SPECIMEN MATERIAL

GCSE
PHYSICS

F

Foundation Tier Paper 1F

Specimen 2018 Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:

- a ruler
- a calculator
- the Physics Equation Sheet (enclosed).

Instructions

- 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.

Information

- There are 100 marks available on this paper.
- 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.
- When answering questions 05.2, 06.1 and 10 you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully meets the requirements of the question
  - shows that each separate point or step supports the overall answer.

Advice

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

Please write clearly, in block capitals, to allow character computer recognition.

Centre number ☐☐☐☐☐ Candidate number ☐☐☐☐

Surname ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Forename(s) ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Candidate signature _____

0 1 Energy resources can be renewable or non-renewable.

0 1 . 1 Coal is a non-renewable energy resource.

Name **two** other non-renewable energy resources.

[2 marks]

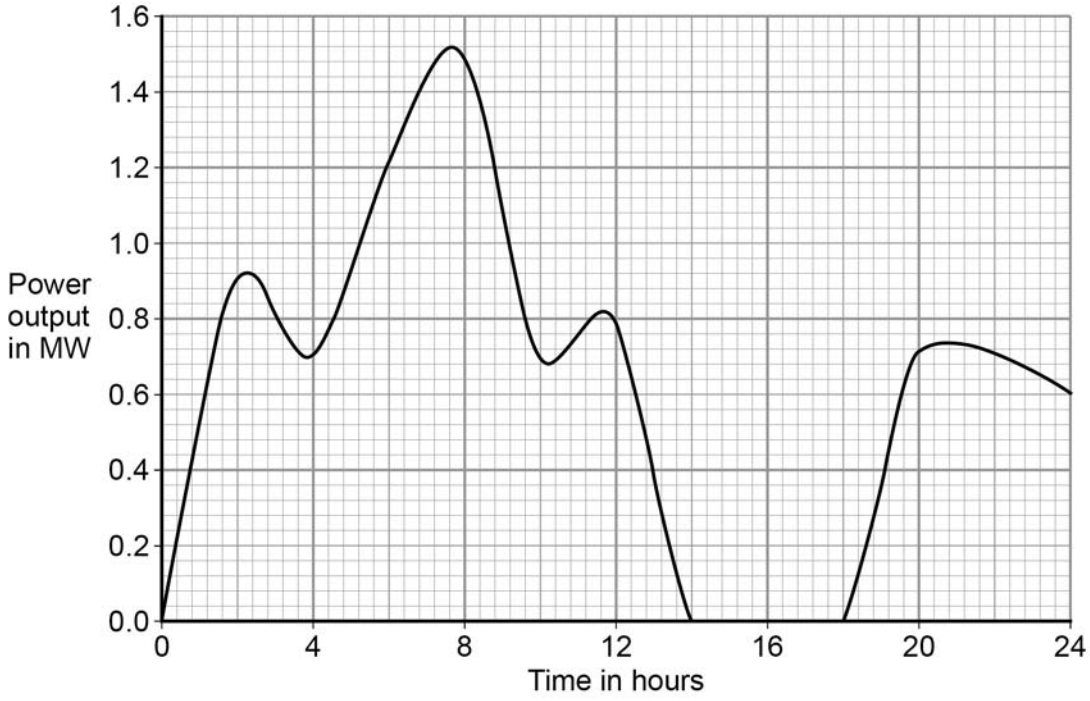
1 _____

2 _____

Wind turbines are used to generate electricity.

Figure 1 shows how the power output of a wind turbine changes over one day.

Figure 1



0 1 . 2 A wind turbine does not generate electricity constantly.

For how many hours did the wind turbine generate no electricity?

[1 mark]

Time = _____ hours

0 1 . 3 Electrical power is transferred from power stations to the National Grid.

What is the National Grid?

Tick **one** box.

[1 mark]

- a system of cables and pylons ☐
- a system of cables and transformers ☐
- a system of cables, transformers and power stations ☐

0 1 . 4 An island has a large number of wind turbines and a coal-fired power station.

The island needs to use the electricity generated by the coal-fired power station at certain times.

Choose **one** reason why.

[1 mark]

Tick **one** box.

- Wind is a renewable energy resource. ☐
- Wind turbine power output is constant. ☐
- The power output of wind turbines is unpredictable. ☐
- The fuel cost for wind turbines is very high. ☐

0 1 . 5 A wind turbine has an average power output of 0.60 MW.

A coal-fired power station has a continuous power output of 1500 MW.

Calculate how many wind turbines would be needed to generate the same power output as one coal-fired power station.

[2 marks]

Number of wind turbines = _____

0 1 . 6 It is important that scientists develop new energy resources.

Choose **one** reason why.

[1 mark]

Tick **one** box.

All energy resources are running out. ☐

All energy resources are used to generate electricity. ☐

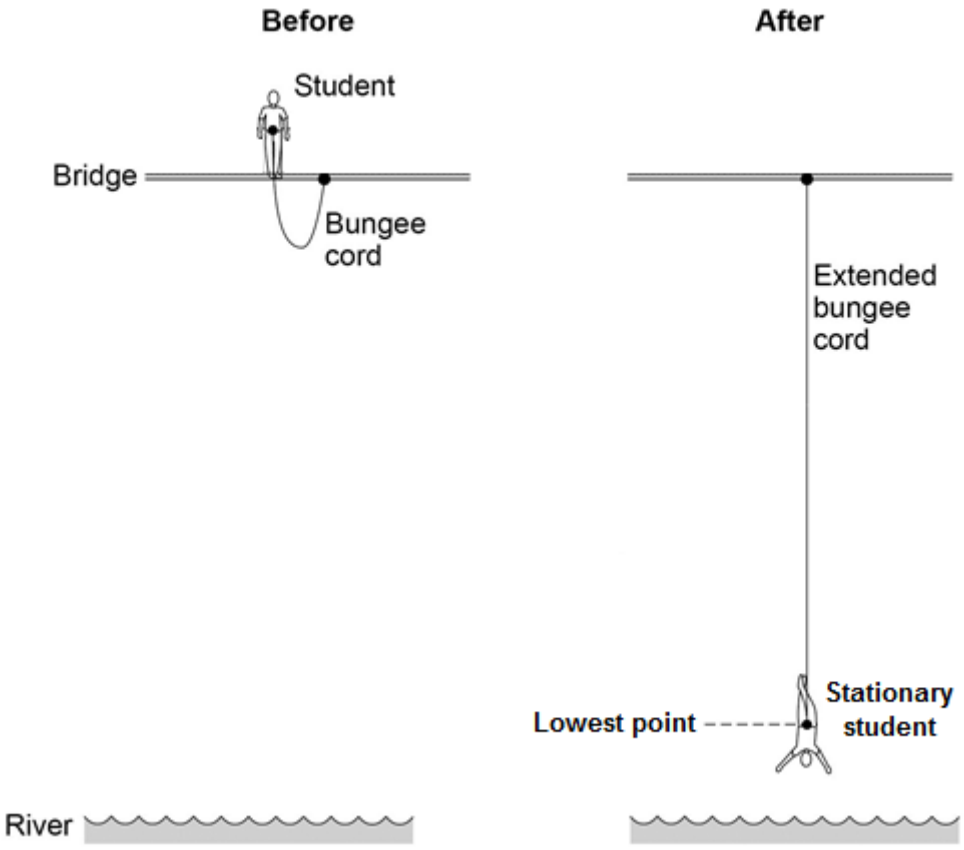
Most energy resources have negative environmental effects. ☐

Turn over for the next question

0 2 **Figure 2** shows a student before and after a bungee jump.

The bungee cord has an unstretched length of 20 m.

Figure 2



0 2 . 1 For safety reasons, it is important that the bungee cord used is appropriate for the student's weight.

Give **two** reasons why.

[2 marks]

1

2

0 2 . 2 The student jumps off the bridge.

Complete the sentences to describe the energy transfers.

Use answers from the box.

[3 marks]

elastic potential	**gravitational potential**	**kinetic**	**sound**	**thermal**

Before the student jumps from the bridge he has a store of

_____ energy.

When he is falling, the student's store of _____ energy increases.

When the bungee cord is stretched, the cord stores energy as

_____ energy.

0 2 . 3 At the lowest point in the jump when the student is stationary, the extension of the bungee cord is 35 metres.

The bungee cord behaves like a spring with a spring constant of 40 N/m.

Calculate the energy stored in the stretched bungee cord.

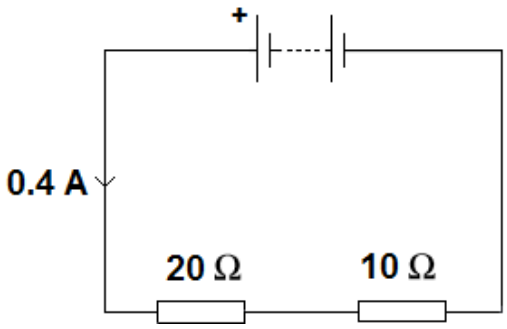
Use the correct equation from the Physics Equations Sheet.

[2 marks]

Energy = _____ J

0 3 An electrical circuit is shown in **Figure 3**.

Figure 3



0 3 . 1 The current in the circuit is direct current.

What is meant by direct current?

[1 mark]

Tick **one** box.

Current that continuously changes direction. ☐

Current that travels directly to the component. ☐

Current that is always in the same direction. ☐

0 3 . 2 The equation which links current, potential difference and resistance is:

potential difference = current x resistance

Calculate the potential difference across the battery in the circuit in **Figure 3**.

[3 marks]

Potential difference = _____ V

0 3 . 3 The equation which links current, potential difference and power is:

power = current x potential difference

Calculate the power output of the battery in **Figure 3.**

Give your answer to one significant figure.

[2 marks]

Power = _____ W

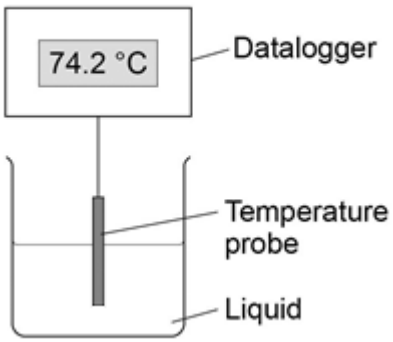
0 4 Two students investigated the change of state of stearic acid from liquid to solid.

They measured how the temperature of stearic acid changed over 5 minutes as it changed from liquid to solid.

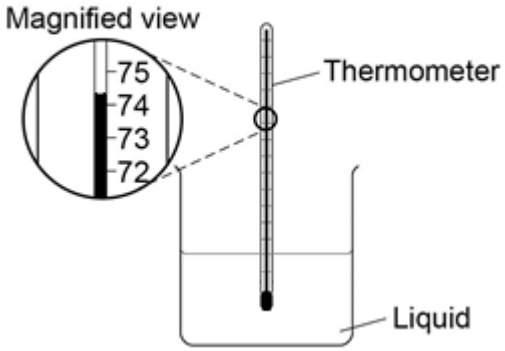
Figure 4 shows the different apparatus the two students used.

Figure 4

Student A's apparatus



Student B's apparatus



0 4 . 1 Choose **two** advantages of using student **A**'s apparatus.

[2 marks]

Tick **two** boxes.

Student **A**'s apparatus made sure the test was fair. ☐

Student **B**'s apparatus only measured categoric variables. ☐

Student **A**'s measurements had a higher resolution. ☐

Student **B** was more likely to misread the temperature. ☐

0 4 . 2 Student **B** removed the thermometer from the liquid each time he took a temperature reading.

What type of error would this cause?

[1 mark]

Tick **one** box.

A systematic error ☐

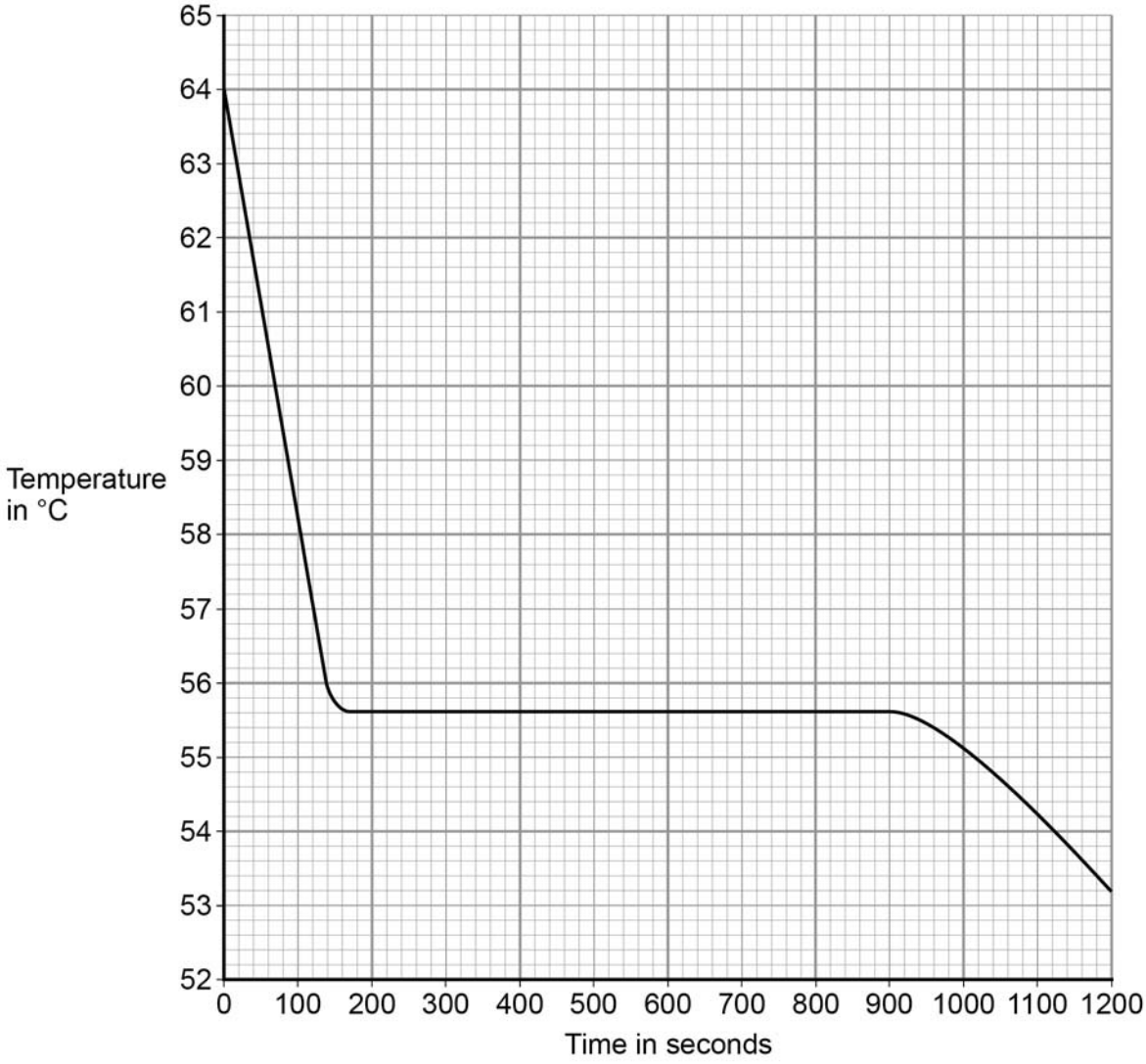
A random error ☐

A zero error ☐

Question 4 continues on the next page

Student **A**'s results are shown in **Figure 5**.

Figure 5



0 4 . 3 What was the decrease in temperature between 0 and 160 seconds?

[1 mark]

Tick **one** box.

8.2 °C ☐

8.4 °C ☐

53.2 °C ☐

55.6 °C ☐

0 4 . 4 Use **Figure 5** to determine the time taken for the stearic acid to change from a liquid to a solid.

[1 mark]

Time = _____ seconds

0 4 . 5 Calculate the energy transferred to the surroundings as 0.40 kg of stearic acid changed state from liquid to solid.

The specific latent heat of fusion of stearic acid is 199 000 J/kg.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Energy = _____ J

0 4 . 6 After 1200 seconds the temperature of the stearic acid continued to decrease.

Explain why.

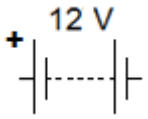
[2 marks]

Turn over for the next question

0 5 A student wants to investigate how the current through a filament lamp affects its resistance.

0 5 . 1 Use the circuit symbols in the boxes to draw a circuit diagram that she could use.

[2 marks]

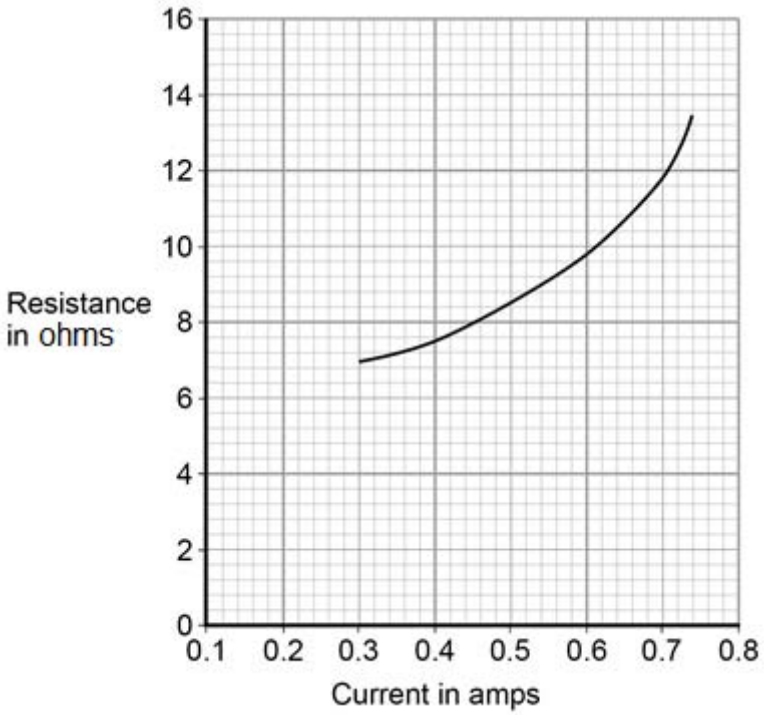
12 V battery	variable resistor	filament lamp	voltmeter	ammeter
				

0 5 . 2 Describe how the student could use her circuit to investigate how the current through a filament lamp affects its resistance.

[4 marks]

The student's results are shown in **Figure 6**.

Figure 6



0 5 . 3 Describe how the resistance of the filament lamp changes as the current through it increases.

[1 mark]

0 5 . 4 Use **Figure 6** to estimate the resistance of the filament lamp when a current of 0.10 A passes through the lamp.

[1 mark]

Resistance = _____ Ω

The current–potential difference graphs of three components are shown in **Figure 7**.

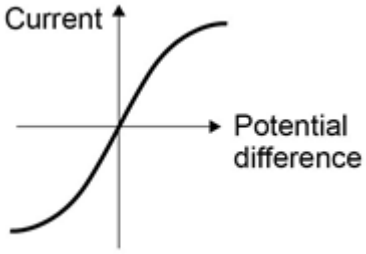
0 5 . 5 Use answers from the box to identify each component.

[3 marks]

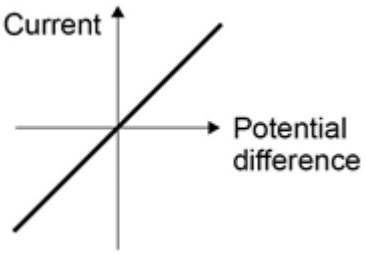
diode	**filament lamp**	**light dependent resistor**
resistor at constant temperature		**thermistor**

Figure 7

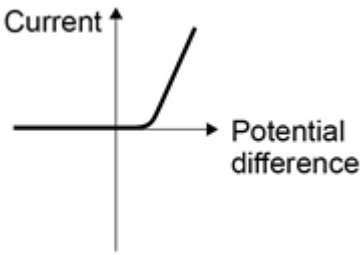
Graph A



Graph B



Graph C

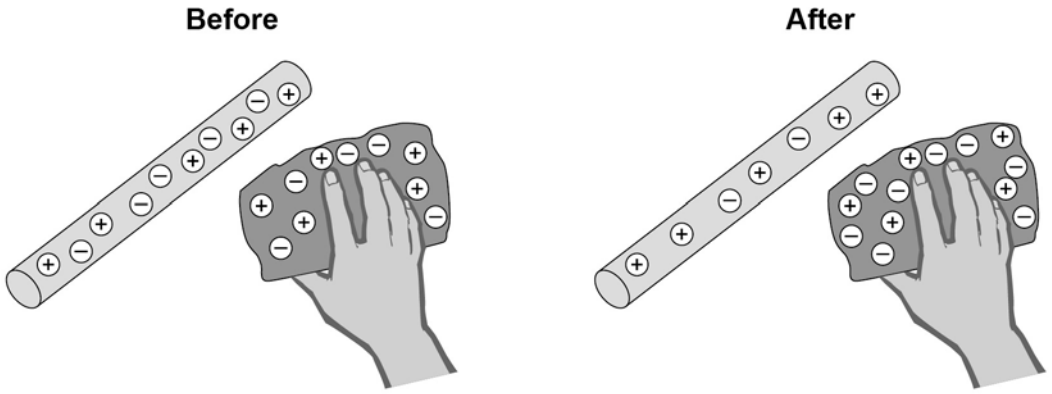


Turn over for the next question

0 6 A student rubs an acetate rod with a cloth.

Figure 8 shows the charges on the acetate rod and cloth before and after rubbing.

Figure 8



0 6 . 1 Explain how rubbing an acetate rod with a cloth causes the rod and cloth to become charged.

[4 marks]

0 6 . 2 After charging them, the student moves the acetate rod and the cloth closer together.

Which statement is correct?

Tick **one** box.

There is no force between the acetate rod and the cloth. ☐

There is a force of attraction between the acetate rod and the cloth. ☐

There is a force of repulsion between the acetate rod and the cloth. ☐

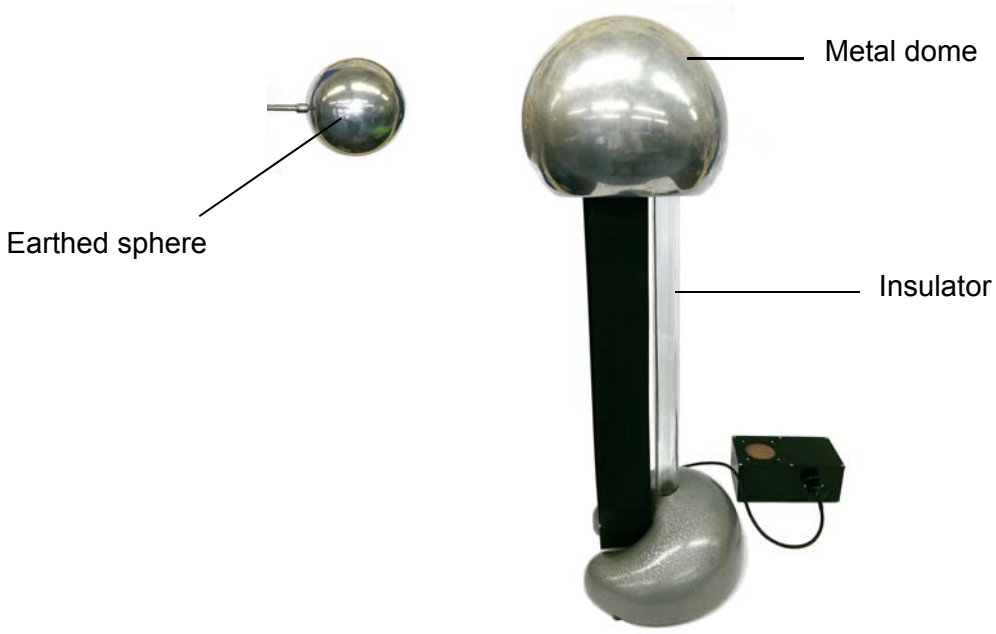
Give a reason for your answer.

[2 marks]

Question 6 continues on the next page

Figure 9 shows a Van de Graaff generator, which is used to generate static electricity.

Figure 9



0 6 . 3 The longer the Van de Graaff generator is switched on, the more charge is stored on the metal dome.

Use an answer from the box to complete the sentence.

[1 mark]

decrease	**increase**	**stay the same**

The amount of charge on the metal dome is increased, which causes the potential difference between the metal dome and the earthed sphere to _____ .

0 6 . 4 When the potential difference between the Van de Graaff generator and the earthed sphere is 60 kV, a spark jumps between the metal dome and the earthed sphere.

The spark transfers 0.000025 coulombs of charge to the earthed sphere.

The equation which links charge, energy and potential difference is:

$$\text{energy transferred} = \text{charge} \times \text{potential difference}$$

Calculate the energy transferred by the spark.

[2 marks]

Energy transferred = _____ J

Turn over for the next question

0 7 Alpha, beta and gamma are types of nuclear radiation.

0 7 . 1 Draw **one** line from each type of radiation to what the radiation consists of.

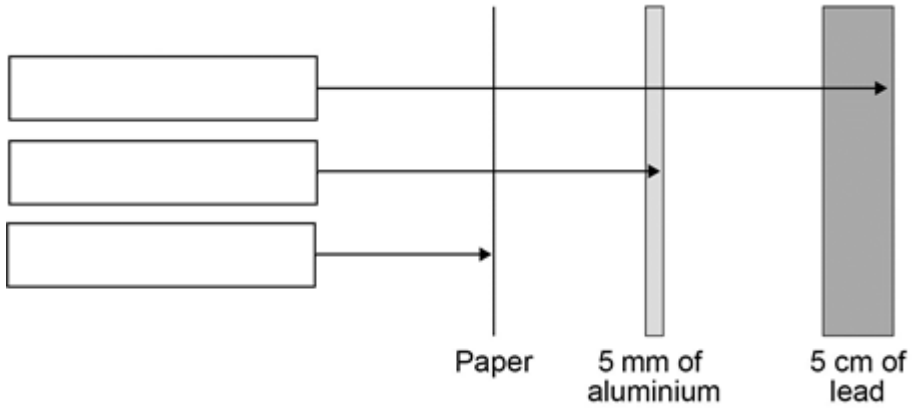
[3 marks]

Type of radiation	What radiation consists of
	Electron from the nucleus
Alpha	
	Two protons and two neutrons
Beta	
	Electromagnetic radiation
Gamma	
	Neutron from the nucleus

A teacher demonstrates the penetration of alpha, beta and gamma radiation through different materials.

The demonstration is shown in **Figure 10**.

Figure 10



0 7 . 2 Complete **Figure 10** by writing the name of the correct radiation in each box.

[2 marks]

0 7 . 3 Give **two** safety precautions the teacher should have taken in the demonstration.

[2 marks]

1

2

Table 1 shows how the count rate from a radioactive source changes with time.

Table 1

Time in seconds	0	40	80	120	160
Count rate in counts / second	400	283	200	141	100

0 7 . 4 Use **Table 1** to calculate the count rate after 200 seconds.

[2 marks]

0 7 . 5 The half-life of the radioactive source used was very short.

Give **one** reason why this radioactive source would be much less hazardous after 800 seconds.

[1 mark]

0 8 An electrician is replacing an old electric shower with a new one.

The inside of the old shower is shown in **Figure 11**.

Figure 11

0 8 . 1 The electrician should **not** change the shower unless he switches off the mains electricity supply.

Explain why.

[2 marks]

0 8 . 2 The new shower has a power output of 10 690 W when it is connected to the 230 V mains electricity supply.

The equation which links current, potential difference and power is:

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

Calculate the current passing through the new shower.

Give your answer to two significant figures.

[4 marks]

Current = _____ A

0 8 . 3 The new shower has a higher power rating than the old shower.

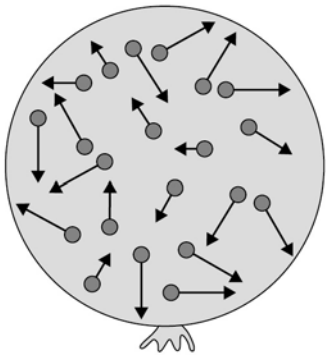
How does the power of the new shower affect the cost of using the shower?

Give a reason for your answer.

[2 marks]

0 9 **Figure 12** shows a balloon filled with helium gas.

Figure 12



0 9 . 1 Describe the movement of the particles of helium gas inside the balloon.

[2 marks]

0 9 . 2 What name is given to the total kinetic energy and potential energy of all the particles of helium gas in the balloon?

[1 mark]

Tick **one** box.

External energy ☐

Internal energy ☐

Movement energy ☐

0 9 . 3 Write down the equation which links density, mass and volume.

[1 mark]

0 9 . 4 The helium in the balloon has a mass of 0.00254 kg.

The balloon has a volume of 0.0141 m^3.

Calculate the density of helium. Choose the correct unit from the box.

[3 marks]

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

Density = _____ Unit _____

Turn over for the next question

There are no questions printed on this page

1 0 Scientists sometimes replace one scientific model with a different model.

For example, in the early 20th Century the plum pudding model of the atom was replaced by the nuclear model of the atom.

Explain what led to the plum pudding model of the atom being replaced by the nuclear model of the atom.

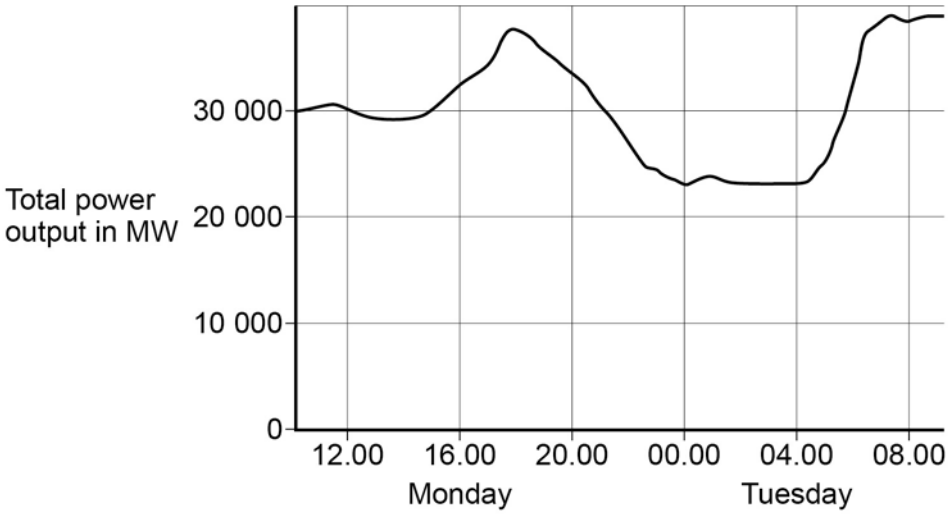
[6 marks]

Turn over for the next question

1 1 The National Grid ensures that the supply of electricity always meets the demand of the consumers.

Figure 13 shows how the output from fossil fuel power stations in the UK varied over a 24-hour period.

Figure 13



1 1 . 1 Suggest **one** reason for the shape of the graph between 15.00 and 18.00 on Monday.

[1 mark]

1 1 . 2 Gas fired power stations reduce their output when demand for electricity is low.

Suggest **one** time on **Figure 13** when the demand for electricity was low.

[1 mark]

1 1 . 3 The National Grid ensures that fossil fuel power stations in the UK only produce about 33% of the total electricity they could produce when operating at a maximum output.

Suggest **two** reasons why.

[2 marks]

1

2

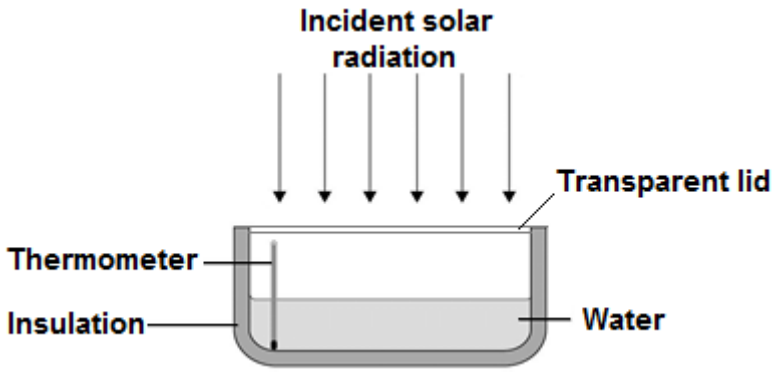
Turn over for the next question

1 2 A student investigated how much energy from the Sun was incident on the Earth's surface at her location.

She put an insulated pan of water in direct sunlight and measured the time it took for the temperature of the water to increase by 0.6 °C.

The apparatus she used is shown in **Figure 14**.

Figure 14



1 2 . 1 Choose the most appropriate resolution for the thermometer used by the student.

[1 mark]

Tick **one** box.

0.1 ºC ☐

0.5 ºC ☐

1.0 ºC ☐

The energy transferred to the water was 1050 J.

The time taken for the water temperature to increase by 0.6 °C was 5 minutes.

The specific heat capacity of water is 4200 J/kg °C.

1 2 . 2 Write down the equation which links energy transferred, power and time.

[1 mark]

1 2 . 3 Calculate the mean power supplied by the Sun to the water in the pan.

[2 marks]

Average power = _____ W

1 2 . 4 Calculate the mass of water the student used in her investigation.

Use the correct equation from the Physics Equation Sheet.

[3 marks]

Mass = _____ kg

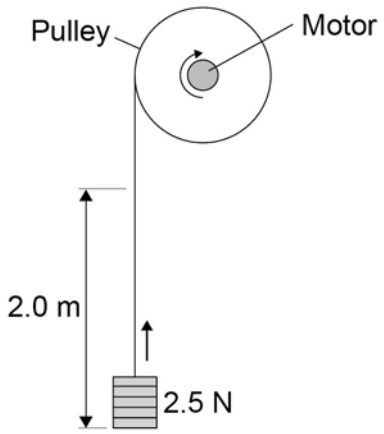
1 2 . 5 The student's results can only be used as an estimate of the mean power at her location.

Give **one** reason why.

[1 mark]

1 3 A student investigated the efficiency of a motor using the equipment in **Figure 15**.

Figure 15



He used the motor to lift a weight of 2.5 N a height of 2.0 m.

He measured the speed at which the weight was lifted and calculated the efficiency of the energy transfer.

He repeated the experiment to gain two sets of data.

1 3 . 1 Give **one** variable that the student controlled in his investigation.

[1 mark]

1 3 . 2 Give **two** reasons for taking repeat readings in an investigation.

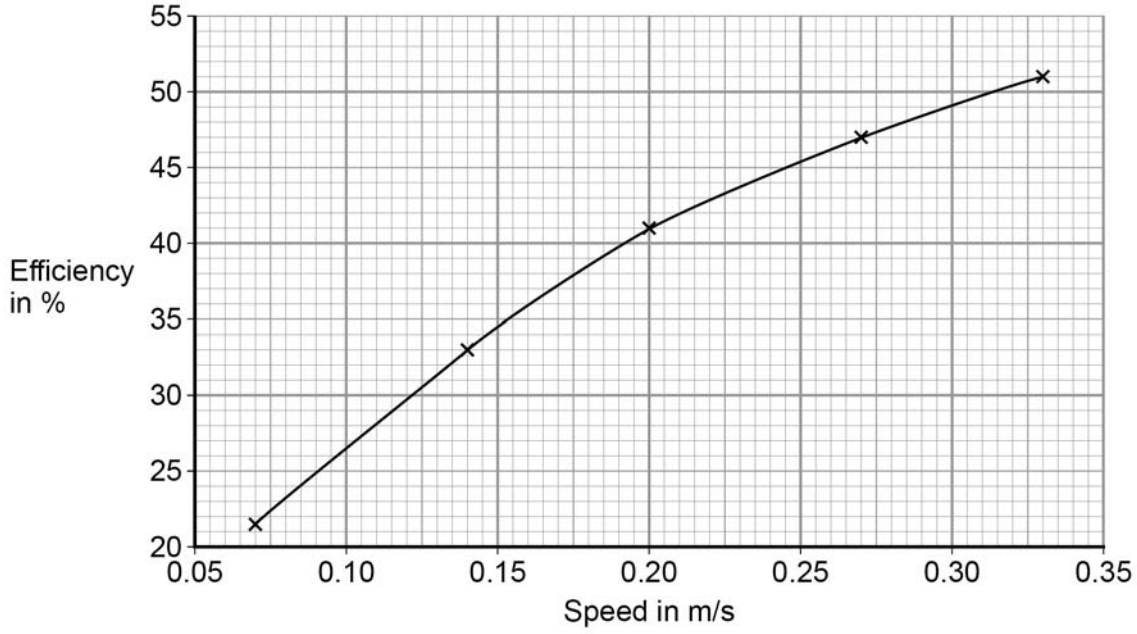
[2 marks]

1

2

Figure 16 shows a graph of the student's results.

Figure 16



1 3 . 3 Give **two** conclusions that could be made from the data in **Figure 16**.

[2 marks]

1 3 . 4 Give the main way that the motor is likely to waste energy.

[1 mark]

1 3 . 5 When the total power input to the motor was 5 W the motor could not lift the 2.5 N weight.

State the efficiency of the motor.

[1 mark]

Efficiency = _____ %

END OF QUESTIONS

There are no questions printed on this page