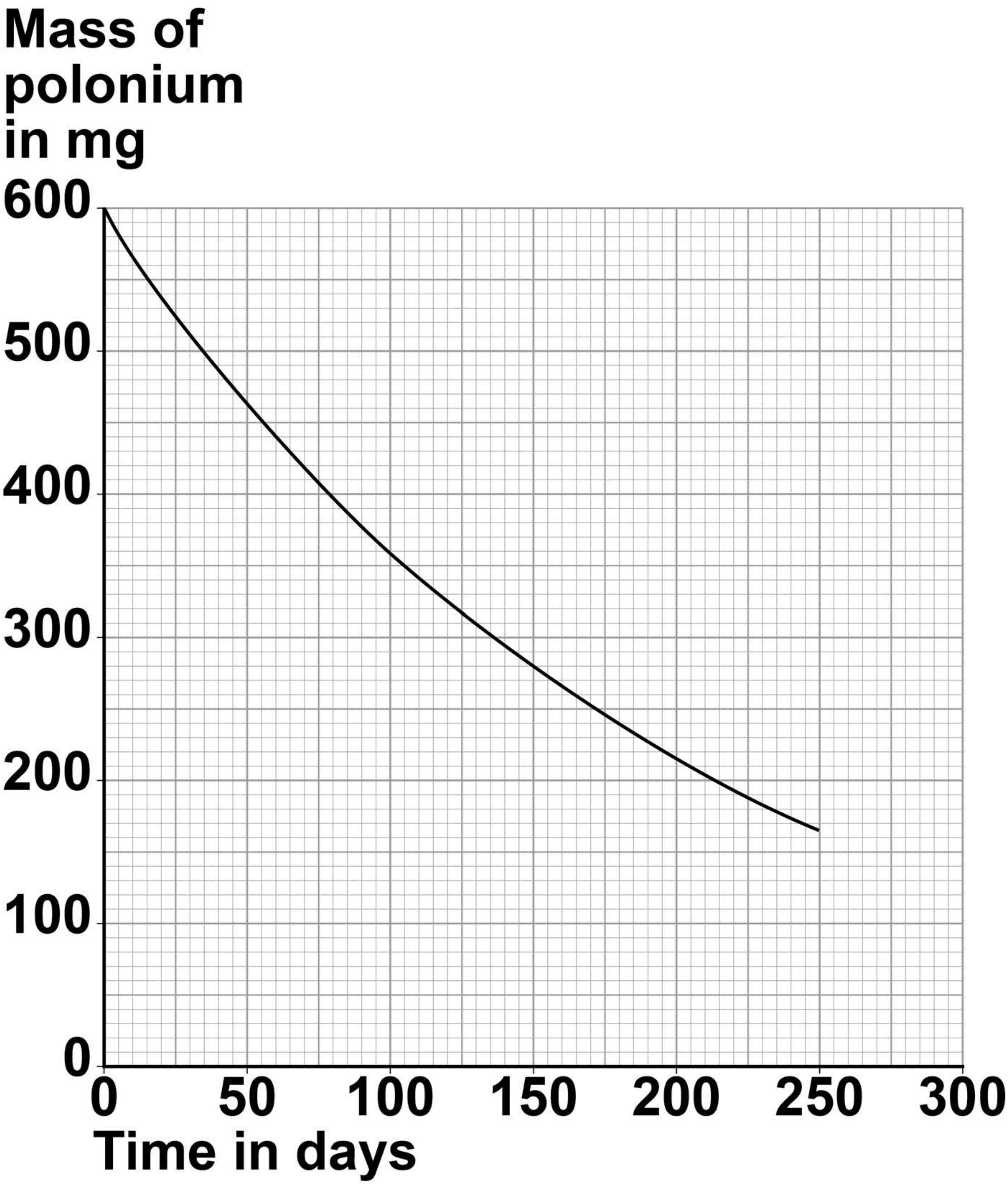
☐ **Alpha radiation is highly ionising.**

☐ **Alpha radiation is very penetrating.**

[Turn over]

FIGURE 3 shows how the mass of a sample of polonium-210 changes with time.

FIGURE 3



02.3

Determine the change in mass of the sample of polonium-210 between 50 and 150 days. [2 marks]

____

____

____

____

____

Change in mass = ____________________ mg

02.4

Estimate the mass of polonium-210 remaining after 300 days. [1 mark]

____

____

Mass = ______________________________ mg

[Turn over]

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0 2 . 5

Nuclear radiation can cause ionisation.

Complete the sentences.

Choose answers from the list below.
[2 marks]

- **a negative**
- **an electron**
- **a neutron**
- **a positive**
- **a proton**
- **a zero**

An atom becomes an ion when it loses

____________________ .

The resulting ion has ____________________

charge.

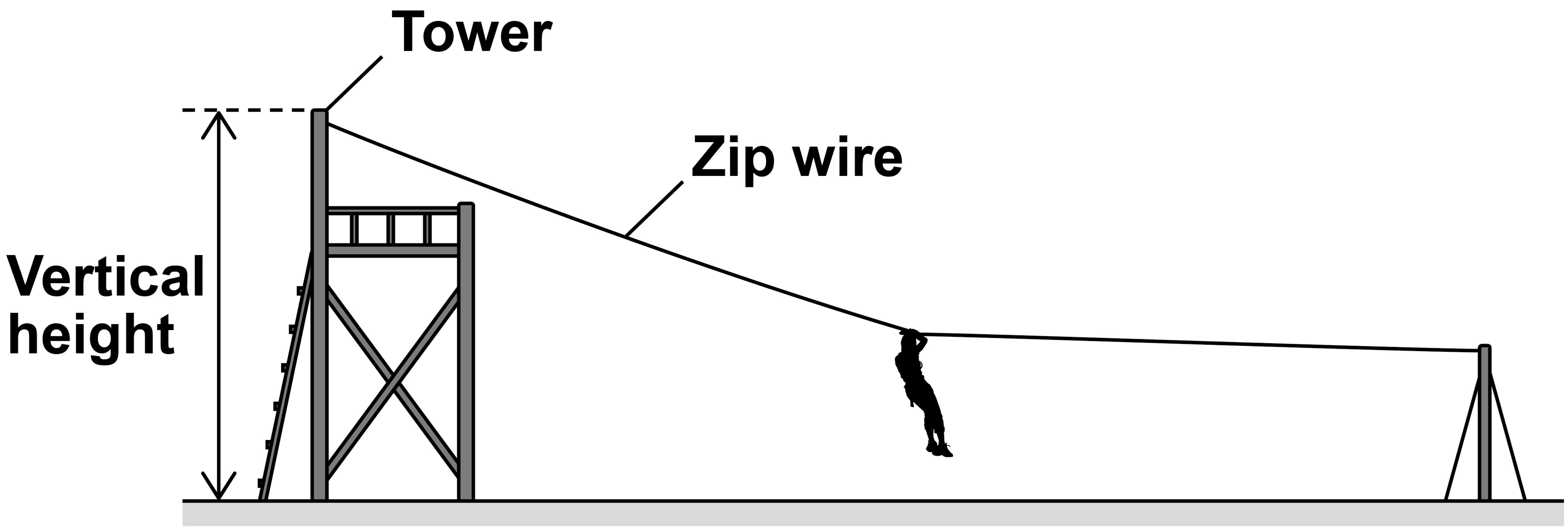
[Turn over]

7

0 3

FIGURE 4 shows a person sliding down a zip wire.

FIGURE 4



0 3 . 1

Describe how the vertical height of the tower could be measured accurately. [2 marks]

[Turn over]

0 3 . 2

When using the zip wire, the person moved through a vertical height of 2.0 m

The person has a mass of 45 kg

gravitational field strength = 9.8 N/kg

Calculate the change in gravitational potential energy of the person.

Use the equation:

gravitational potential energy =
mass × gravitational field strength × height

[2 marks]

Change in gravitational potential energy =

____________________ J

BLANK PAGE

0 3 . 3

Give THREE factors that affected the kinetic energy of the person as she reached the bottom of the zip wire.
[3 marks]

1 ______________________________

____

____

2 ______________________________

____

____

3 ______________________________

____

____

7

[Turn over]

0 4

The ancient Greeks thought that atoms were tiny spheres that could not be divided into anything smaller.

Since then, different discoveries have led to the model of the atom changing.

Some of the discoveries are given in TABLE 1.

TABLE 1

A	The mass of an atom is concentrated in the nucleus.
B	Electrons orbit the nucleus at specific distances.
C	The nucleus contains neutrons.
D	The nucleus contains positively charged protons.

0 4 . 1

Which discovery was the earliest?
[1 mark]

Tick (✓) ONE box.

☐ **A**

☐ **B**

☐ **C**

☐ **D**

[Turn over]

BLANK PAGE

0 4 . 2

Which discovery was the most recent?
[1 mark]

Tick (✓) ONE box.

☐ **A**

☐ **B**

☐ **C**

☐ **D**

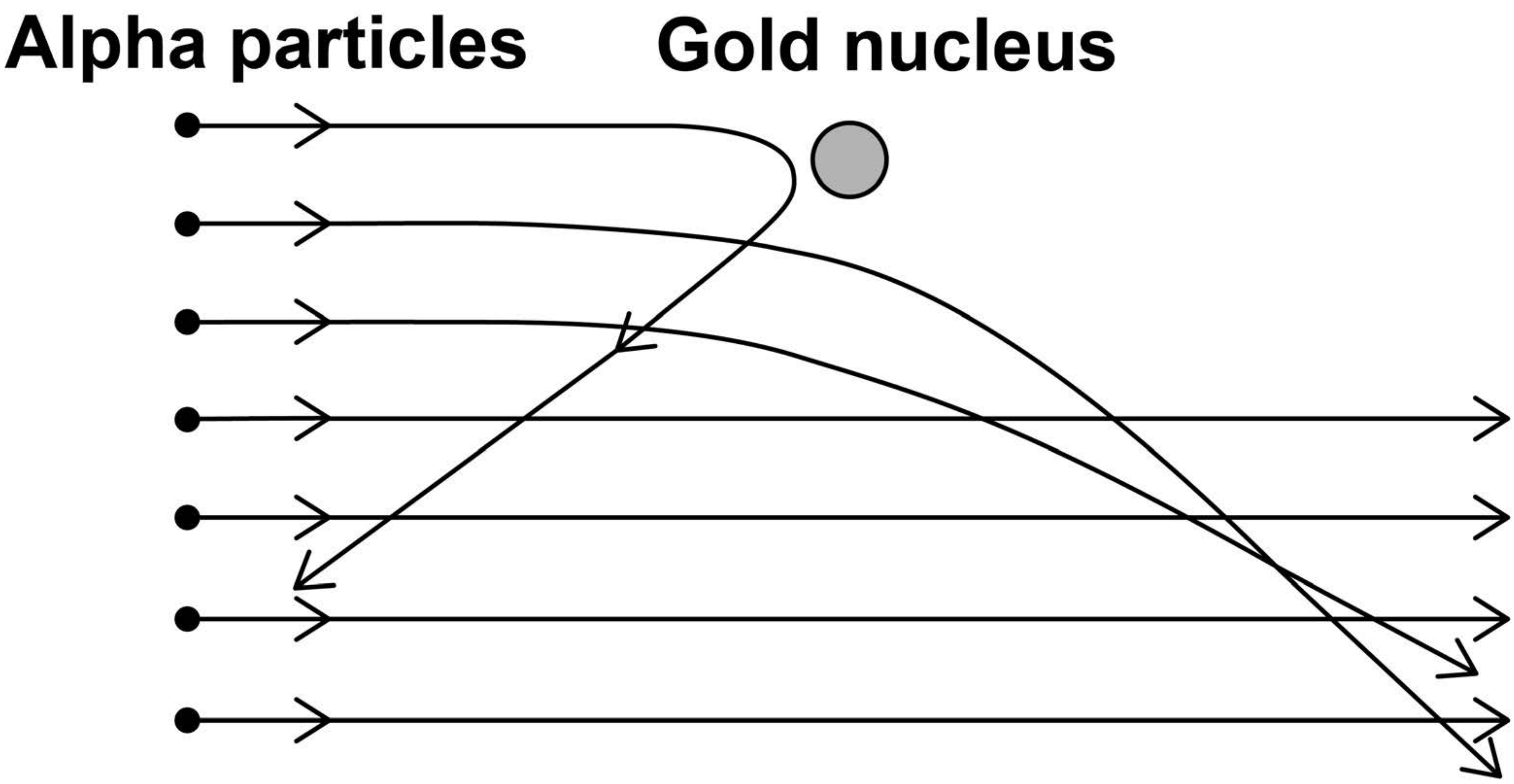
[Turn over]

04.3

The alpha particle scattering experiment led to the nuclear model of the atom.

FIGURE 5 shows the paths of alpha particles travelling close to a gold nucleus.

FIGURE 5



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[Turn over]

Complete the sentences on the opposite page.

Choose answers from the list below.

Each answer may be used once, more than once or not at all. [3 marks]

- **attracts**
- **decreases**
- **does not change**
- **increases**
- **reflects**
- **repels**

Alpha particles and gold nuclei are both positively charged.
The gold nucleus ____________________ the alpha particles.

As the alpha particle approaches the gold nucleus, the electric field strength experienced by the alpha particle ____________________ .

As an alpha particle approaches the gold nucleus, the force experienced by the alpha particle ____________________ .

[Turn over]

0 4 . 4

The results of the alpha particle scattering experiment were reproducible.

What does reproducible mean?
[1 mark]

Tick (✓) ONE box.

☐ **Another scientist repeats the experiment and gets the same results.**

☐ **Another scientist repeats the experiment and gets different results.**

☐ **The same scientist repeats the experiment and gets the same results.**

☐ **The same scientist repeats the experiment and gets different results.**

6

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[Turn over]

0 5

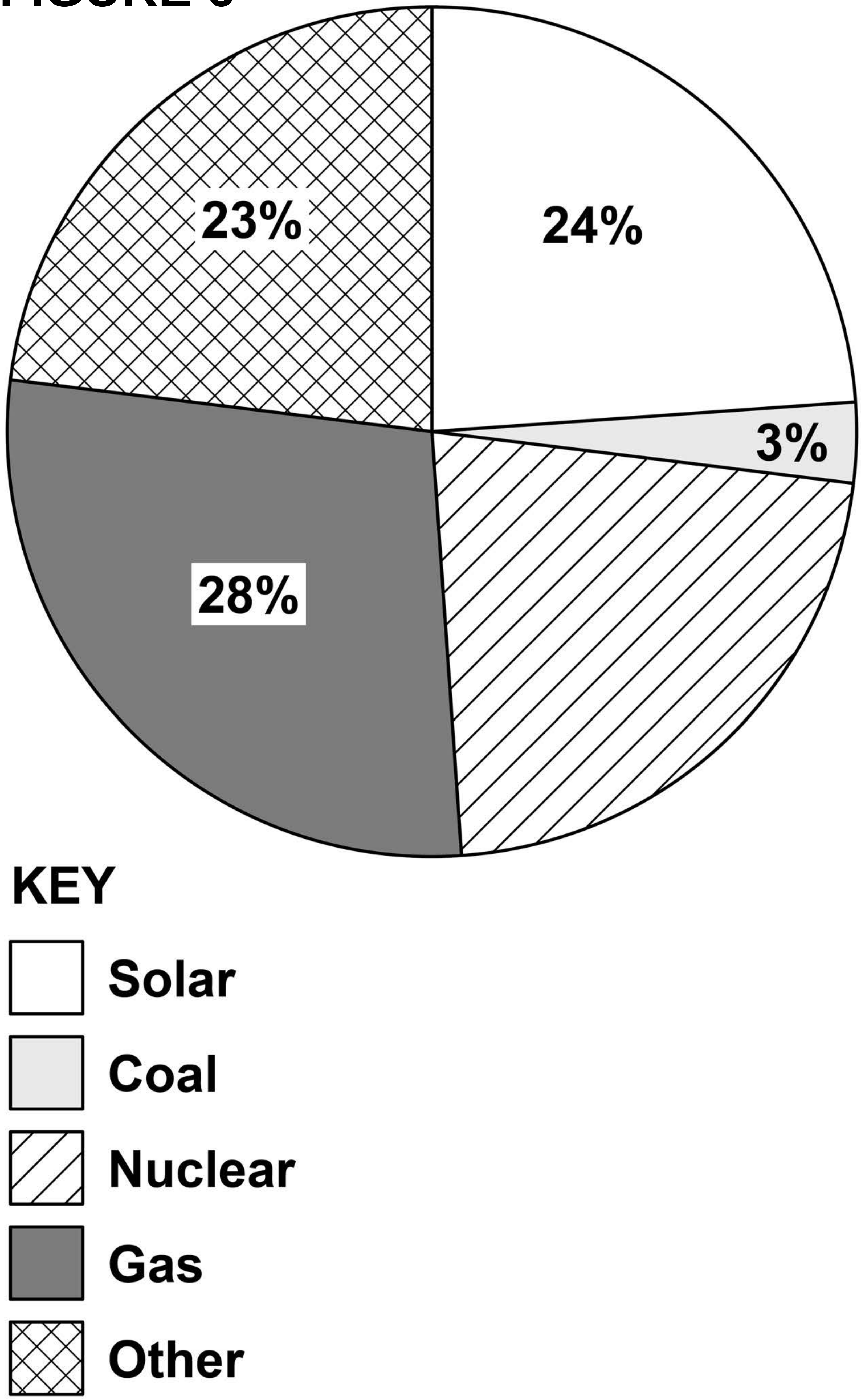
FIGURE 6, on the opposite page, shows how different energy resources were used in the United Kingdom (UK) to generate electricity on one day in June 2018.

0 5 . 1

The UK government plans to stop using coal-fired power stations by 2025.

Explain ONE environmental problem caused when electricity is generated by burning coal. [2 marks]

FIGURE 6



[Turn over]

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0 5 . 2

Give TWO renewable energy resources that could make up the ‘Other’ energy resources in FIGURE 6, on page 35.
[2 marks]

1 ______________________________________

____

____

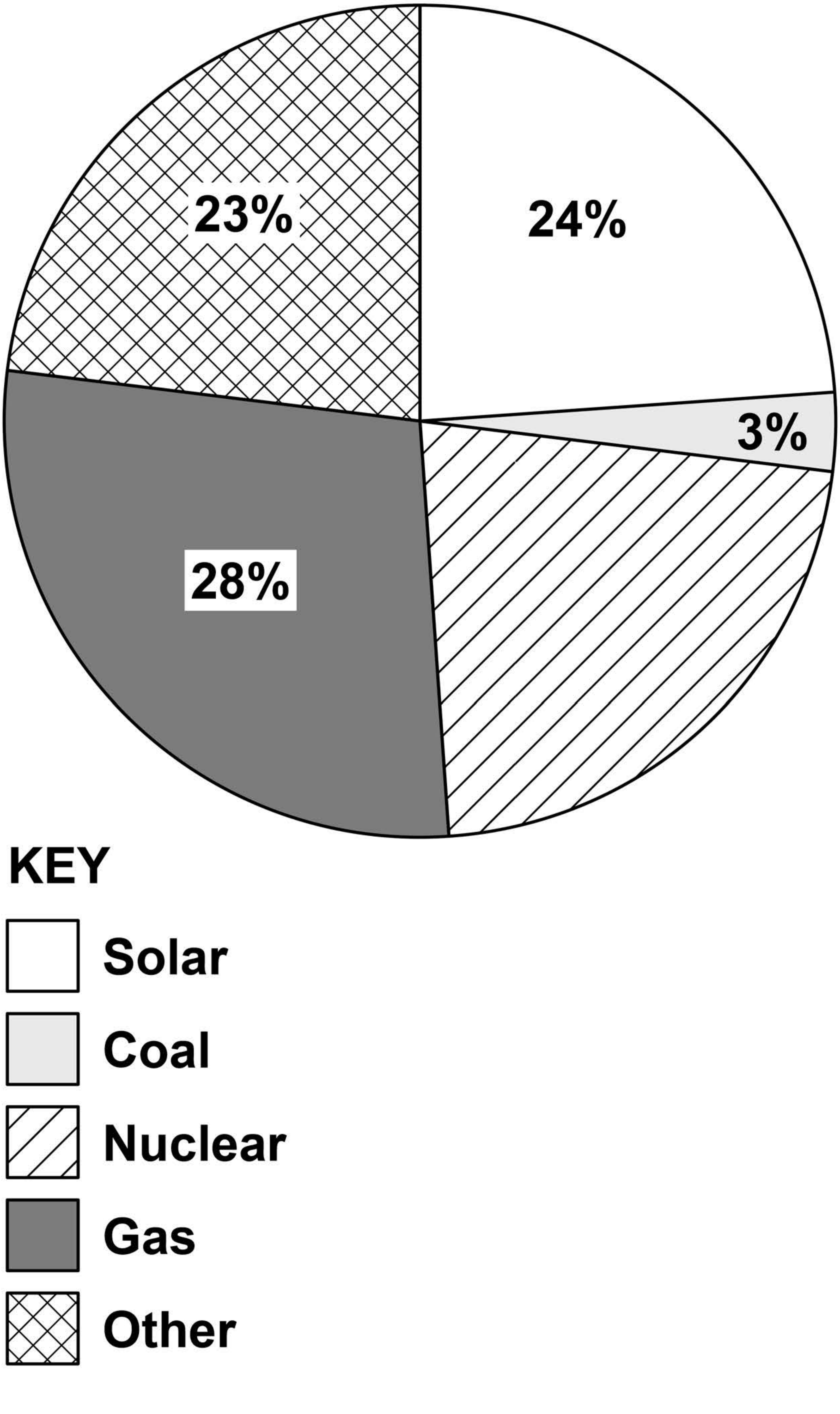
2 ______________________________________

____

____

[Turn over]

Repeat of FIGURE 6



05.3

Determine the percentage of electricity generated in nuclear power stations that day.

Use data from FIGURE 6. [2 marks]

____

____

____

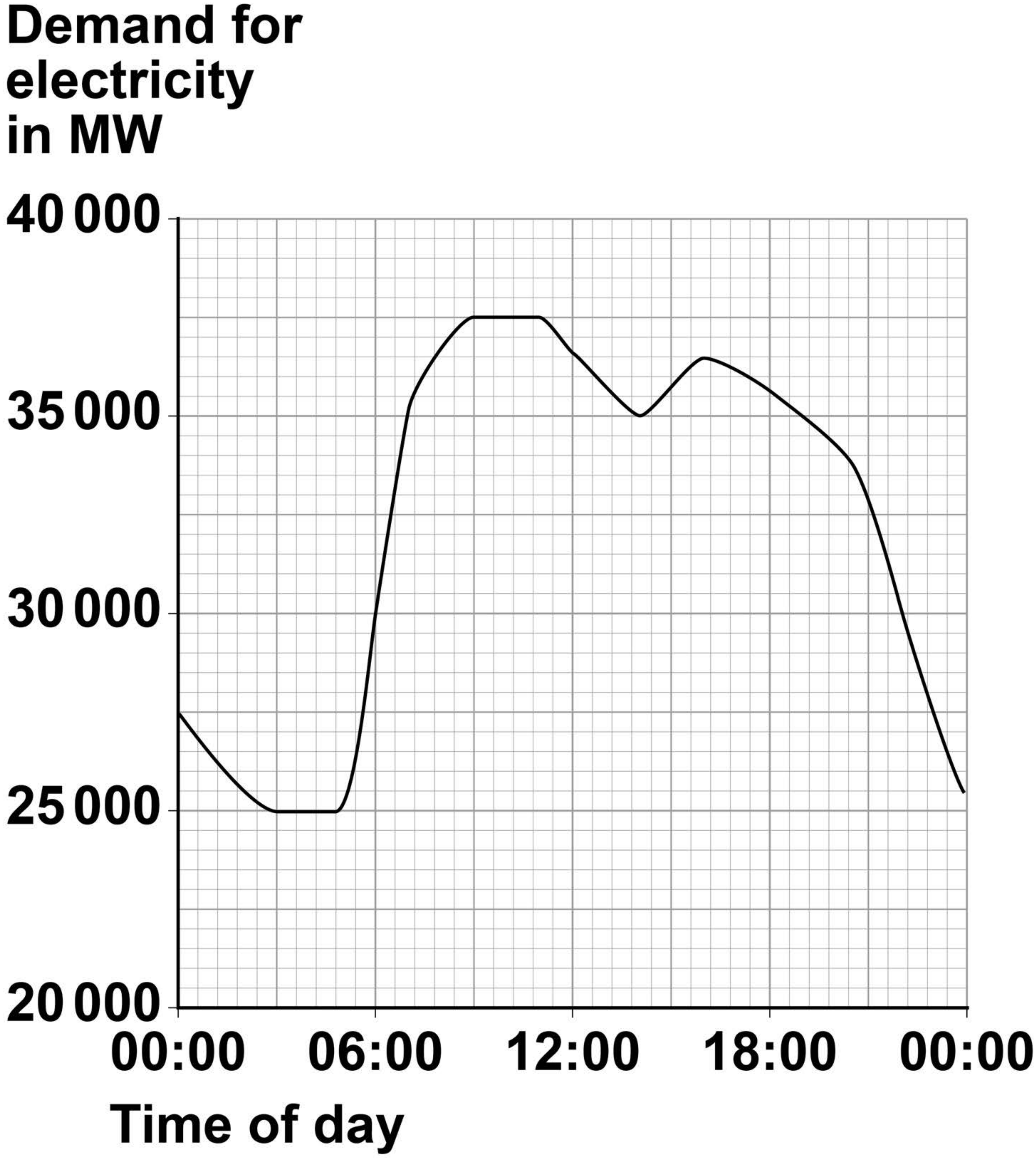
____

Percentage of electricity generated in nuclear power stations = __________ %

[Turn over]

FIGURE 7 shows how the demand for electricity varied with the time of day.

FIGURE 7



0 5 . 4

What was the difference between the maximum demand and minimum demand for electricity during this day?
[2 marks]

____

____

____

____

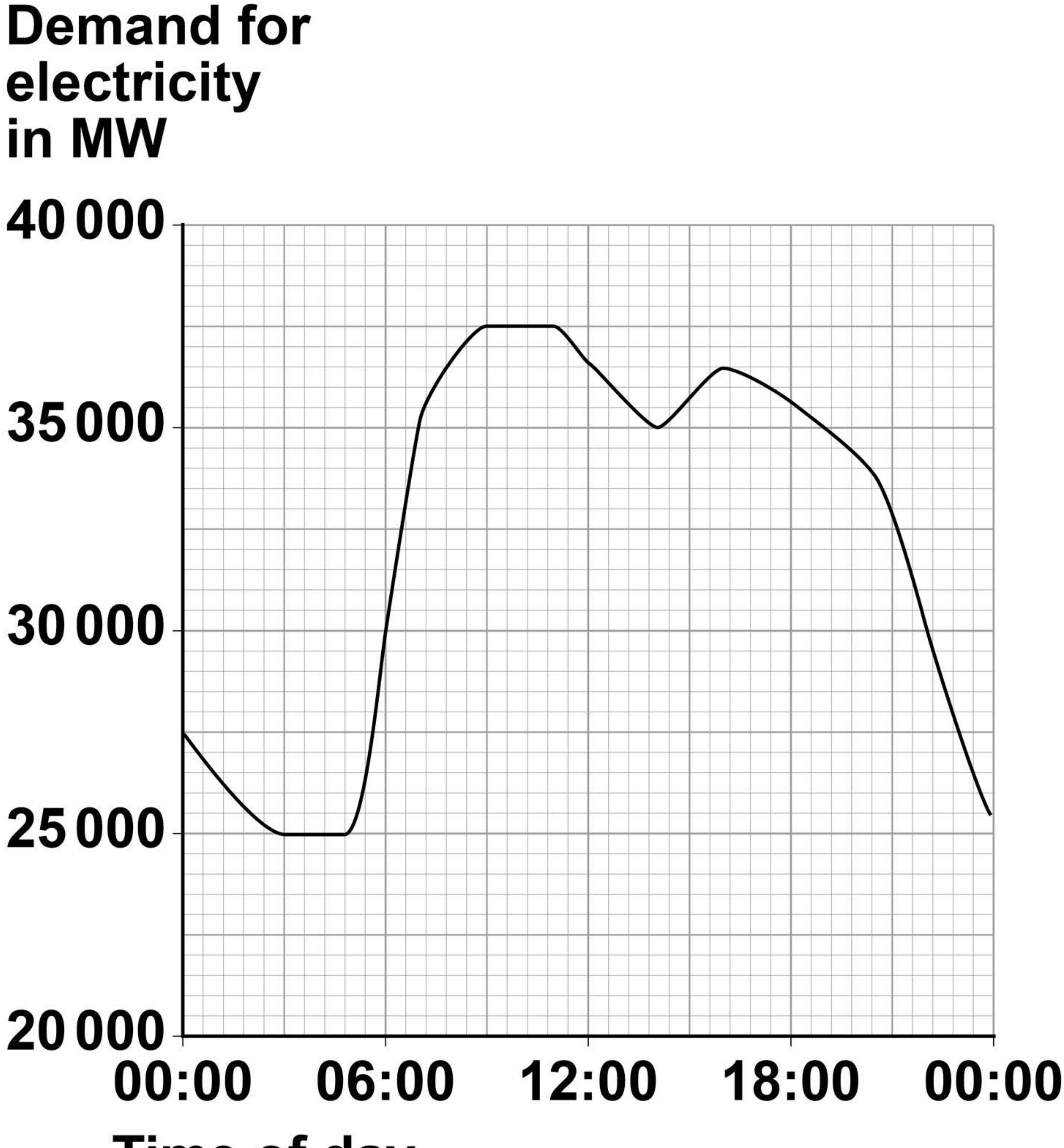
____

____

Difference = ________________________ MW

[Turn over]

Repeat of FIGURE 7



0 5 . 5

FIGURE 7, on the opposite page, shows that the demand for electricity increased between 06:00 and 09:00

Solar power could have met the demand if there were enough solar panels installed in the UK.

Explain why. [2 marks]

10

[Turn over]

0 6

An electric car has a motor that is powered by a battery.

A diesel car has an engine that is powered by diesel fuel.

0 6 . 1

TABLE 2, on the opposite page, compares an electric car and a diesel car.

TABLE 2

Power source	Maximum acceleration in m/s^2	Mass of power source in kg	Range in km	Maximum power output in kW
Battery	4.8	420	220	200
Diesel fuel	3.2	51	1120	120

[Turn over]

BLANK PAGE

Give TWO advantages of the diesel car compared with the electric car in TABLE 2, on page 45. [2 marks]

1 ______________________________

____

____

2 ______________________________

____

____

[Turn over]

Repeat of TABLE 2

Power source	Maximum acceleration in m/s^2	Mass of power source in kg	Range in km	Maximum power output in kW
Battery	4.8	420	220	200
Diesel fuel	3.2	51	1120	120

0 6 . 2

The mass of the battery in the electric car is 420 kg

The total mass of the electric car is 1610 kg

Calculate the mass of the battery as a percentage of the total mass of the electric car. [2 marks]

Percentage of total mass = ____________ %

[Turn over]

BLANK PAGE

06.3

Designers of electric car batteries want to increase the amount of energy that can be stored in a battery.

Suggest TWO reasons why. [2 marks]

1 ______________________________

____

____

2 ______________________________

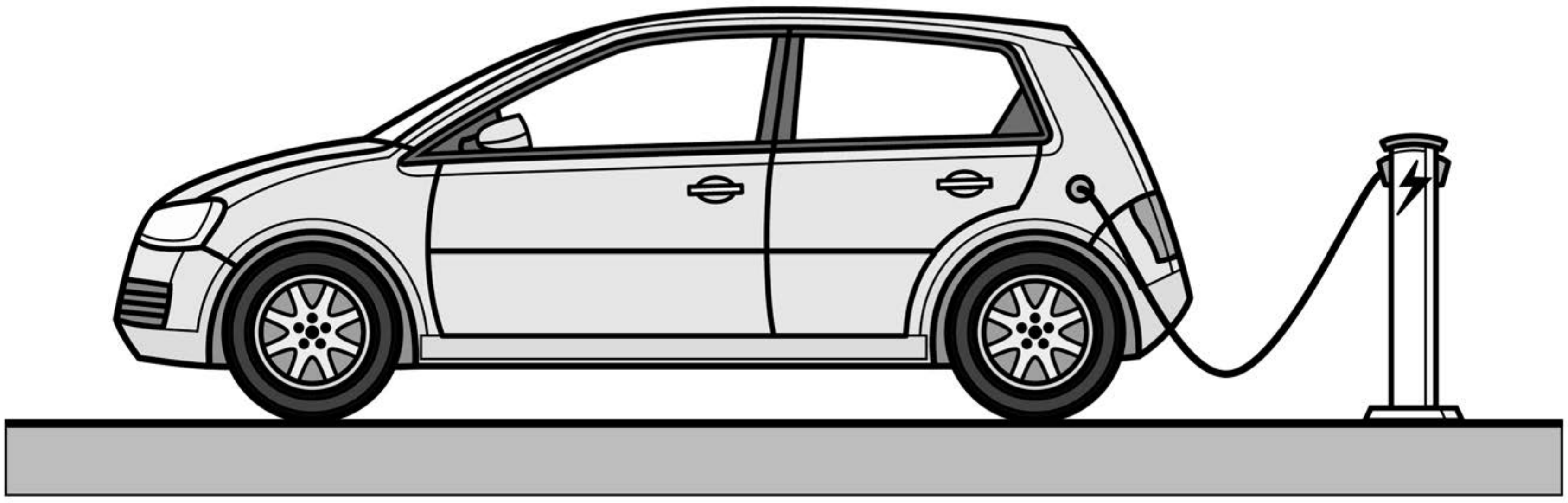
____

____

[Turn over]

FIGURE 8 shows an electric car being recharged.

FIGURE 8



0 6 . 4

Write down the equation which links energy transferred, power and time.
[1 mark]

0 6 . 5

The charger has a power output of 7000 W

Calculate the time taken to transfer 420 000 J of energy to the car battery. [3 marks]

____

____

____

____

____

____

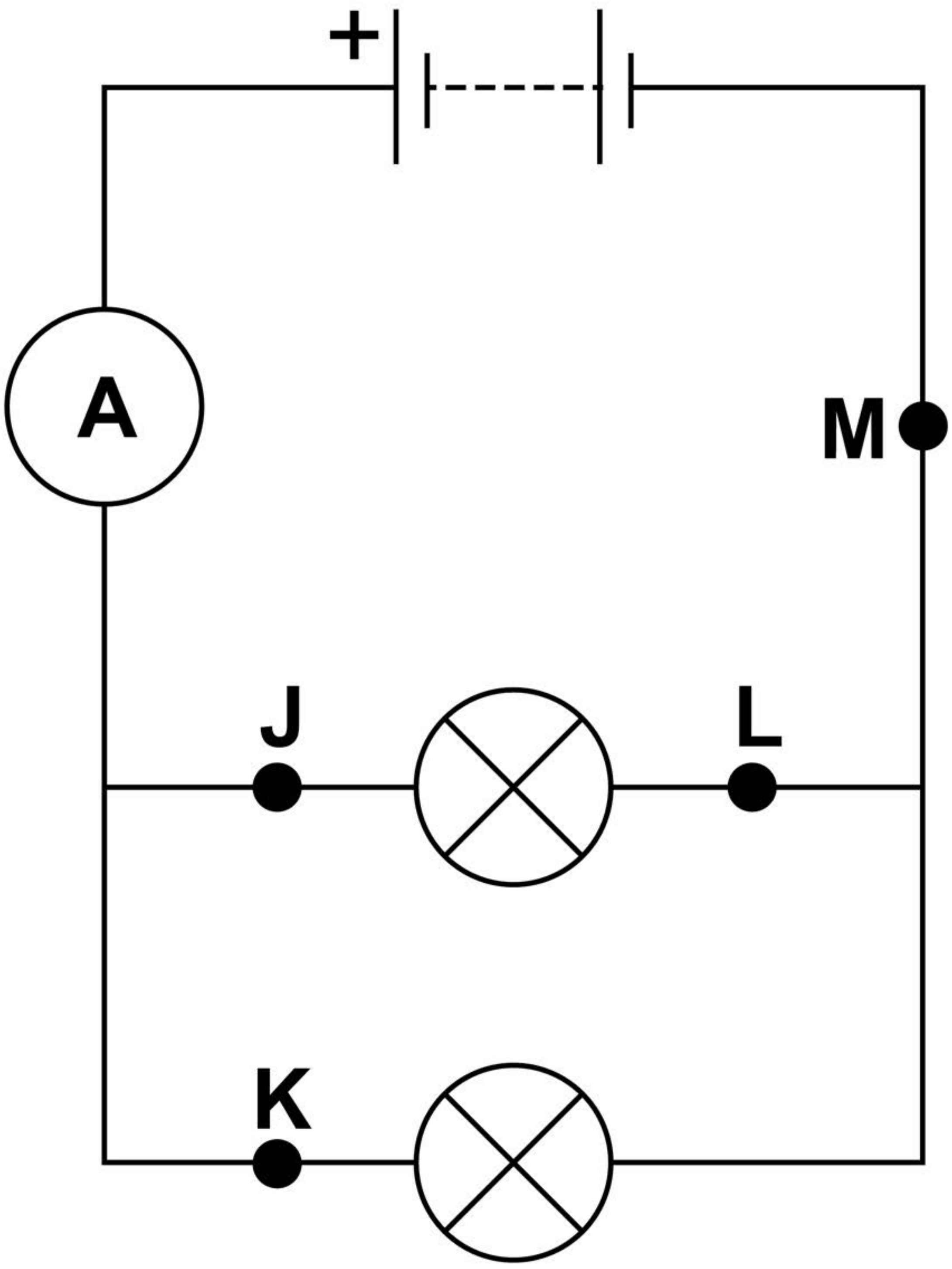
Time = ______________________ s

10

0 7

FIGURE 9 shows a circuit diagram.

FIGURE 9



0 7 . 1

In which position could a switch be placed so that both lamps can be switched on or off at the same time?
[1 mark]

Tick (✓) ONE box.

☐ **J**

☐ **K**

☐ **L**

☐ **M**

[Turn over]

0 7 . 2

Draw the circuit symbol for a switch in the box below. [1 mark]

0 7 . 3

In 30 seconds, 24 coulombs of charge flow through the battery.

Calculate the current in the battery.

Use the equation:

$$\text{current} = \frac{\text{charge flow}}{\text{time}}$$

[2 marks]

____

____

____

____

____

____

Current = ___________________________ A

[Turn over]

BLANK PAGE

07.4

There is a potential difference of 3.6 V across the battery.

Calculate the energy transferred by the battery when 60 coulombs of charge flows through the battery.

Use the equation:

energy transferred = charge flow × potential difference

[2 marks]

____

____

____

____

____

____

Energy transferred = ______________ J

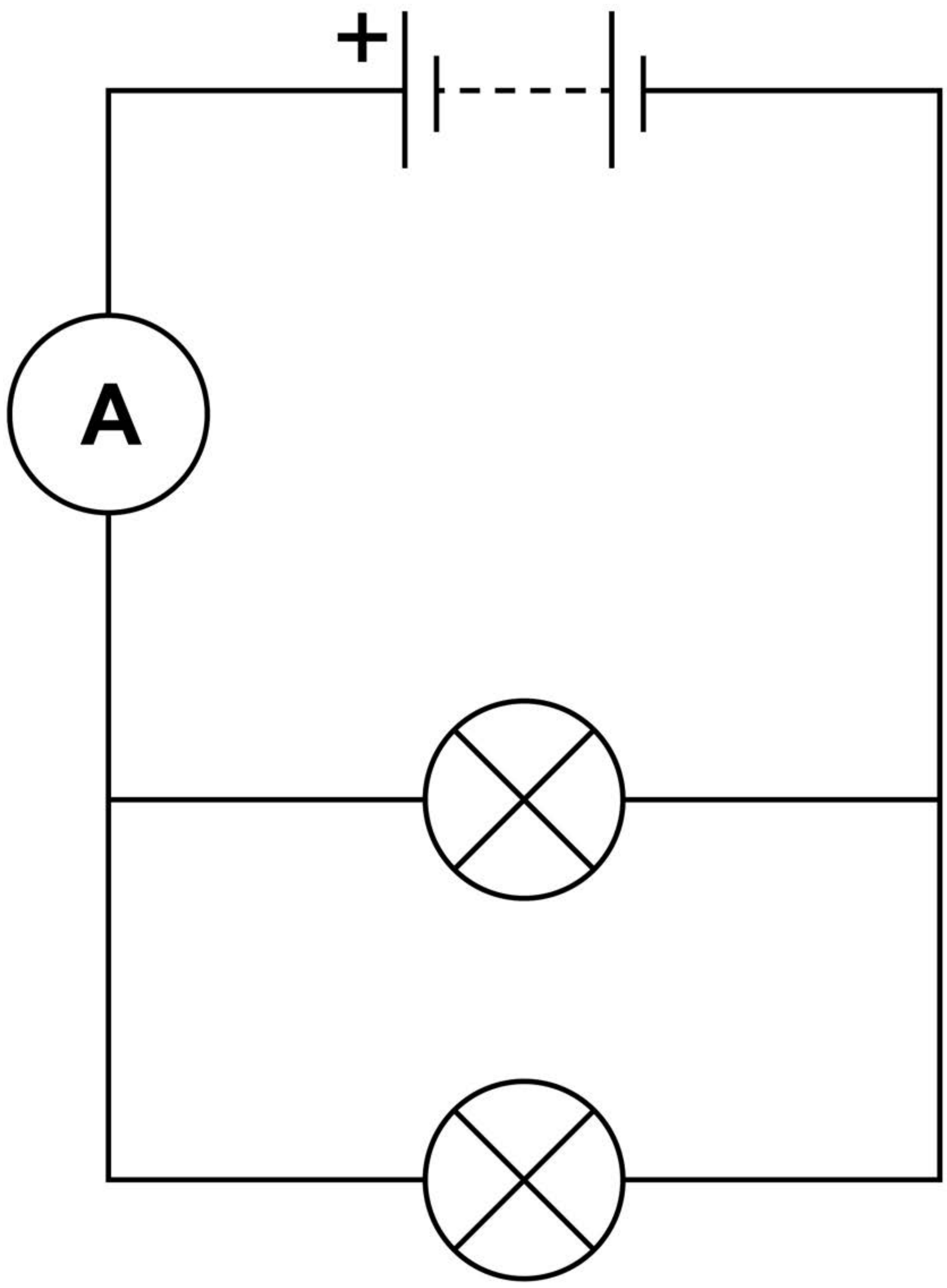
[Turn over]

A student built CIRCUIT X, below, and CIRCUIT Y, on page 61, shown in FIGURE 10.

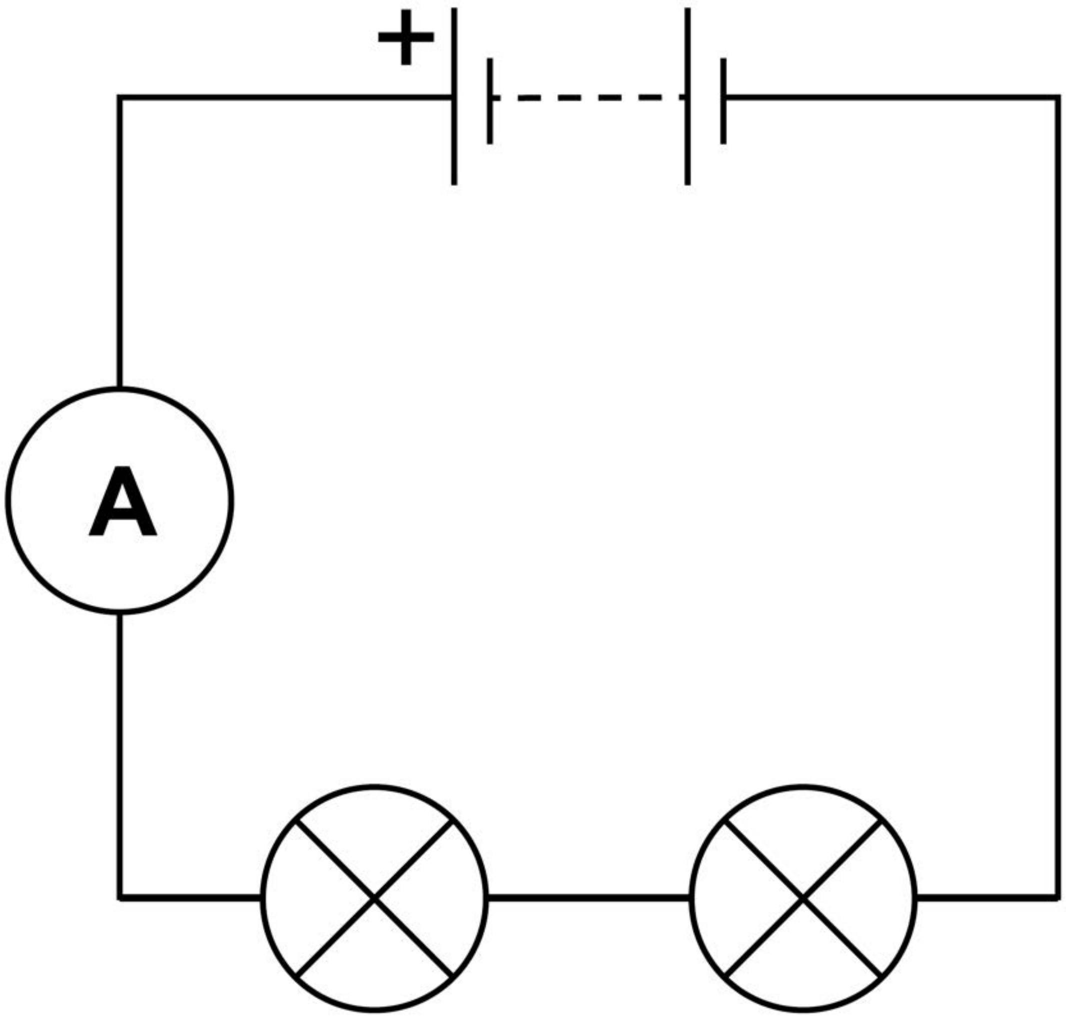
The components used in each circuit were identical.

FIGURE 10

CIRCUIT X



CIRCUIT Y



[Turn over]

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07.5

How would the reading on the ammeter in CIRCUIT Y compare to the reading on the ammeter in CIRCUIT X?
[1 mark]

Tick (✓) ONE box.

- [ ] The reading in Y would be higher.
- [ ] The reading in Y would be lower.
- [ ] The readings would be the same.

[Turn over]

BLANK PAGE

0 7 . 6

How does the total resistance of CIRCUIT Y compare with the total resistance of CIRCUIT X? [1 mark]

Tick (✓) ONE box.

☐ **The total resistance of Y is greater.**

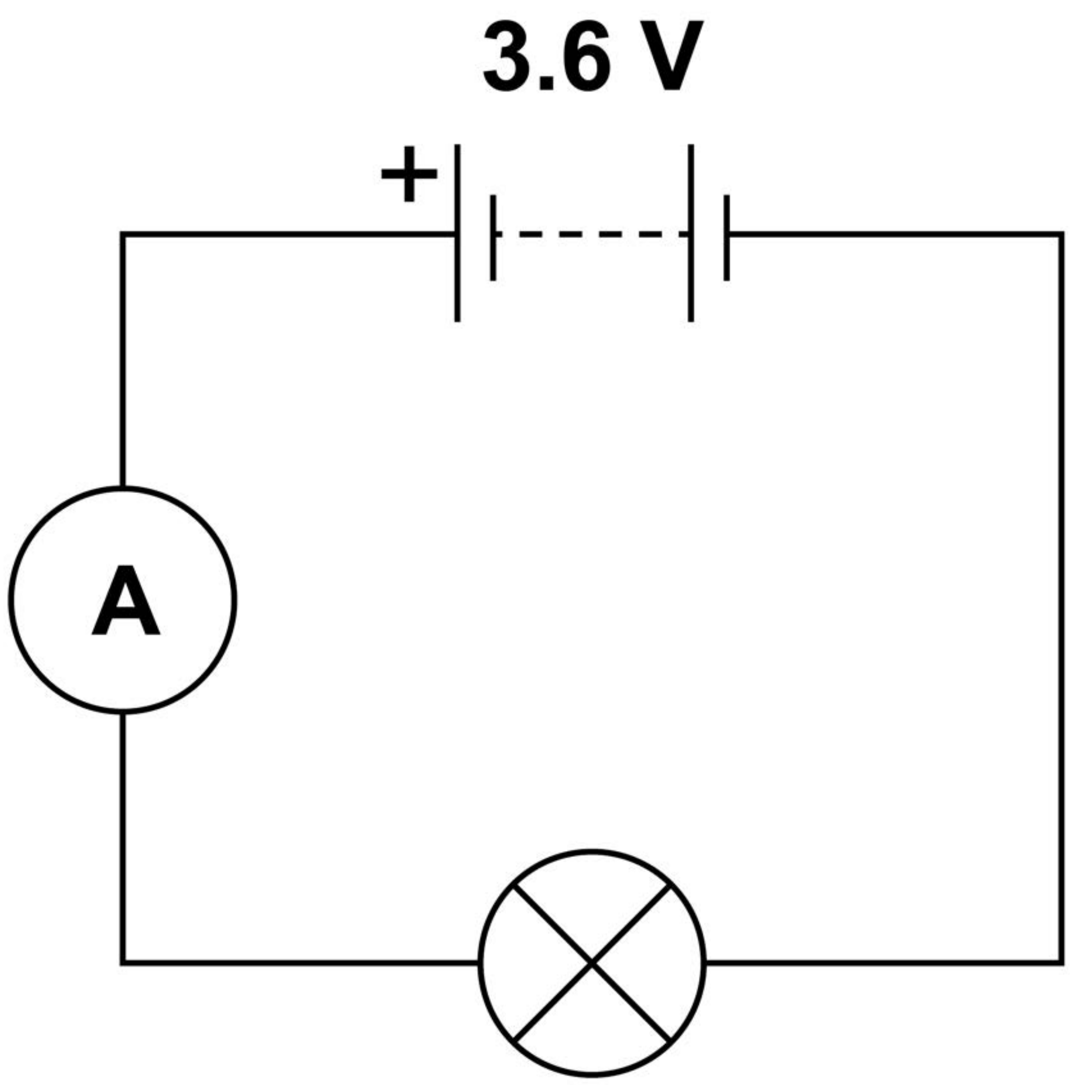
☐ **The total resistance of Y is less.**

☐ **The total resistance is the same.**

[Turn over]

The student built another circuit which is shown in FIGURE 11.

FIGURE 11



0 7 . 7

Write down the equation which links current, potential difference and resistance. [1 mark]

0 7 . 8

There is a potential difference of 3.6 V across the lamp in FIGURE 11.

The current through the lamp is 0.80 A

Calculate the resistance of the lamp.
[3 marks]

____

____

____

____

____

____

Resistance = ____________________ Ω

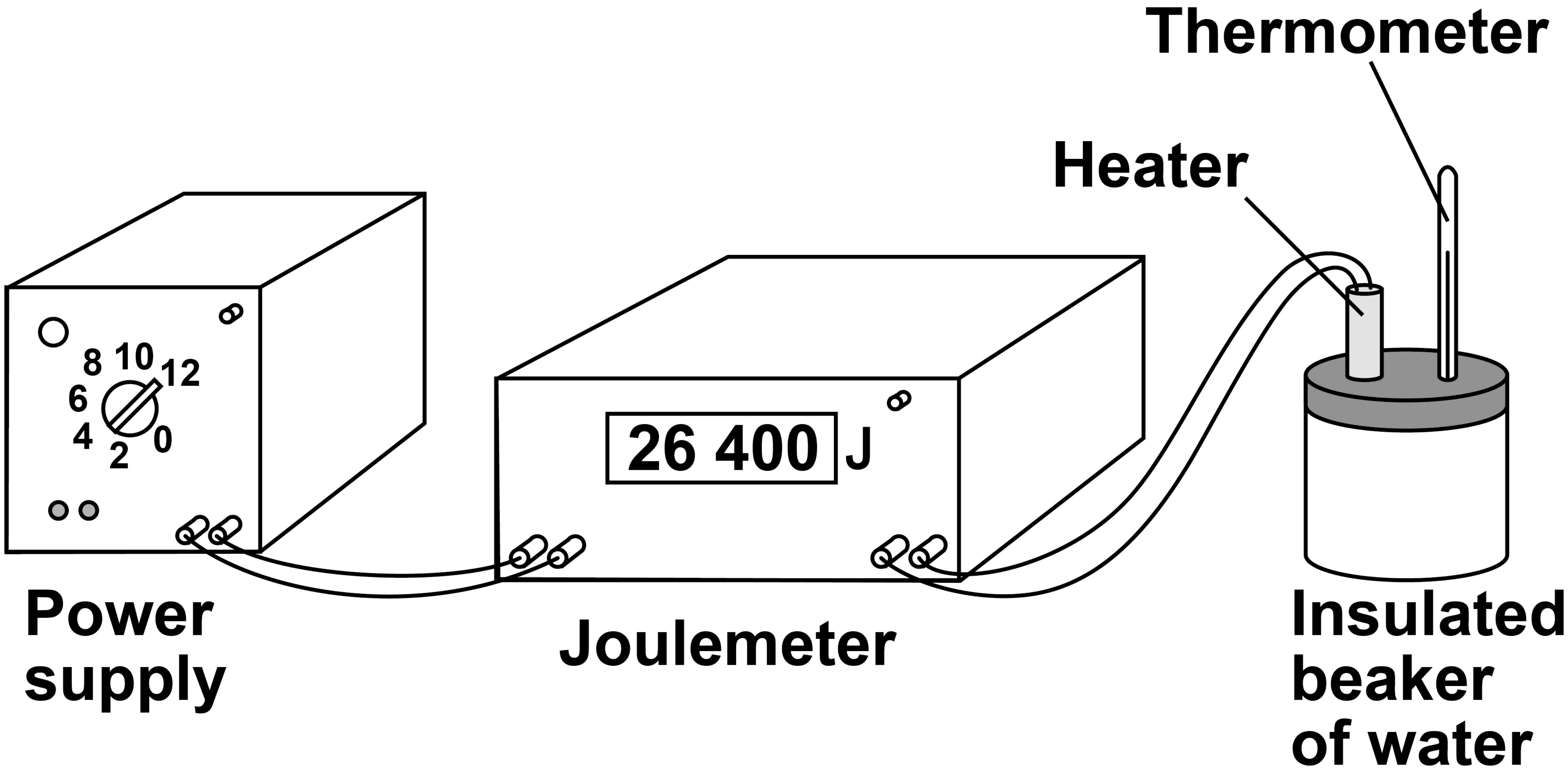
12

0 8

A student carried out an experiment to determine the specific heat capacity of water.

FIGURE 12, on the opposite page, shows the equipment the student used to heat the water.

FIGURE 12



[Turn over]

0 8 . 1

Why did the student insulate the beaker of water? [1 mark]

Tick (✓) ONE box.

☐ **To increase energy transfer to the surroundings.**

☐ **To reduce energy transfer to the surroundings.**

☐ **To stop energy transfer to the surroundings.**

0 8 . 2

One hazard in this experiment is the hot water.

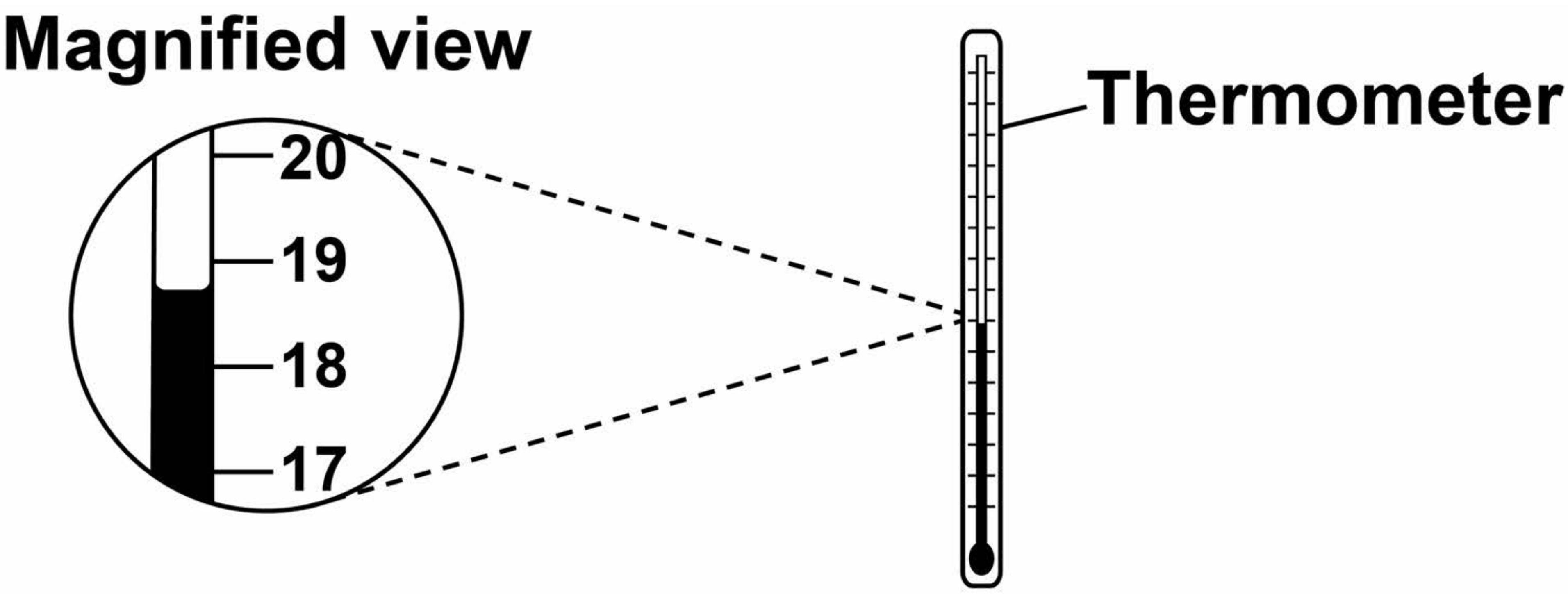
Give ONE risk to the student caused by this hazard.
[1 mark]

[Turn over]

0 8 . 3

FIGURE 13 shows the thermometer that the student used.

FIGURE 13



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

Tick (✓) ONE box.

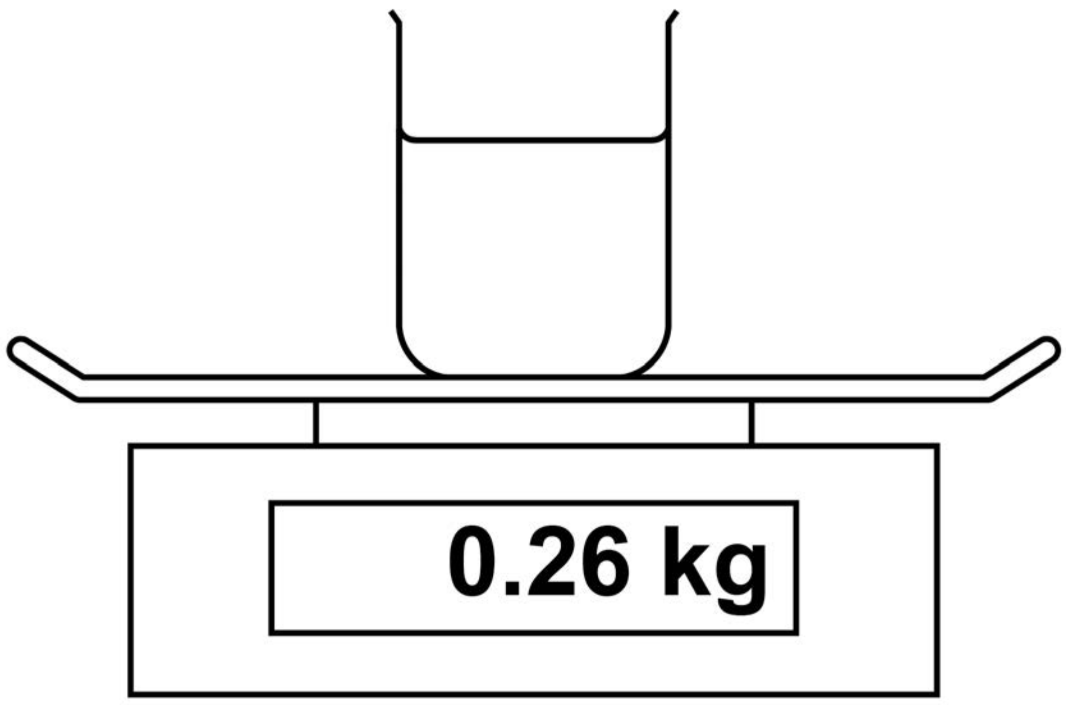
- [ ] **1 °C**
- [ ] **3 °C**
- [ ] **19 °C**

[Turn over]

0 8 . 4

FIGURE 14 shows the beaker of water on a balance.

FIGURE 14



The mass of the water was 0.20 kg

What was the mass of the beaker?
[1 mark]

Tick (✓) ONE box.

☐ **0.06 kg**

☐ **0.20 kg**

☐ **0.26 kg**

☐ **0.46 kg**

[Turn over]

08.5

The energy transferred to the water was 26 400 J

The mass of water was 0.20 kg

The temperature increase of the water was 30 °C

Calculate the specific heat capacity of water using the data from this experiment.

Use the Physics Equations Sheet.

Choose the unit from the list below.
[4 marks]

- **J / kg**
- **J / kg °C**
- **J / °C**

Specific heat capacity = ________________

Unit ________________

8

[Turn over]

0 9

Light bulbs are labelled with a power input.

0 9 . 1

What does power input mean? [1 mark]

Tick (✓) ONE box.

☐ **The charge transferred each second by the bulb.**

☐ **The current through the bulb.**

☐ **The energy transferred each second to the bulb.**

☐ **The potential difference across the bulb.**

09.2

**Write down the equation which links current, potential difference and power.
[1 mark]**

____

____

09.3

A light bulb has a power input of 40 W

The mains potential difference is 230 V

**Calculate the current in the light bulb.
[3 marks]**

____

____

____

____

____

Current = ____________________________ A

[Turn over]

TABLE 3 shows information about three different light bulbs.

TABLE 3

Light bulb	Total power input in watts	Useful power output in watts	Efficiency
P	6.0	5.4	0.90
Q	40	2.0	0.05
R	9.0	X	0.30

0 9 . 4

Write down the equation which links efficiency, total power input and useful power output. [1 mark]

0 9 . 5

Calculate the value of X in TABLE 3.
[3 marks]

X = ______________________ **W**

[Turn over]

BLANK PAGE

0 9 . 6

In addition to power input, light bulbs should also be labelled with the rate at which they emit visible light.

Suggest why. [2 marks]

____

____

____

____

____

____

11

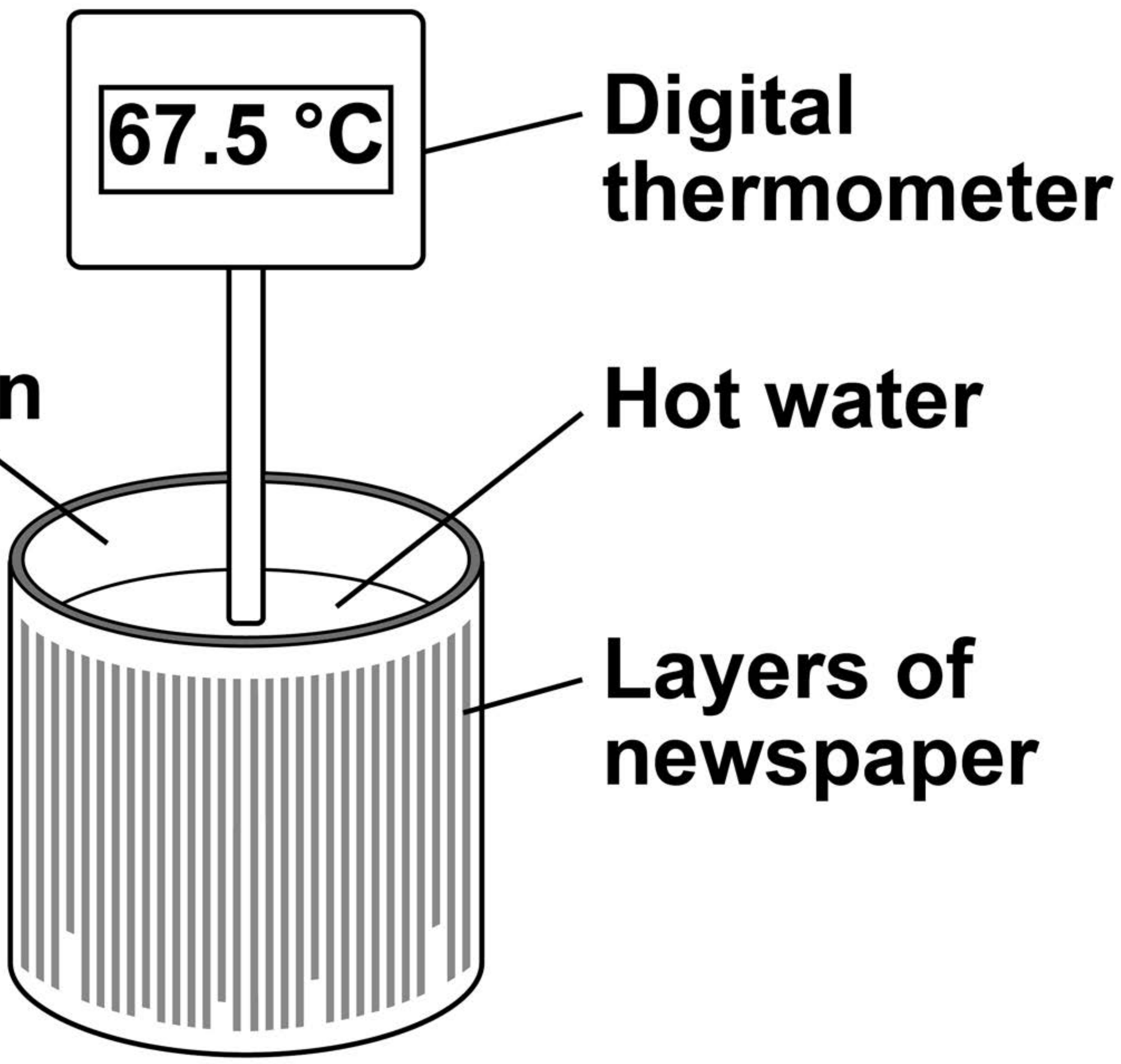
[Turn over]

1 0

A student investigated the insulating properties of newspaper.

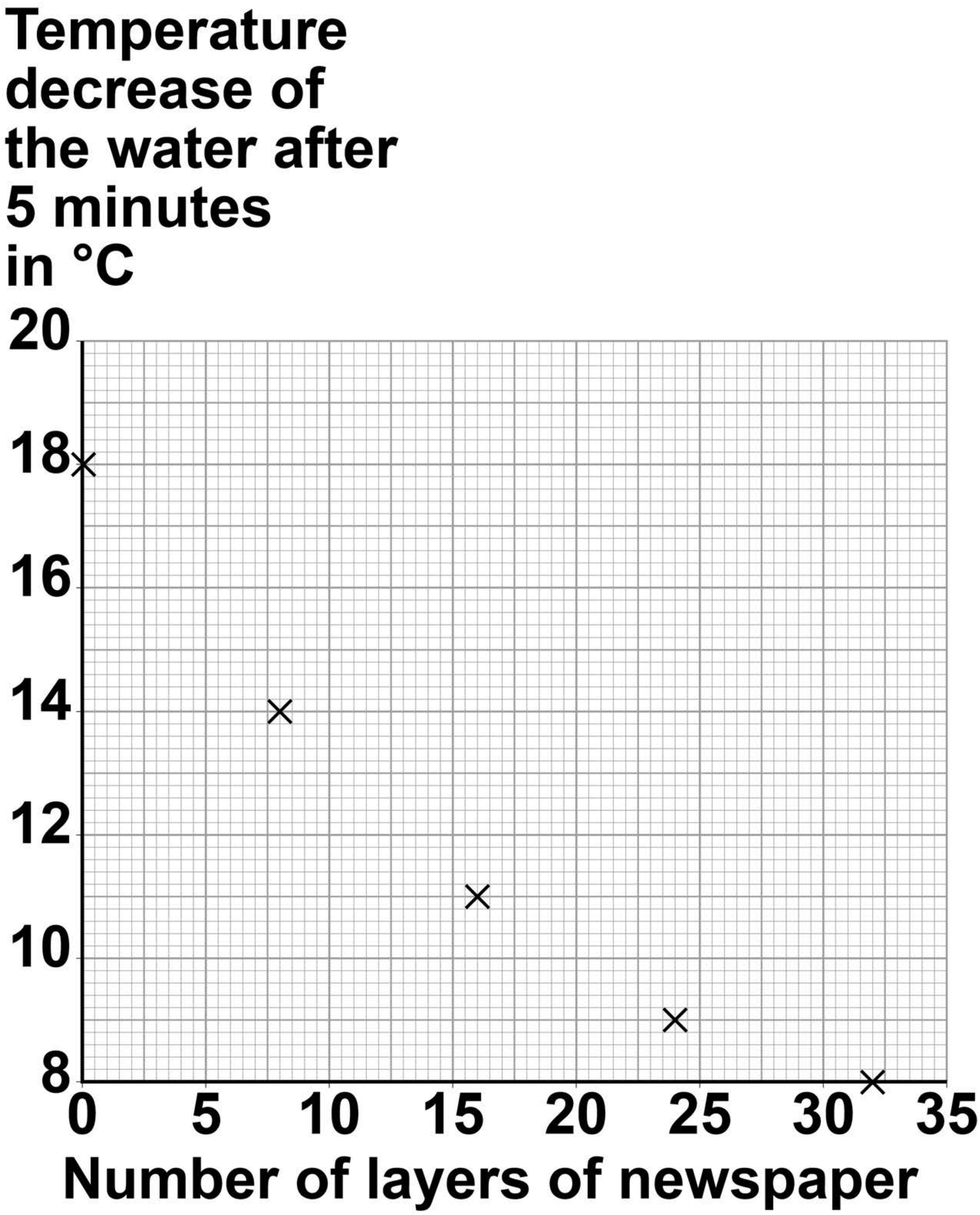
FIGURE 15 shows the apparatus the student used.

FIGURE 15



The student's results are shown in FIGURE 16, on the opposite page.

FIGURE 16



[Turn over]

10.1

Describe a method the student could have used to obtain the results shown in FIGURE 16, on page 85. [6 marks]

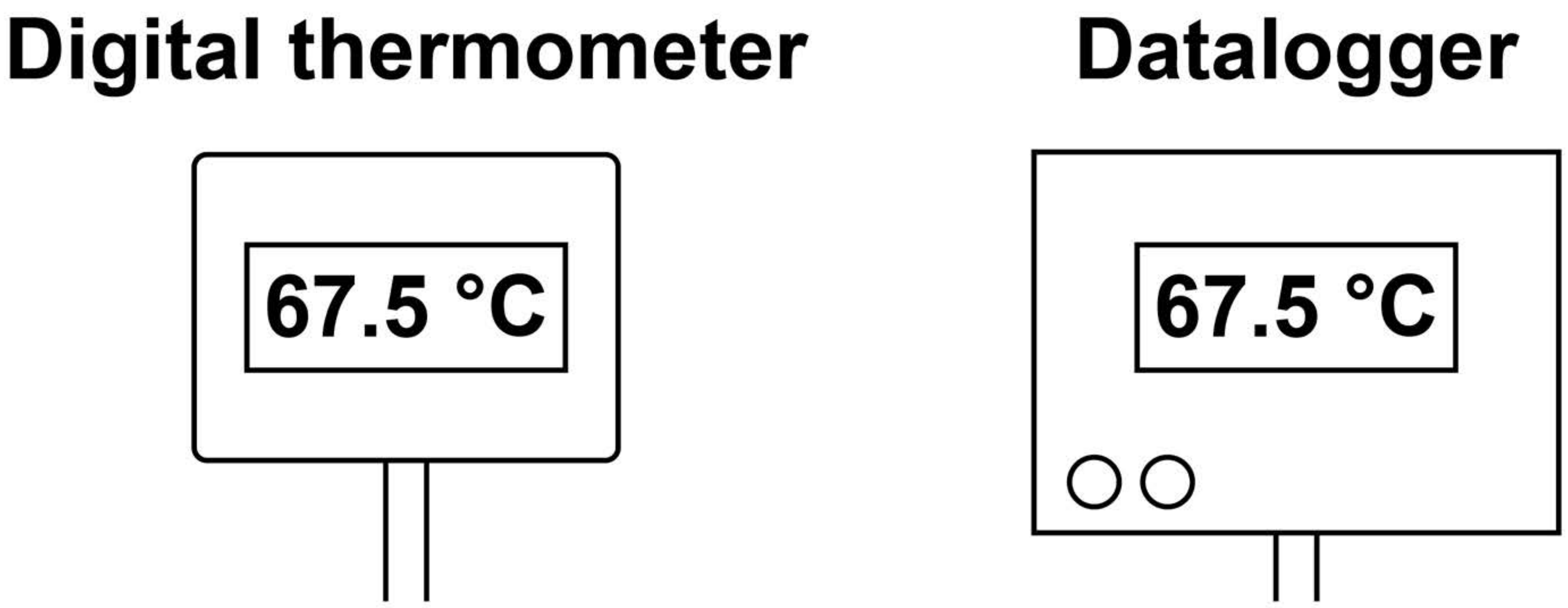
[Turn over]

10.2

The student could have used a datalogger with a temperature probe instead of the digital thermometer.

FIGURE 17 shows the readings on the digital thermometer and the datalogger.

FIGURE 17



The datalogger records 10 readings every second.

The student considered using a temperature probe and datalogger.

Explain why it was NOT necessary to use a temperature probe and datalogger for this investigation.
[2 marks]

[Turn over]

8

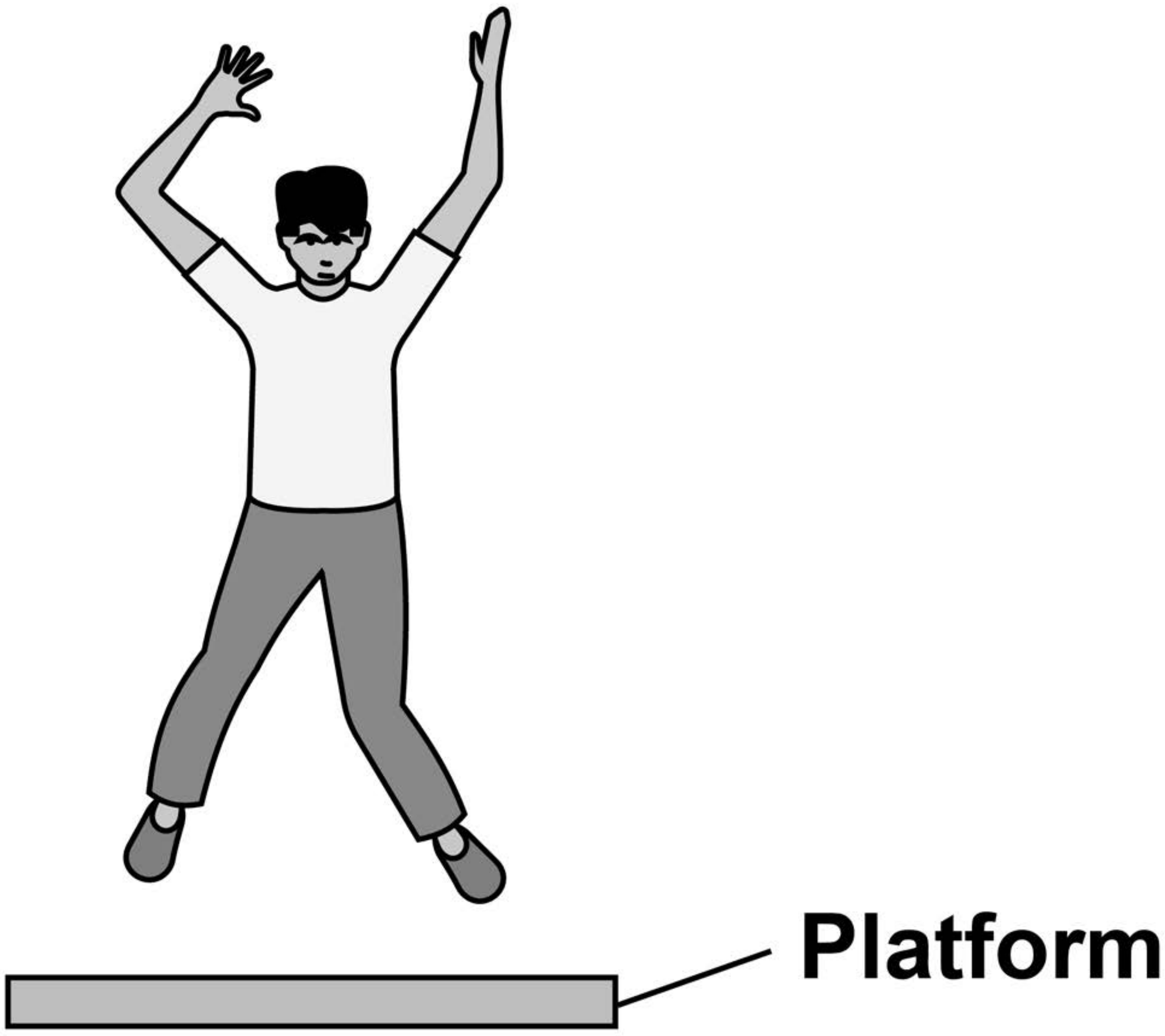
11

A scientist investigated how the maximum muscle power of humans varies with age and gender.

The scientist asked volunteers to stand on a platform and to jump as high as they could.

FIGURE 18 shows a volunteer taking part in the experiment.

FIGURE 18



An electronic timer measured the time that the volunteer was in the air.

11.1

The muscle power in watts per kg is calculated using the following equation:

$$\text{muscle power} = \frac{9.8 \times \text{jump height}}{\text{time}}$$

One volunteer has a muscle power of 41 W/kg

He was in the air for 0.12 s

Calculate his jump height. [3 marks]

____

____

____

____

____

____

Jump height = ____________________ m

[Turn over]

11.2

Write down the equation which links kinetic energy, mass and speed.
[1 mark]

11.3

One volunteer had a kinetic energy of 270 J and a speed of 3.0 m/s at the moment he left the ground.

Calculate his mass. [3 marks]

Mass = ______________________________ kg

[Turn over]

FIGURE 19

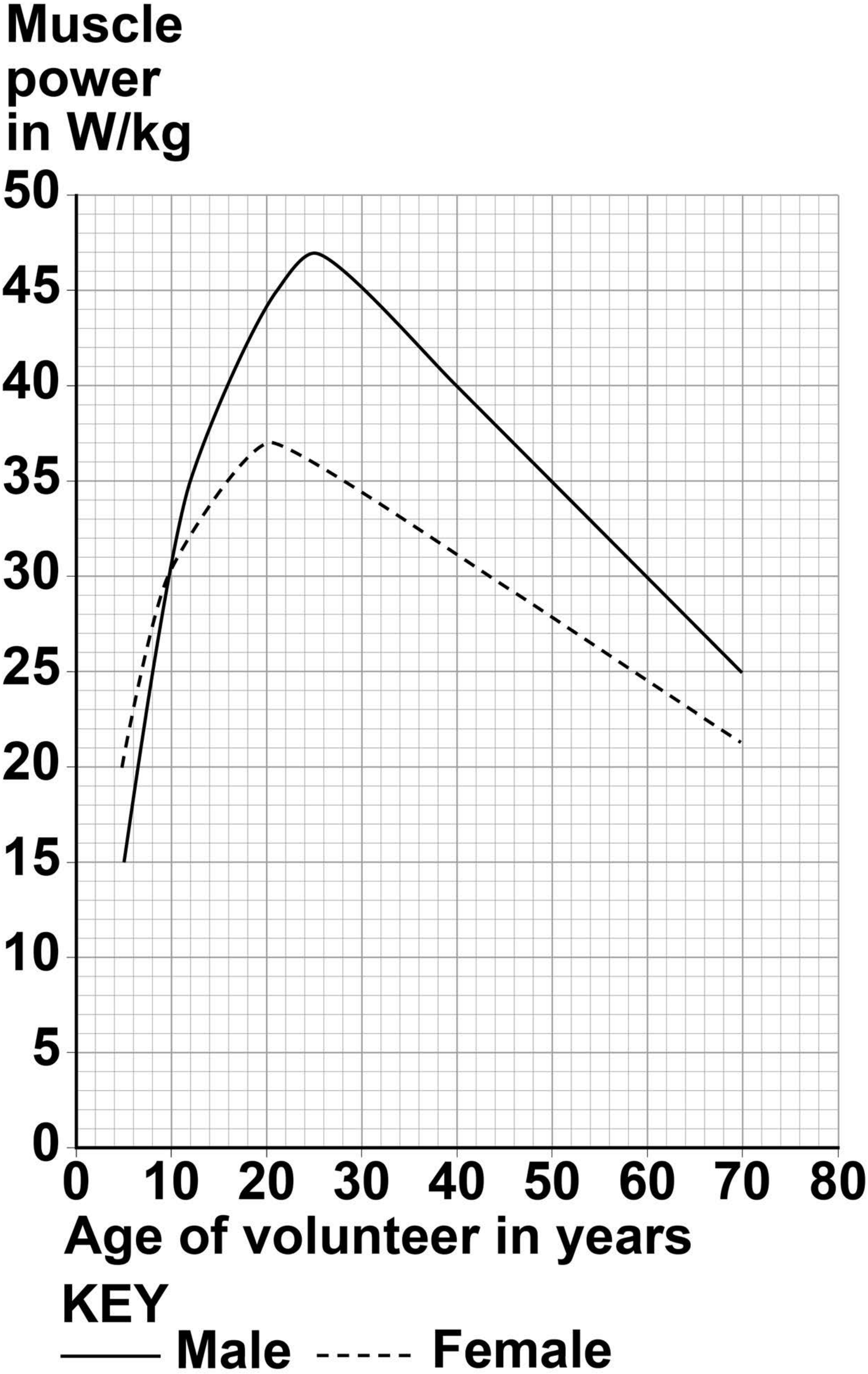

Muscle power in W/kg
50
45
40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
60
70
80
Age of volunteer in years
KEY
Male
Female

FIGURE 19, on the opposite page, shows the scientist's results.

11.4

Compare the muscle power of males with the muscle power of females.

Use data from FIGURE 19 in your answer. [4 marks]

[Turn over]

11.5

The muscle power of each volunteer was measured five times.

The highest muscle power reading was recorded instead of calculating an average.

Suggest ONE reason why. [1 mark]

12

END OF QUESTIONS

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For Examiner's Use	
Question	Mark
1	
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8	
9	
10	
11	
TOTAL	

IB/M/IK/Jun19/8463/1F/E2