



Surname _____

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Centre Number _____

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Candidate Signature _____

GCSE

PHYSICS

H

Higher Tier Paper 1

8463/1H

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]



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

Light bulbs are labelled with a power input.

0 1 . 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.

01.2

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

01.3

**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 1 shows information about three different light bulbs.

TABLE 1

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 1 . 4

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

0	1	.	5
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**Calculate the value of X in TABLE 1.
[3 marks]**

X = _____ W

[Turn over]



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0 1 . 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]

[Turn over]

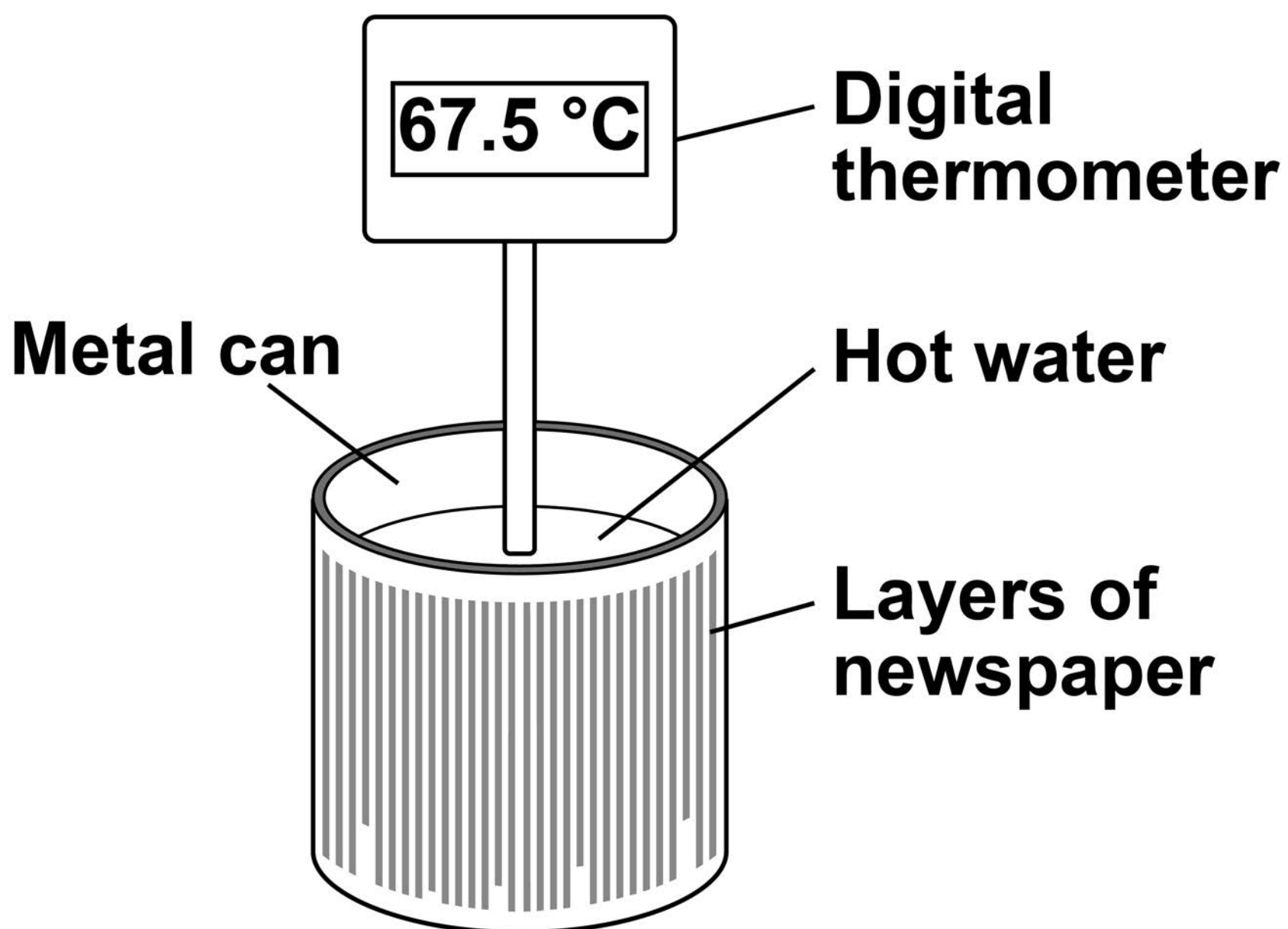
11

02

A student investigated the insulating properties of newspaper.

FIGURE 1 shows the apparatus the student used.

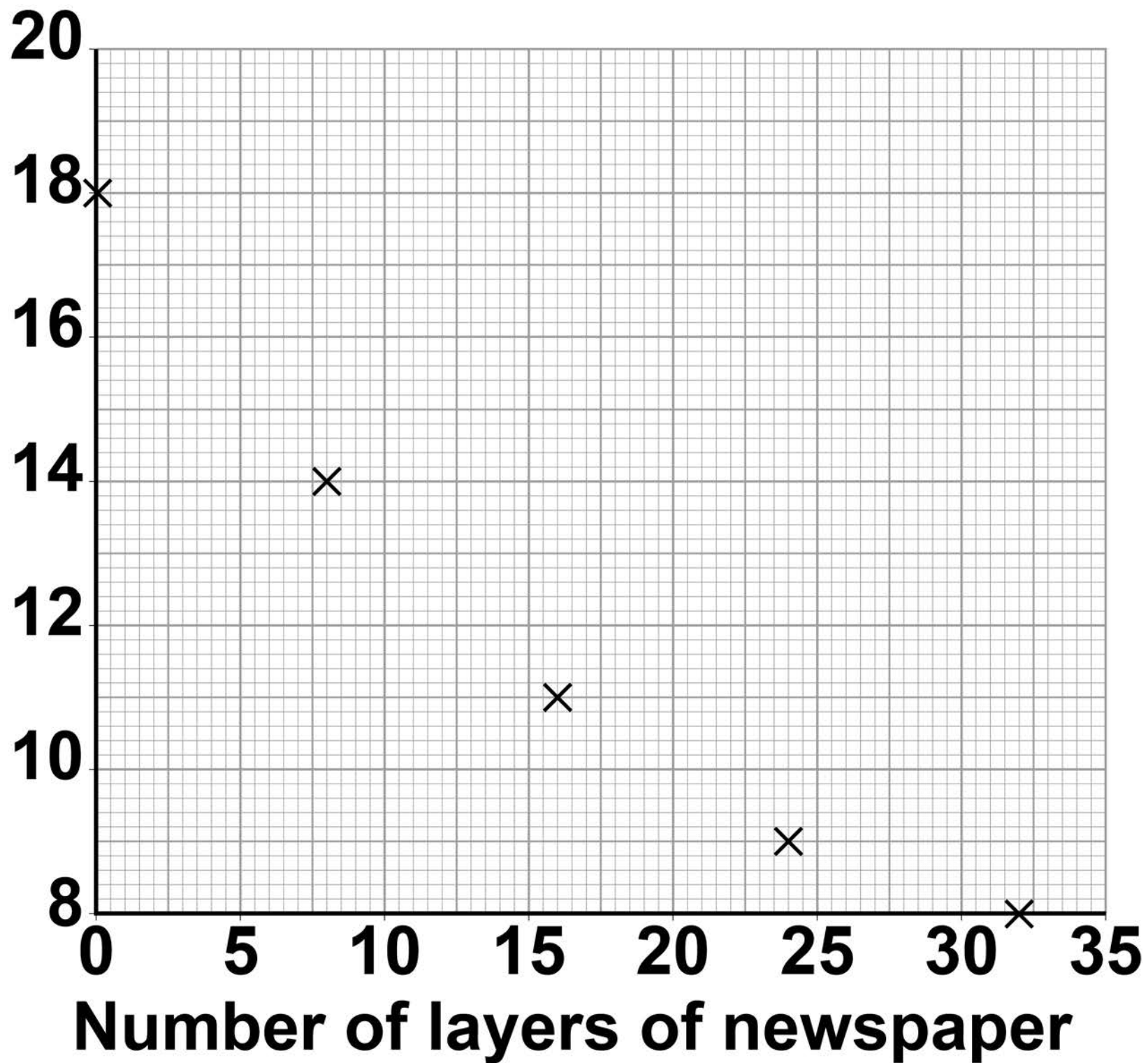
FIGURE 1



The student's results are shown in FIGURE 2, on the opposite page.

FIGURE 2

**Temperature
decrease of
the water after
5 minutes
in °C**



[Turn over]



0 2 . 1

Describe a method the student could have used to obtain the results shown in FIGURE 2, on page 11. [6 marks]

[Turn over]



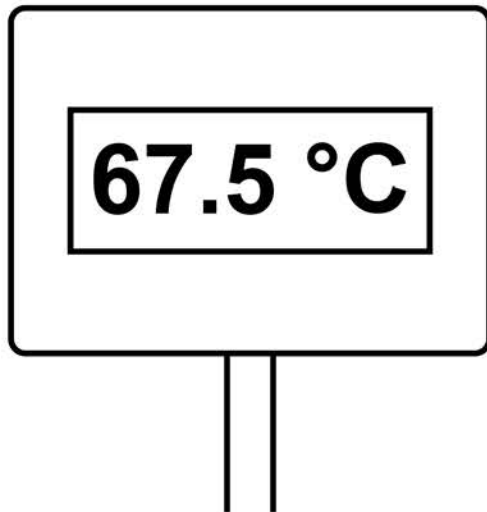
0 2 . 2

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

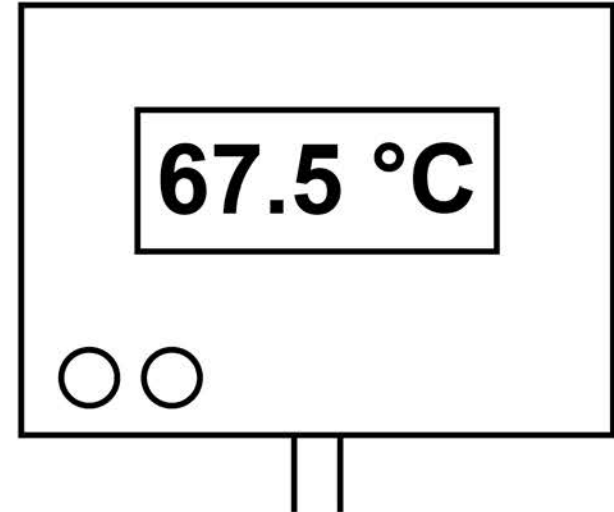
FIGURE 3 shows the readings on the digital thermometer and the datalogger.

FIGURE 3

Digital thermometer



Datalogger



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]



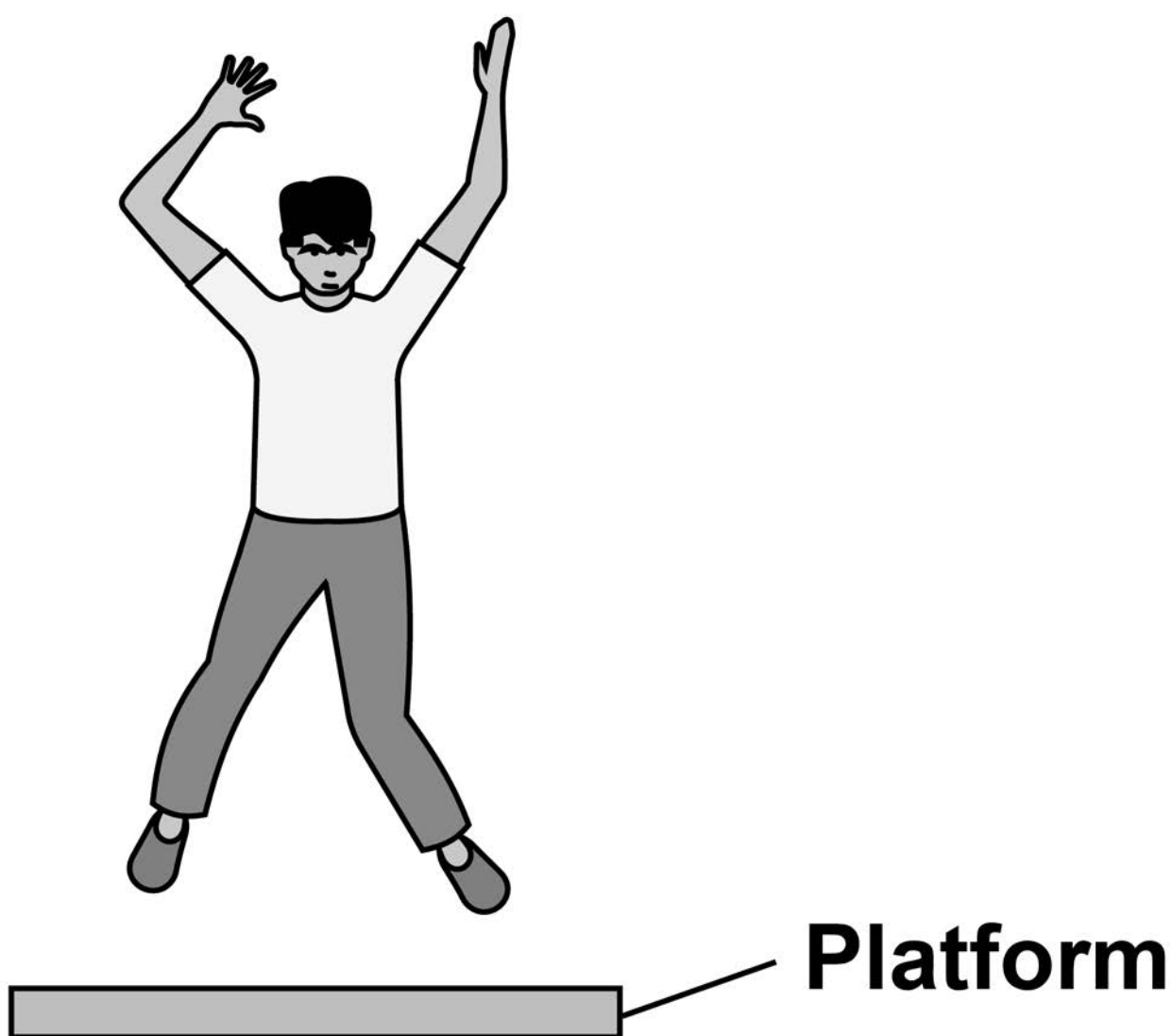
03

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 4 shows a volunteer taking part in the experiment.

FIGURE 4



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



0	3	.	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]



03.2

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

03.3

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

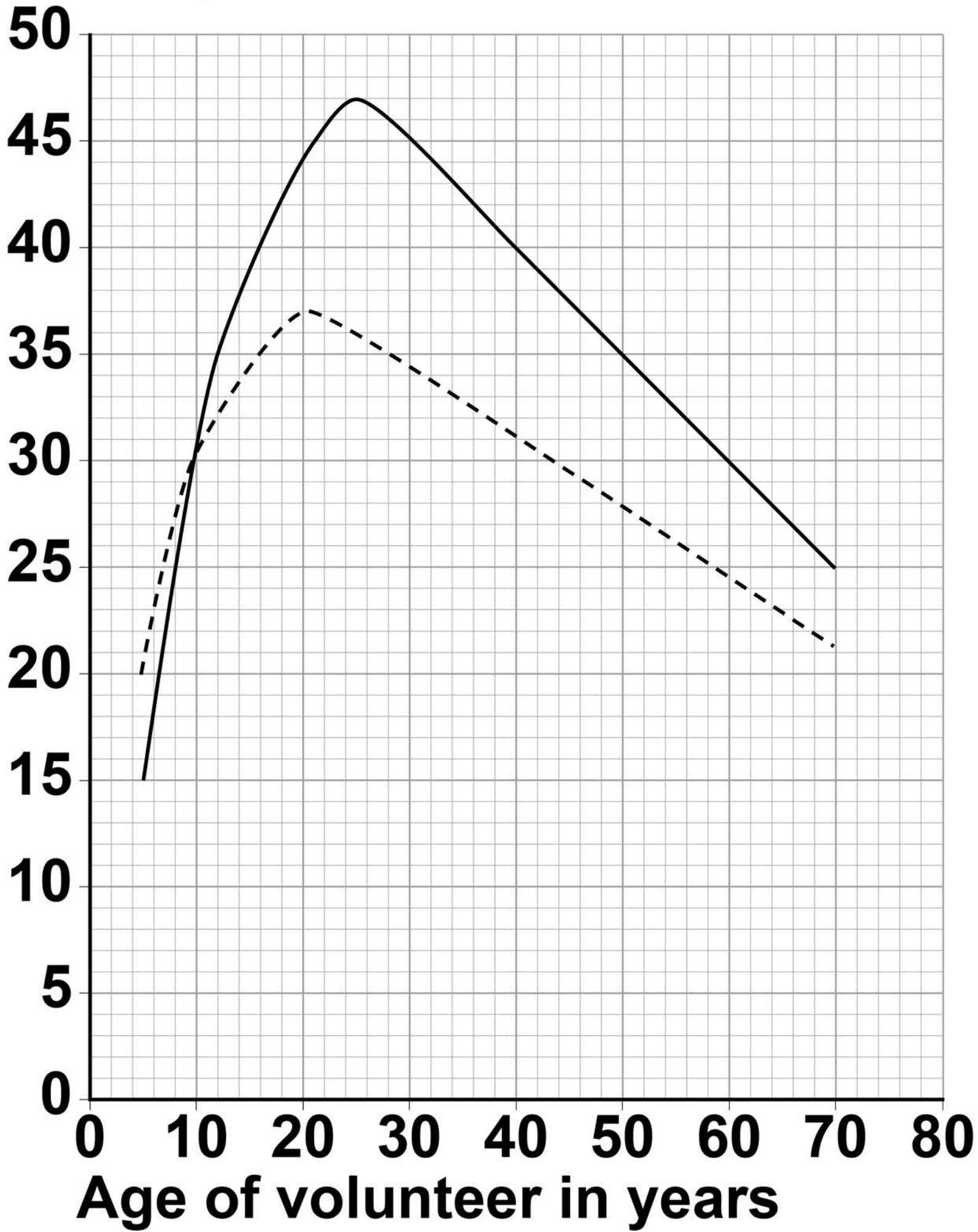
Calculate his mass. [3 marks]

Mass = _____ **kg**

[Turn over]

FIGURE 5

Muscle
power
in W/kg



KEY

—— Male - - - - Female



FIGURE 5, on the opposite page, shows the scientist's results.

03.4

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

Use data from FIGURE 5 in your answer. [4 marks]

[Turn over]



0 3 . 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]

[Turn over]

12

0 4

Electric cars have motors that are powered by a battery.

Diesel cars have engines that are powered by diesel fuel.

TABLE 2, on the opposite page, compares one type of electric car with one type of diesel car.



TABLE 2

Power source	Energy density in MJ / kg	Mass of power source in kg	Total mass of car in kg	Time to recharge battery or refill fuel tank in minutes
Battery	0.95	280	1600	40
Diesel fuel	45	51	1500	3

[Turn over]

04.1

The electric car has a range of 400 km with a fully charged battery.

The diesel car has a range of 1120 km with a full tank of diesel.

Explain the difference in the time needed to complete a 500 km journey using the electric car compared with the diesel car.

Assume both cars travel at the same speed. [2 marks]

[Turn over]



04.2

Energy density is the amount of energy stored per kilogram of the energy source.

Show why the diesel car has a greater range than the electric car.

Use data from TABLE 2, on page 25.

28

Assume the efficiency of the two cars is the same.

Include calculations in your answer. [3 marks]



[Turn over]

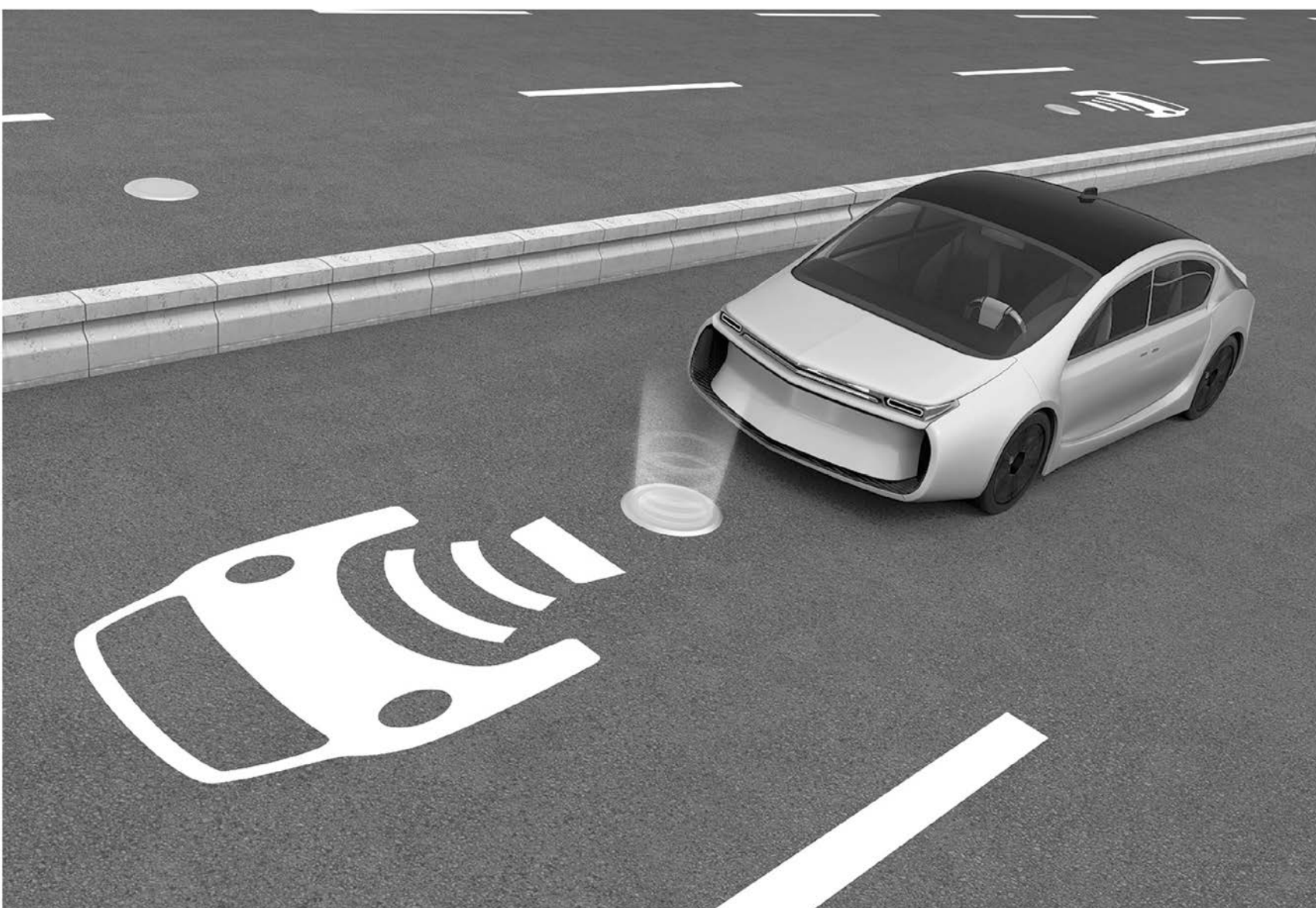


Engineers have developed a way of charging electric cars while they are driving along the road.

Coils of wire buried under the road transfer energy to the car's battery as the car is passing over the coils.

FIGURE 6 shows a charging lane on a motorway.

FIGURE 6



0 4 . 3

Suggest TWO advantages of using this method to charge electric cars compared with plugging them into the mains electricity supply. [2 marks]

1

2

[Turn over]



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04.4

When electric cars are not being driven, energy stored in their batteries could be used to meet sudden peaks in electricity demand.

Suggest how. [2 marks]

[Turn over]

9

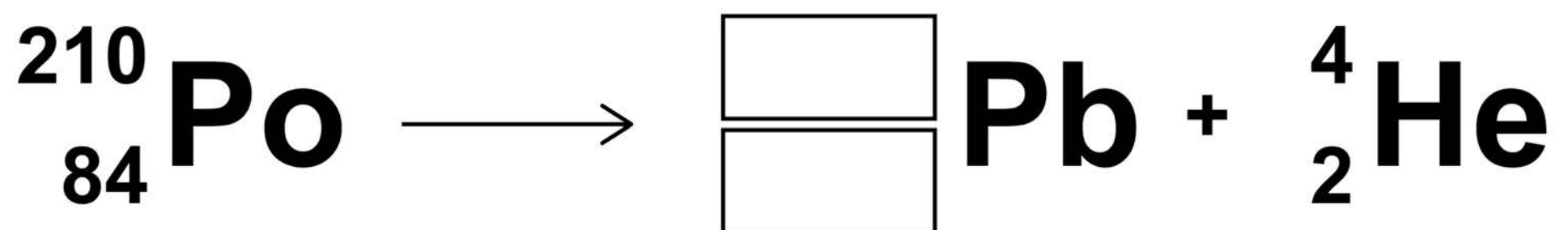


0	5
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Polonium-210 ($^{210}_{84}\text{Po}$) is a radioactive isotope that decays by emitting alpha radiation.

0	5	.	1
---	---	---	---

Complete the decay equation for polonium-210 [2 marks]



05.2

Explain why contamination of the inside of the human body by a radioactive material that emits alpha radiation is highly dangerous.

[3 marks]

[Turn over]



0	5	.	3
---	---	---	---

A sample of polonium-210 was left for 414 days.

After this time it had a mass of 1.45×10^{-4} g

The half-life of polonium-210 is 138 days.

**Calculate the initial mass of the sample.
[3 marks]**

Initial mass = _____ g

8

[Turn over]

0	6
---	---

FIGURE 7 shows a person using an electric lawn mower.

FIGURE 7



0	6	.	1
---	---	---	---

The lawn mower is connected to the mains electricity supply.

What is the frequency of the mains electricity supply in the UK? [2 marks]

Frequency = _____

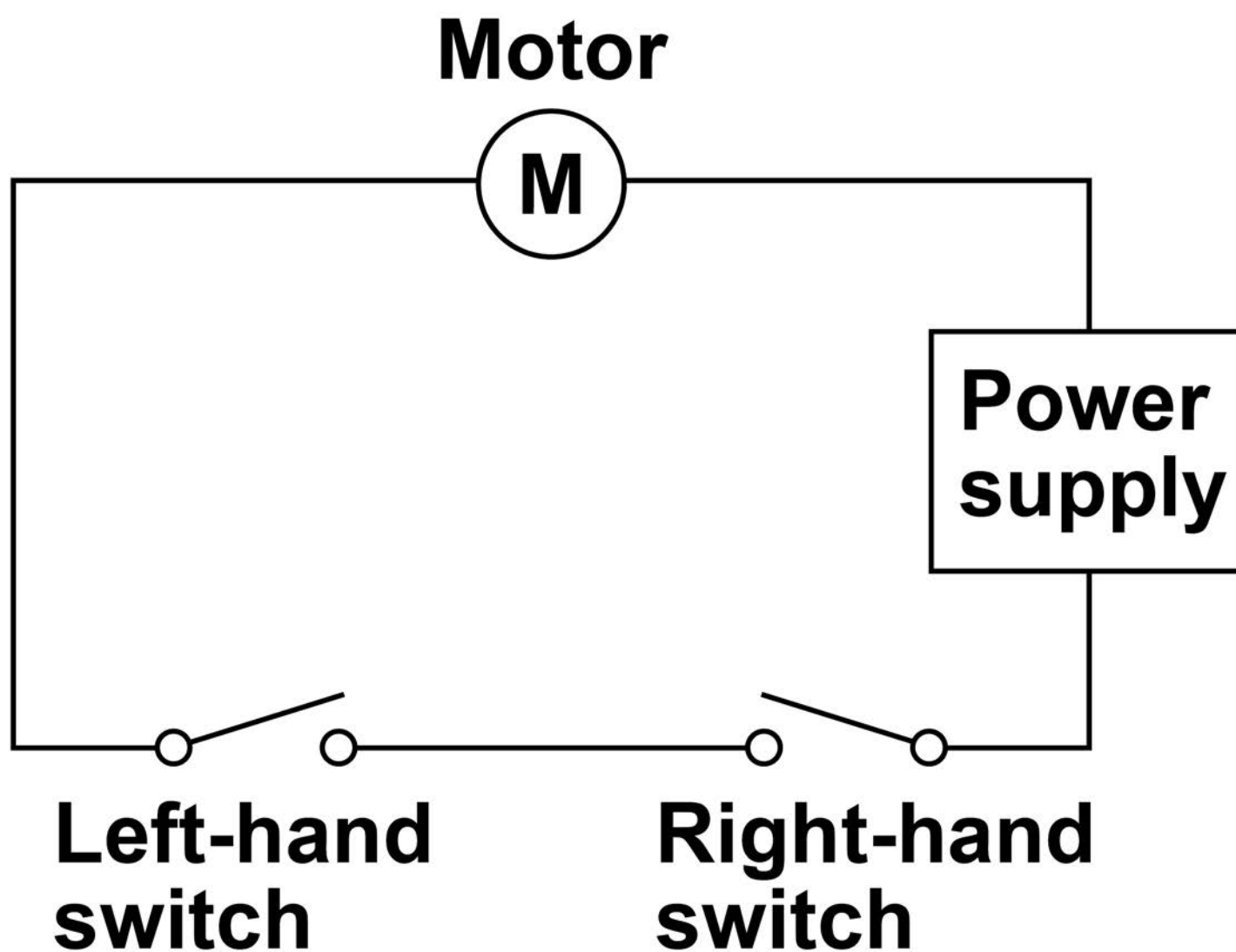
Unit _____

[Turn over]

The lawn mower has a switch on each side of the handle.

FIGURE 8 shows the circuit diagram for the lawn mower.

FIGURE 8



0 6 . 2

The motor in the lawn mower can only be turned on when the person using it holds the handle of the lawn mower with both hands.

Explain why. [2 marks]

[Turn over]

0	6	.	3
---	---	---	---

The power input to the motor is 1.8 kW

The resistance of the motor is 32 Ω

Calculate the current in the motor.
[3 marks]

Current = _____ A

0	6	.	4
---	---	---	---

The useful power output from the motor is 1.5 kW

Calculate the time it takes for the motor to transfer 450 000 J of useful energy.
[3 marks]

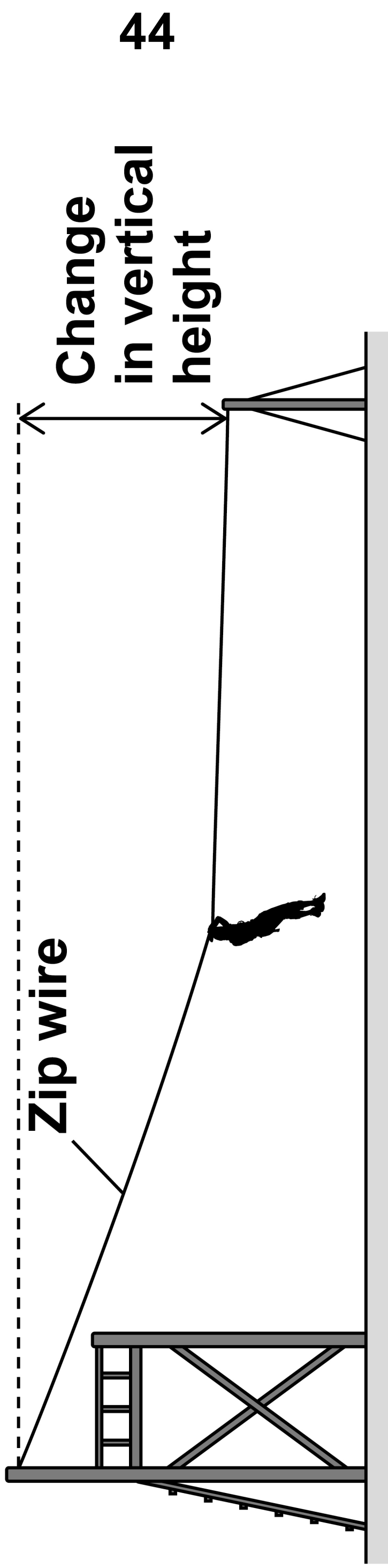
Time = _____ seconds

[Turn over]

10

FIGURE 9 shows a person sliding down a zip wire.

FIGURE 9



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[Turn over]



07.1

As the person slides down the zip wire, the change in the gravitational potential energy of the person is 1.47 kJ

The mass of the person is 60 kg

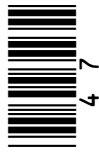
gravitational field strength = 9.8 N/kg

**Calculate the change in vertical height of the person.
[3 marks]**

Change in vertical height =

m

[Turn over]



07.2

As the person moves down the zip wire her increase in kinetic energy is less than her decrease in gravitational potential energy.

Explain why. [2 marks]

07.3

Different people have different speeds at the end of the zip wire.

Explain why. [2 marks]

[Turn over]

7



0	8
---	---

A student investigated the thermal conductivity of different metals.

This is the method used:

- 1. Measure the mass of an ice cube.**
- 2. Put the ice cube on a metal block which is at room temperature.**
- 3. Measure the mass of the ice cube after one minute.**
- 4. Repeat with other blocks of the same mass made from different metals.**

FIGURE 10

TABLE 3 shows the student's results.

TABLE 3

Metal	Initial mass of ice cube in grams	Final mass of ice cube in grams	Change in mass of ice cube in grams
Aluminium	25.85	21.14	4.71
Copper	26.20	20.27	5.93
Lead	25.53	21.97	3.56
Steel	24.95	19.45	5.50

[Turn over]



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0	8	.	1
---	---	---	---

The initial temperature of each ice cube was $-15\text{ }^{\circ}\text{C}$

Why was it important that the initial temperature of each ice cube was the same? [1 mark]

Tick (✓) ONE box.

Initial temperature was a continuous variable.

Initial temperature was a control variable.

Initial temperature was the dependent variable.

Initial temperature was the independent variable.

[Turn over]



08.2

Which metal had the highest thermal conductivity?

**Give a reason for your answer.
[2 marks]**

Metal: _____

Reason: _____

0 8 . 3

Suggest ONE source of random error in the student's investigation. [1 mark]

[Turn over]

0	8	.	4
---	---	---	---

An ice cube has a temperature of $-15.0\text{ }^{\circ}\text{C}$

The total thermal energy needed to raise the temperature of this ice cube to $0.0\text{ }^{\circ}\text{C}$ and completely melt the ice cube is 5848 J

specific heat capacity of ice = $2100\text{ J/kg }^{\circ}\text{C}$

specific latent heat of fusion of ice = $334\text{ }000\text{ J/kg}$

**Calculate the mass of the ice cube.
[5 marks]**

Mass of ice cube = _____ kg

[Turn over]

9

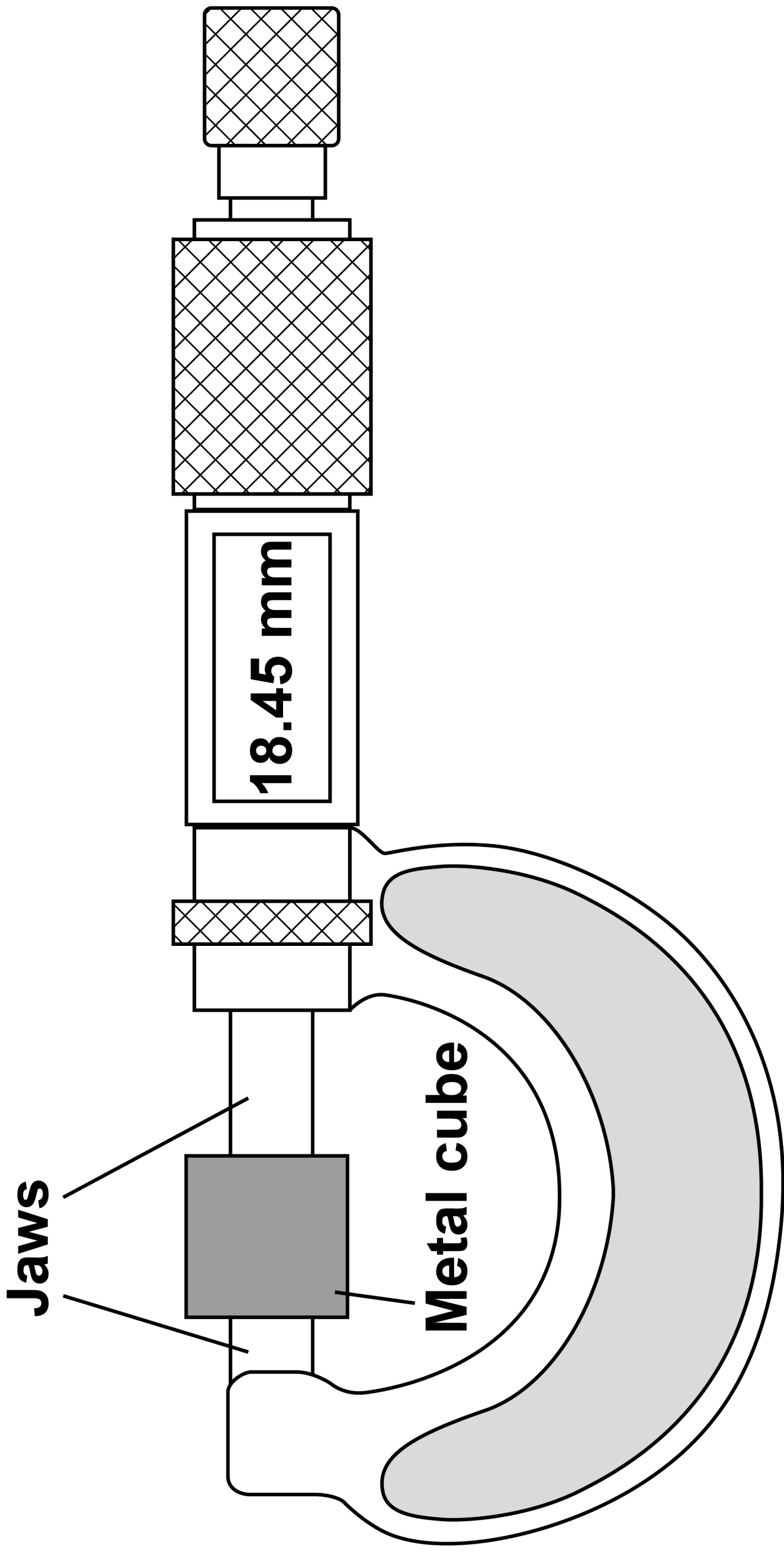
09

A student measured the width of a solid metal cube using a digital micrometer.

FIGURE 11, on the opposite page, shows the micrometer.



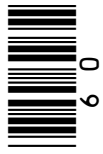
FIGURE 11



[Turn over]



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09.1

The resolution of the micrometer is
0.01 mm

The student could have used a metre rule to measure the
width of the cube.

Explain how using a metre rule would have affected the
accuracy of the student's measurement of width. [2 marks] 61

[Turn over]



0	9	.	2
---	---	---	---

The mass of the metal cube was measured using a top pan balance.

The balance had a zero error.

Explain how the zero error may be corrected after readings had been taken from the balance. [2 marks]

0	9	.	3
---	---	---	---

The width of the cube was 18.45 mm.

The density of the cube was

$8.0 \times 10^3 \text{ kg/m}^3$

Calculate the mass of the cube.

[5 marks]

Mass = _____ kg

[Turn over]

9

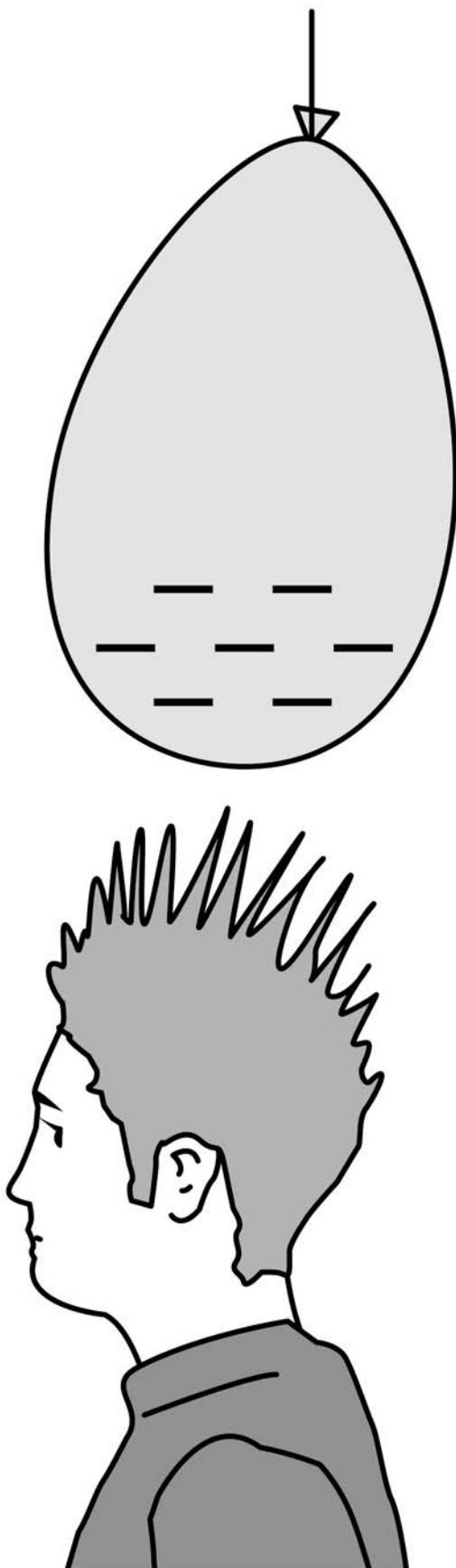


1	0
---	---

FIGURE 12 shows a student after rubbing a balloon on his hair.

The balloon and hair have become charged.

FIGURE 12



10.1

Describe the force that acts on the student's hair in FIGURE 12. [2 marks]

[Turn over]

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10.2

An earthed conductor was brought near the charged student. A spark jumped between the conductor and the student.

**The potential difference between the conductor and the student was 2.5 kV
The energy transferred by the spark was 0.0050 J**

Calculate the charge transferred by the spark. [3 marks]

Charge = _____ C

[Turn over]



10.3

A defibrillator can transfer a charge to regulate a person's heartbeat.

FIGURE 13 shows a defibrillator.

FIGURE 13



When the defibrillator is in use, a potential difference of 4800 V is applied across the person's chest.



A charge of 0.16 coulombs passes through the person's chest in 4.0 ms

Calculate the resistance of the person's chest. [5 marks]

Resistance = _____ Ω

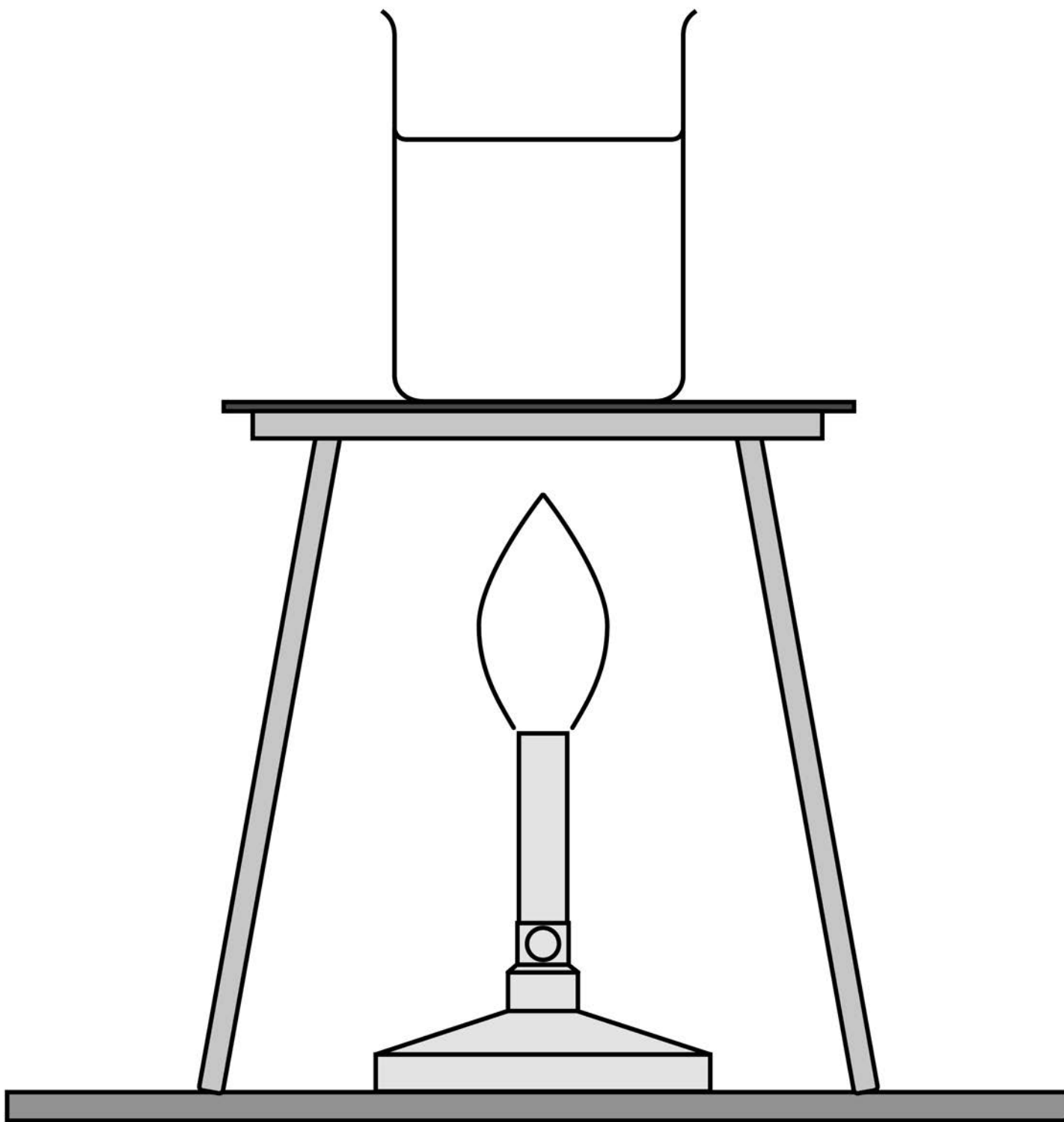
[Turn over]

10

1	1
---	---

FIGURE 14 shows a Bunsen burner heating some water in a beaker. Eventually the water changes into steam.

FIGURE 14



1	1	.	1
---	---	---	---

Explain how the internal energy of the water changes as it is heated from 20 °C to 25 °C
[2 marks]

[Turn over]

1	1	.	2
---	---	---	---

How is the particle model used to explain the difference in density between a liquid and a gas? [1 mark]

Tick (✓) ONE box.

Particles in a gas have less kinetic energy than particles in a liquid.

Particles in a gas have more potential energy than particles in a liquid.

Particles in a liquid are further apart than particles in a gas.

Particles in a liquid are larger than particles in a gas.

1 1.3

A student measured the mass of boiling water that was turned into steam in five minutes.

Explain how the student could use this information to estimate the power output of the Bunsen burner in watts. [4 marks]

END OF QUESTIONS



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For Examiner's Use	
Question	Mark
1	
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11	
TOTAL	

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