AQA

Please write clearly in block capitals.

Centre number

Candidate number

Surname

Forename(s)

Candidate signature

GCSE PHYSICS

F

Foundation Tier

Paper 1F

Specimen 2018 (set 2)

Time allowed: 1 hour 45 minutes

Materials

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.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- 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.

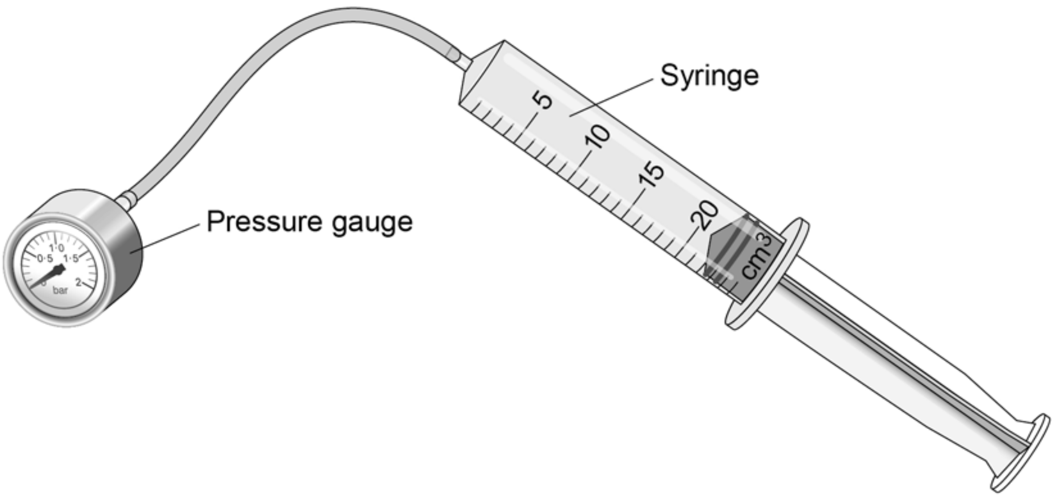
For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
TOTAL	

0 1 A student investigated how the pressure of a gas varied with the volume of the gas.

The mass and temperature of the gas were constant.

Figure 1 shows the equipment the student used.

Figure 1



0 1 . 1 What is the range of the syringe?

[1 mark]

Tick **one** box.

0 to 1 cm^3 ☐

0 to 5 cm^3 ☐

0 to 20 cm^3 ☐

0 to 25 cm^3 ☐

0 1 . 2 What type of variable was the mass of gas?

[1 mark]

Tick **one** box.

Control ☐

Dependent ☐

Independent ☐

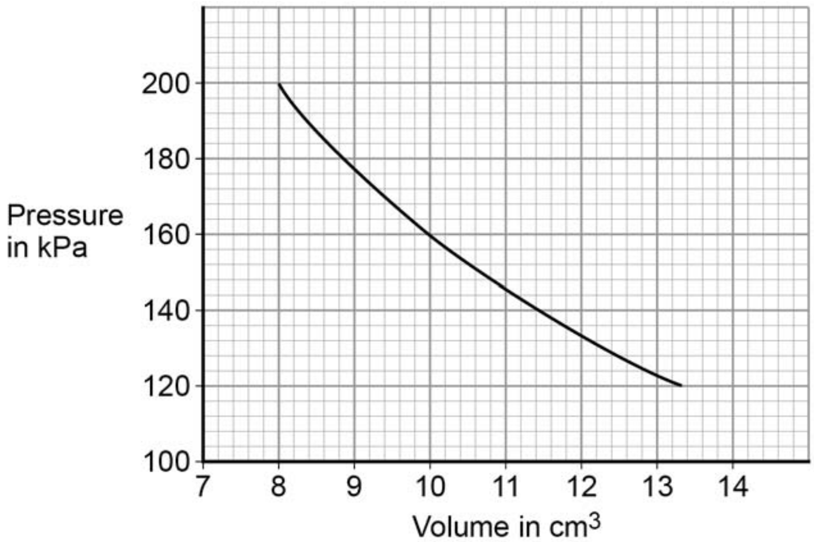
Question 1 continues ion the next page

Do not write outside the box

The student compressed the gas in the syringe and read the pressure from the pressure gauge.

Figure 2 shows the student's results.

Figure 2



0 1 . 3 The student concluded that when the pressure was multiplied by the corresponding volume the answer was the same.

Use data from **Figure 2** to show that the student's conclusion was correct.

[2 marks]

Do not write outside the box

0 1 . 4 Complete the sentences.

Choose the answers from the box.

Each answer may be used once, more than once or not at all.

[3 marks]

decreases	**increases**	**remains the same**

When the gas is compressed, the volume of gas in the syringe ____________________ .

So the number of collisions each second between the gas particles inside the syringe and the inside surface of the syringe ____________________________ .

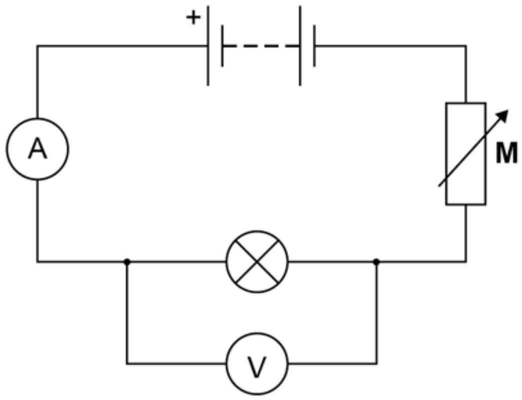
This means the force exerted on the inside surface of the container walls ______________________ .

7

Turn over for the next question

0 2 **Figure 3** shows the circuit used to obtain the data needed to plot the current-potential difference graph for a filament lamp.

Figure 3



0 2 . 1 Why is component **M** included in the circuit?

[1 mark]

Tick **one** box.

To keep the current constant. ☐

To keep the potential difference constant. ☐

To vary the current. ☐

0 2 . 2 Why does the resistance of the lamp increase as the potential difference across the lamp increases?

[1 mark]

___

___

___

Do not write outside the box

0 2 . 3 The potential difference across the lamp is 12.0 V

Calculate the energy transferred by the lamp when 8.5 C of charge flows through the lamp.

Use the equation:

energy transferred = charge flow × potential difference

[2 marks]

Energy transferred = ____________________ J

0 2 . 4 **Table 1** gives data about two types of lamp that householders may use in their homes.

Table 1

Type of lamp	Energy efficiency	Mean lifetime in hours
Halogen	10%	2 000
LED	90%	36 000

Both types of lamp produce the same amount of light.

Describe the environmental advantages of using the LED lamp compared with the halogen lamp.

[2 marks]

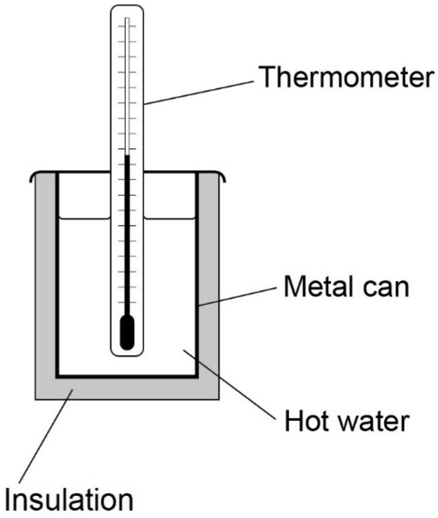
6

Turn over ►

0 3 A student investigated the properties of three insulating materials.

Figure 4 shows the apparatus the student used.

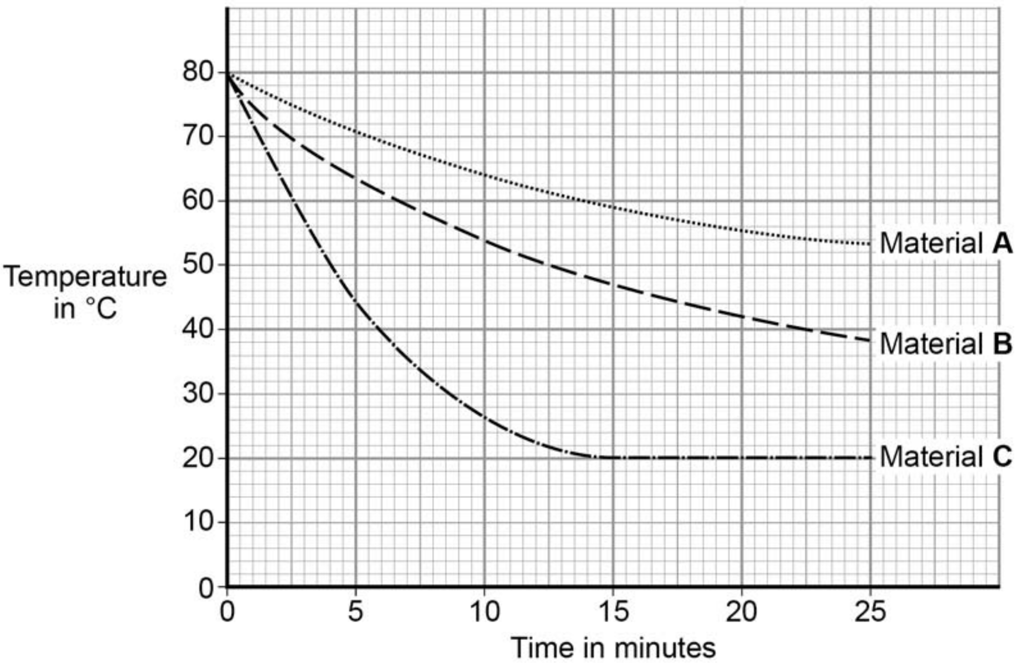
Figure 4



In the investigation, different insulating materials were used to insulate a metal can filled with hot water.

Figure 5 shows how the temperature measured by the thermometer changed over 25 minutes for each of the materials.

Figure 5



Do not write outside the box

0 3 . 1 What was the temperature of the room where the student carried out the investigation?

[1 mark]

Tick **one** box.

20 °C ☐ 38 °C ☐ 53 °C ☐ 80 °C ☐

0 3 . 2 Material C has the highest thermal conductivity.

[1 mark]

How does the graph in **Figure 5** show this?

____

____

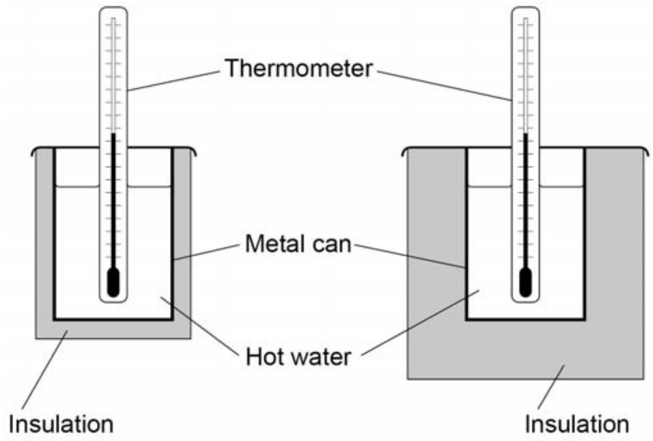
Question 3 continues on the next page

Do not write outside the box

0 3 . 3 Another student repeated the investigation using the equipment shown in **Figure 6**.

Figure 4 shows the first set of equipment used.

Figure 4 **Figure 6**



Suggest how using the equipment in **Figure 6** will have affected the student's results.

[2 marks]

____

____

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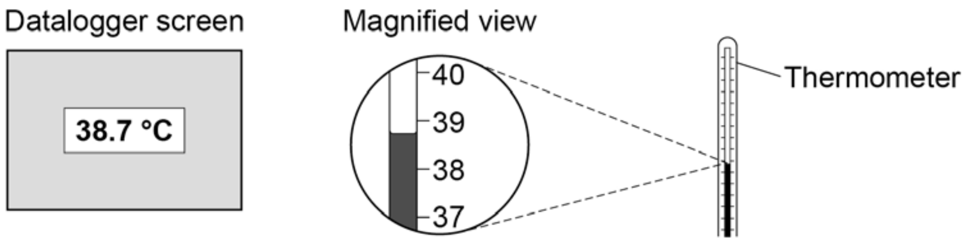
Do not write outside the box

0 3 . 4 The students could have used a temperature probe and datalogger instead of a thermometer.

Figure 7 shows the datalogger screen and the thermometer.

Figure 7



Complete the sentences.

Choose the answers from the box.

[2 marks]

higher	**lower**	**the same**

Compared to the thermometer, the datalogger and temperature probe have a resolution that is ________________________ .

Compared to the thermometer, the chance of misreading the datalogger and temperature probe is ________________________ .

Question 3 continues on the next page

0 3 . 5 **Table 2** gives information about four types of insulation that could be used in the walls of houses.

Table 2

Type of insulation	**Thermal conductivity in W/m °C**
Felt wool	0.070
Mineral wool	0.040
Polyurethane foam	0.030
Rock wool	0.045

Which type of insulation would be most effective in reducing the rate of cooling of a building?

[2 marks]

Tick **one** box.

Felt wool ☐

Mineral wool ☐

Polyurethane foam ☐

Rock wool ☐

Give a reason for your answer.

____

____

____

____

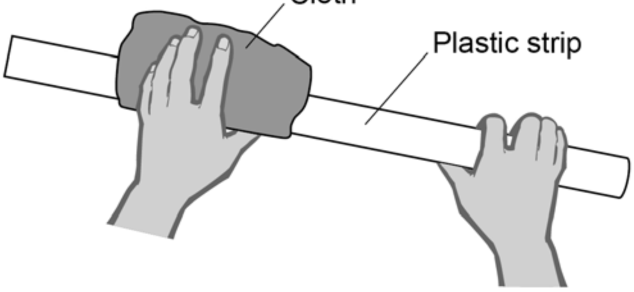
8

Do not write outside the box

0 4 A student used some everyday items to investigate static electricity.

Figure 8 shows a flexible plastic strip being rubbed with a cloth.

Figure 8



0 4 . 1 Complete the sentence.

Choose the answer from the box.

[1 mark]

electrons **neutrons** **protons**

Rubbing the plastic strip with the cloth causes the strip to become negatively charged because ____________________________ move from the cloth onto the plastic strip.

0 4 . 2 Complete the sentence.

Choose the answer from the box.

[1 mark]

a negative **a positive** **zero**

The cloth is left with ____________________________ charge.

Question 4 continues on the next page

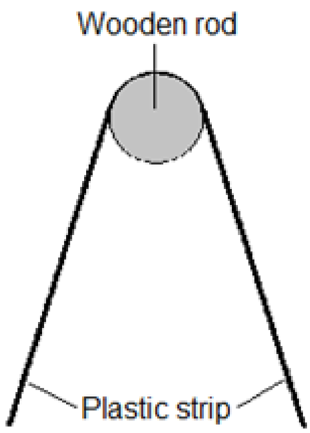
Turn over ►

0 4 . 3 The student hung the plastic strip over a wooden rod.

The ends of the strip moved away from each other.

Figure 9 shows the position of the plastic strip on the wooden rod.

Figure 9



What **two** conclusions should the student make about the forces acting on the two halves of the plastic strip?

[2 marks]

1 ____

____

2 ____

____

Do not write outside the box

0 4 . 4 Another student repeated the experiment using the same method and found the plastic strip moved in the same way.

Complete the sentence.

Choose the answer from the box.

[1 mark]

an anomaly	**repeatable**	**reproducible**

The investigation was ________________________________ .

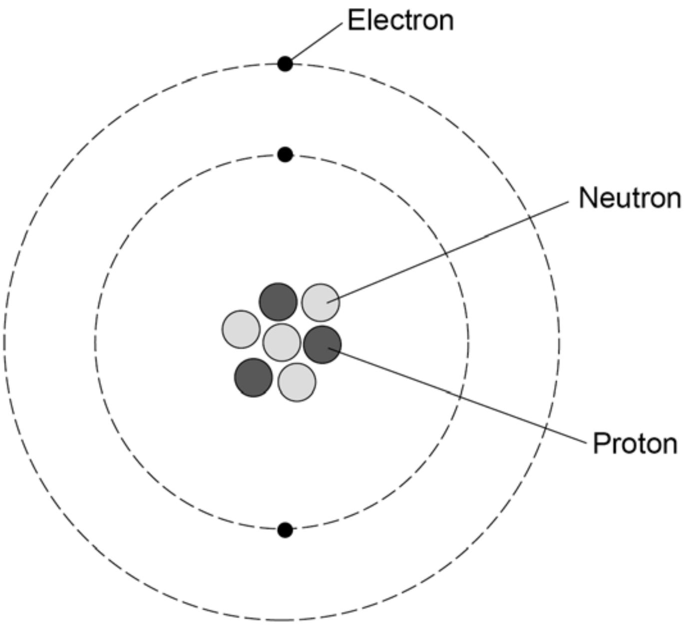
5

Turn over for the next question

Do not write outside the box

0 5 **Figure 10** shows a lithium atom.

Figure 10



0 5 . 1 What is the mass number of this lithium atom?

[1 mark]

Tick **one** box.

3 ☐ 4 ☐ 7 ☐ 10 ☐

0 5 . 2 What is the atomic number of a lithium atom?

[2 marks]

Tick **one** box.

3 ☐ 4 ☐ 7 ☐ 10 ☐

Give a reason for your answer.

____

____

Do not write outside the box

0 5 . 3 Complete the sentence.

Choose the answer from the box.

[1 mark]

circles	**levels**	**rings**

The electrons in an atom orbit in different energy ______________________ .

0 5 . 4 Some atomic nuclei are unstable and decay by emitting an alpha particle or a beta particle.

Complete the symbols for an alpha particle and a beta particle.

Use answers from the box.

[3 marks]

–1	**0**	**1**	**2**	**4**

Alpha $^{\square}_{\square}\mathrm{He}$

Beta $^{0}_{\square}\mathrm{e}$

Question 5 continues on the next page

Do not write outside the box

0 5 . 5 Doctors may use nuclear radiation to diagnose certain types of illness.

Table 3 gives data about three radiation sources used.

Each source emits beta radiation.

Table 3

Radiation source	**Half-life in minutes**
Carbon-11	20
Nitrogen-13	10
Oxygen-15	2

Explain why oxygen-15 is likely to pose the least risk to a patient.

[2 marks]

____

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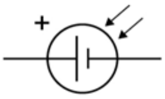
____

9

Do not write outside the box

0 6 Solar cells produce electricity using light from the Sun.

The symbol for a solar cell is: 

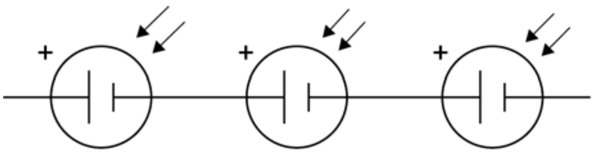
A householder has three solar cells.

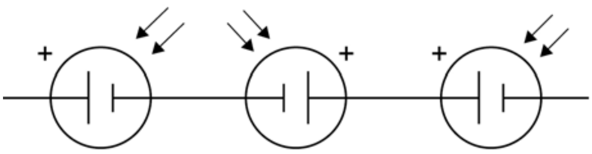
Each solar cell has an output potential difference of 0.70 V

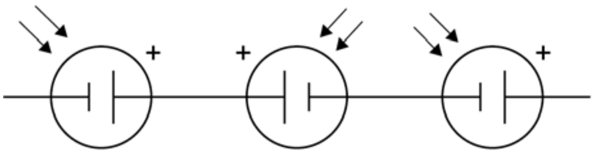
0 6 . 1 Which arrangement of three solar cells will give a potential difference of 2.10 V?

[1 mark]

Tick **one** box.







0 6 . 2 A solar cell has a resistance of 2.5 Ω when the output potential difference is 0.70 V

Calculate the current through the solar cell.

Use the equation:

$$\text{current} = \frac{\text{potential difference}}{\text{resistance}}$$

[2 marks]

____

____

____

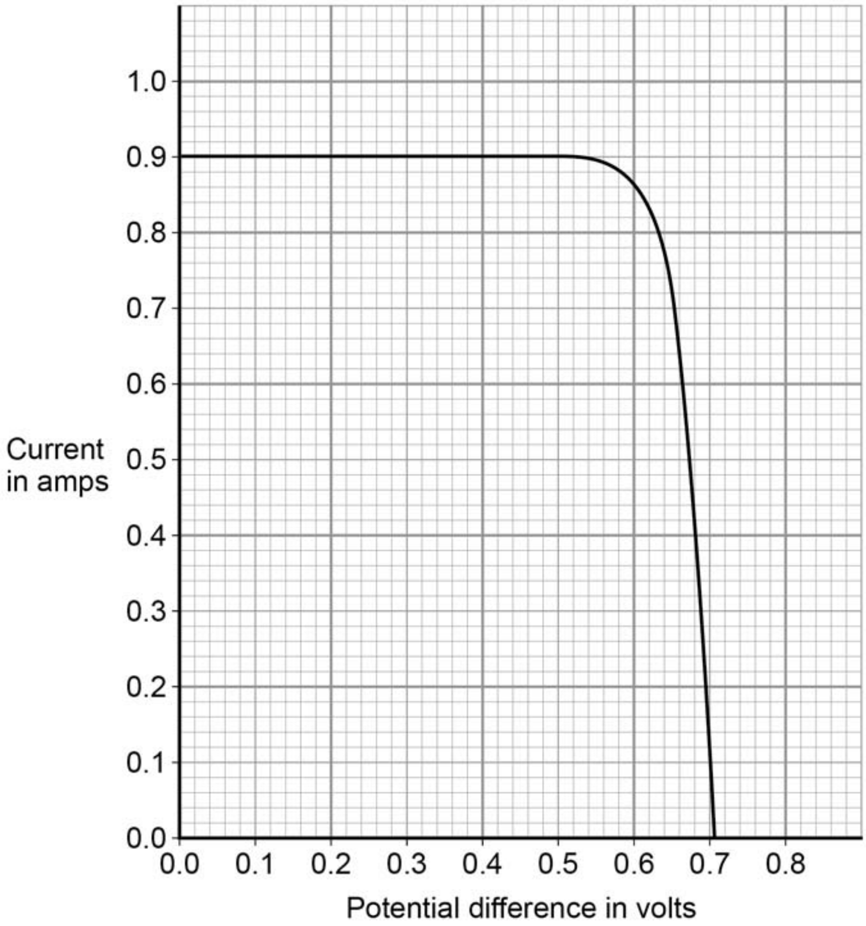
____

Current = ____________________ A

Turn over ►

Figure 11 shows a graph of current against potential difference for a different type of solar cell.

Figure 11



Do not write outside the box

0 6 . 3 The power output of the solar cell is calculated using the equation.

power = current × potential difference

Which value of potential difference on **Figure 11** gives the maximum power output of the solar cell?

[2 marks]

Tick **one** box.

0.1 V ☐ 0.3 V ☐ 0.6 V ☐ 0.7 V ☐

Give the reason for your answer.

____

____

____

0 6 . 4 Write down the equation that links efficiency, total power input and useful power output.

[1 mark]

____

____

0 6 . 5 The total power input to the solar cell is 2.4 W when the efficiency is 0.20

Calculate the useful power output of the solar cell.

[3 marks]

____

____

____

____

Useful power output = ____________________ W

9

Turn over ►

0 7 **Figure 12** shows a battery-powered drone.

Figure 12

0 7 . 1 Complete the sentences.

Choose the answers from the box.

[3 marks]

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

As the drone accelerates upwards

its ______________________________ energy increases

and its ______________________________ energy increases.

The ______________________________ energy store

of the battery decreases.

Do not write outside the box

0 7 . 2 In the USA, drones are not allowed to be flown too high above the ground.

Suggest **one** possible risk of flying a drone too high above the ground.

[1 mark]

____

____

____

0 7 . 3 Write down the equation that links energy transferred, power and time.

[1 mark]

____

0 7 . 4 The drone can fly for 25 minutes before the battery needs recharging.

The power output of the battery is 65.0 W

Calculate the maximum energy stored by the battery.

[3 marks]

____

____

____

____

Maximum energy = ____________________ joules

8

Turn over for the next question

Do not write outside the box

0 8 Sources of background radiation are either natural or man-made.

0 8 . 1 Which **two** of the sources listed in the table are natural sources of background radiation?

[2 marks]

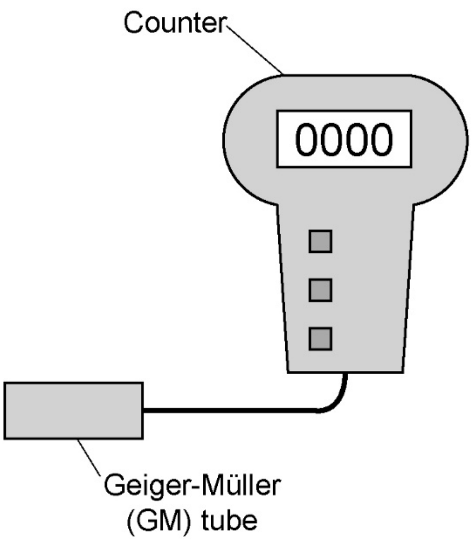
Tick **two** boxes.

Cosmic rays	☐
Medical X-rays	☐
Nuclear power stations	☐
Nuclear weapons testing	☐
Radon gas	☐

A teacher used a Geiger-Müller (GM) tube and counter to measure the background radiation in his laboratory.

Figure 13 shows the GM tube and counter.

Figure 13



0 8 . 2 **Table 4** gives three readings taken by the teacher at three different times on the same day.

Table 4

Counts in 1 minute
16
21
18

What is the most likely reason for the readings being different?

[1 mark]

Tick **one** box.

Radioactive decay is a random process. ☐

The air pressure in the laboratory increased. ☐

The background radiation increased during the day. ☐

The temperature in the laboratory decreased. ☐

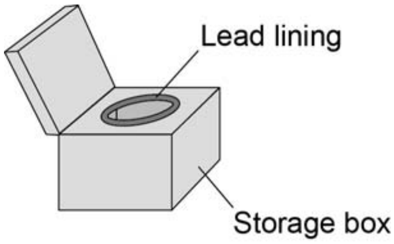
Question 8 continues on the next page

Do not write outside the box

0 8 . 3 The teacher takes a radioactive source from a storage box.

Figure 14 shows the box.

Figure 14



Why does storing the radioactive source in the box reduce the risk of radiation exposure to the teacher?

[1 mark]

Tick **one** box.

The lead lining absorbs the emitted radiation. ☐

The lead lining reflects the emitted radiation. ☐

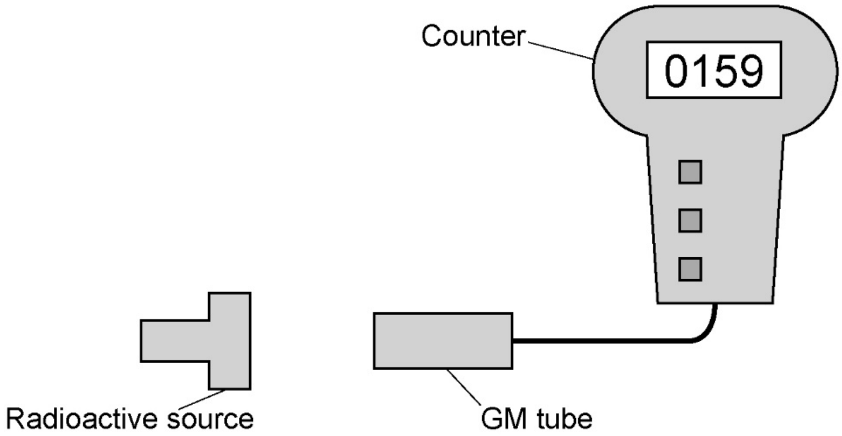
The lead lining transmits the emitted radiation. ☐

0 8 . 4 **Figure 15** shows how the teacher used the GM tube and counter to measure the radiation emitted from the radioactive source.

The counter was reset to zero.

The count after one minute was 159.

Figure 15



How should the teacher calculate the counts from the radioactive source?

[1 mark]

Tick **one** box.

Add the background count to 159	☐
Divide the background count by 159	☐
Multiply the background count by 159	☐
Subtract the background count from 159	☐

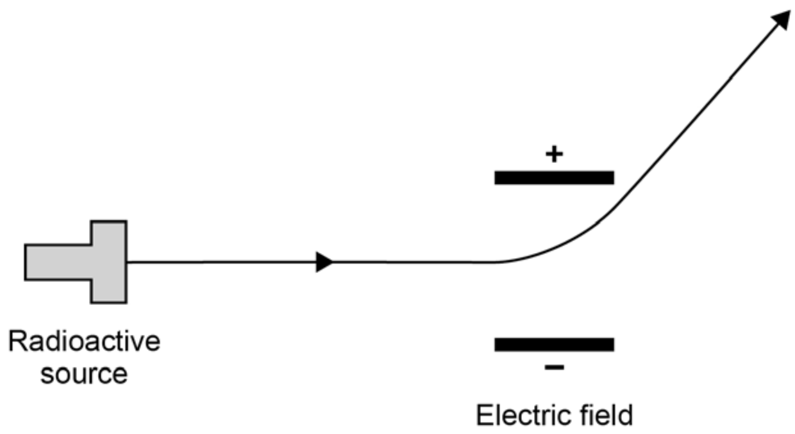
Question 8 continues on the next page

Do not write outside the box

0 8 . 5 The teacher passed the radiation through an electric field.

Figure 16 shows the path that the radiation took through the electric field.

Figure 16



What type of radiation was being emitted by the radioactive source?

[3 marks]

Tick **one** box.

Alpha ☐ Beta ☐ Gamma ☐ Neutron ☐

Explain the reason for your answer.

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____

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8

Do not write outside the box

Turn over for the next question

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

Turn over ►

0 9 Most electric kettles use the ac mains electricity supply.

0 9 . 1 Complete the sentence.

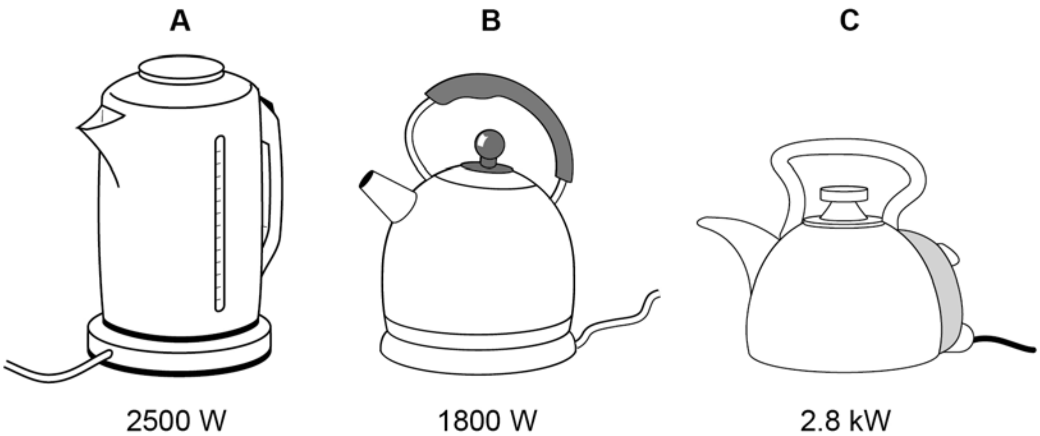
[1 mark]

The ac mains supply has a potential difference that continuously

____________________________ polarity,

Figure 17 gives the power output of three electric kettles.

Figure 17



A student investigated how the power output of a kettle affected the time taken to boil a fixed volume of water.

The water in all three kettles had an initial temperature of 25 ºC.

Do not write outside the box

0 9 . 2 What type of variable was the time?

[1 mark]

Tick **one** box.

Control ☐

Dependent ☐

Independent ☐

0 9 . 3 Which kettle will boil the water in the shortest time?

Give a reason for your answer.

[2 marks]

Kettle ____________________

Reason ____________________

____

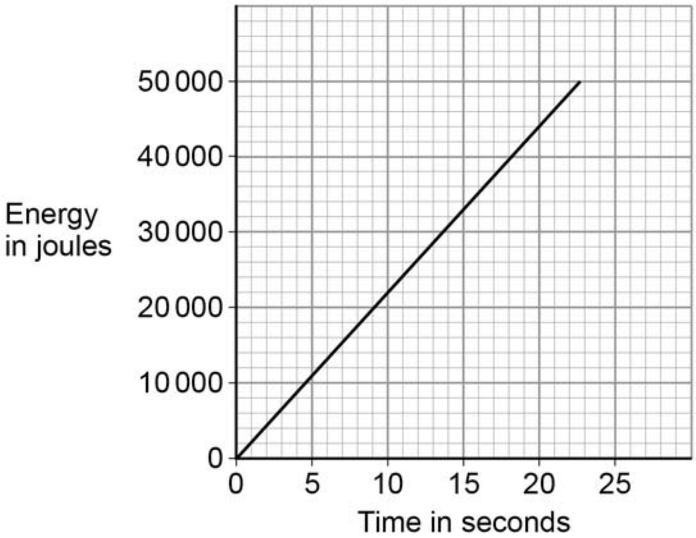
____

Question 9 continues on the next page

Turn over ►

0 9 . 4 **Figure 18** shows how the amount of energy transferred by a kettle varies with time.

Figure 18



The power output of the kettle is given by the gradient of the graph.

Calculate the power output of the kettle.

[2 marks]

____

____

Power output = ______________________ W

0 9 . 5 Write down the equation that links charge flow, current and time.

[1 mark]

____

0 9 . 6 Calculate the current through the kettle when 2400 coulombs of charge flows in 250 seconds.

[3 marks]

____

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____

____

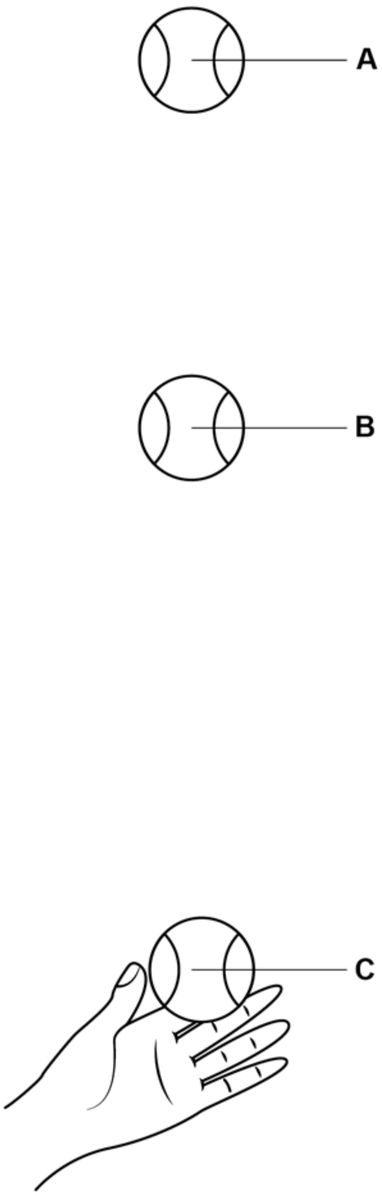
Current = ____________________ A

10

Turn over for the next question

1 0 **Figure 19** shows a tennis ball thrown vertically into the air.

Figure 19



At position **C**, the ball has just left the tennis player's hand at a speed of 5.0 m/s

The tennis ball has a mass of 0.058 kg

1 0 . 1 Write down the equation that links kinetic energy, mass and speed.

[1 mark]

____

Do not write outside the box

1 0 . 2 Calculate the kinetic energy of the tennis ball at position **C**.

[2 marks]

Kinetic energy = ____________________ J

1 0 . 3 At position **A** the tennis ball is at maximum height.

What is the gravitational potential energy of the tennis ball at position **A**?

Ignore the effect of air resistance.

[1 mark]

At position **B** the tennis ball has 0.38 J of gravitational potential energy.

1 0 . 4 Write down the equation that links gravitational field strength, gravitational potential energy, height and mass.

[1 mark]

1 0 . 5 Calculate the height of the tennis ball above the tennis player's hand when at position **B**.

gravitational field strength = 9.8 N/kg

[3 marks]

Height = ____________________ m

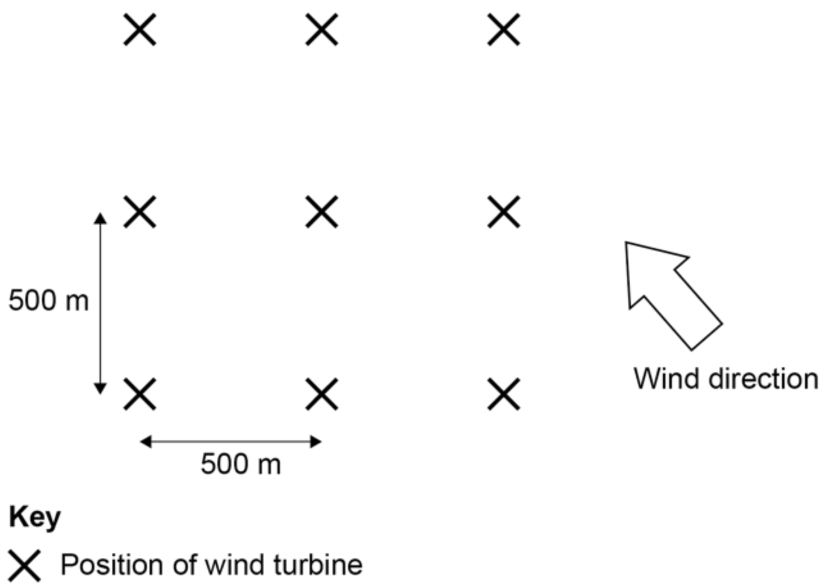
8

Turn over ►

1 1 The wind turbines in a wind farm must have a minimum distance of 500 m between them for maximum efficiency.

Figure 20 shows the position of nine wind turbines in a wind farm.

Figure 20



1 1 . 1 Suggest **one** way in which the layout of this wind farm ensures maximum efficiency when the wind direction changes.

[1 mark]

Do not write outside the box

The average mass of air passing through the blades of one wind turbine is 51 000 kg per second.

The density of air is 1.2 kg / m^3

1 1 . 2 Write down the equation that links density, mass and volume.

[1 mark]

____

1 1 . 3 Calculate the volume of air passing through the blades of one wind turbine per second.

Give the unit.

Give your answer to 2 significant figures.

[5 marks]

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Volume per second = ______________ Unit ______________

Question 11 continues on the next page

Do not write outside the box

11.4 The average power output from one of the wind turbines in **Figure 20** is 1.6×10^6 W

The average power output of a nuclear power station is 2.4×10^9 W

Calculate the number of wind turbines needed to generate power equal to one nuclear power station.

[2 marks]

Number of wind turbines = ____________________

11.5 The UK requires a minimum electrical power of 2.5×10^{10} W at any time.

Give **two** reasons why wind turbines alone are unlikely to be used to meet this requirement.

[2 marks]

1 ____________________

2 ____________________

11

Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Turn over ►

1 2 The specific heat capacity of aluminium can be determined by experiment.

1 2 . 1 Draw a labelled diagram showing how the apparatus used to determine the specific heat capacity of aluminium should be arranged.

[3 marks]

Do not write outside the box

1 2 . 2 Describe how you could use the apparatus you drew in Question **12.1** to determine the specific heat capacity of aluminium.

[6 marks]

Question 12 continue on the next page

Do not write outside the box

1 2 . 3 Methods used to determine the specific heat capacity of aluminium may give a value greater than the actual value.

Explain why.

[2 marks]

____

____

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11

END OF QUESTIONS

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