DRAFT 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.

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]

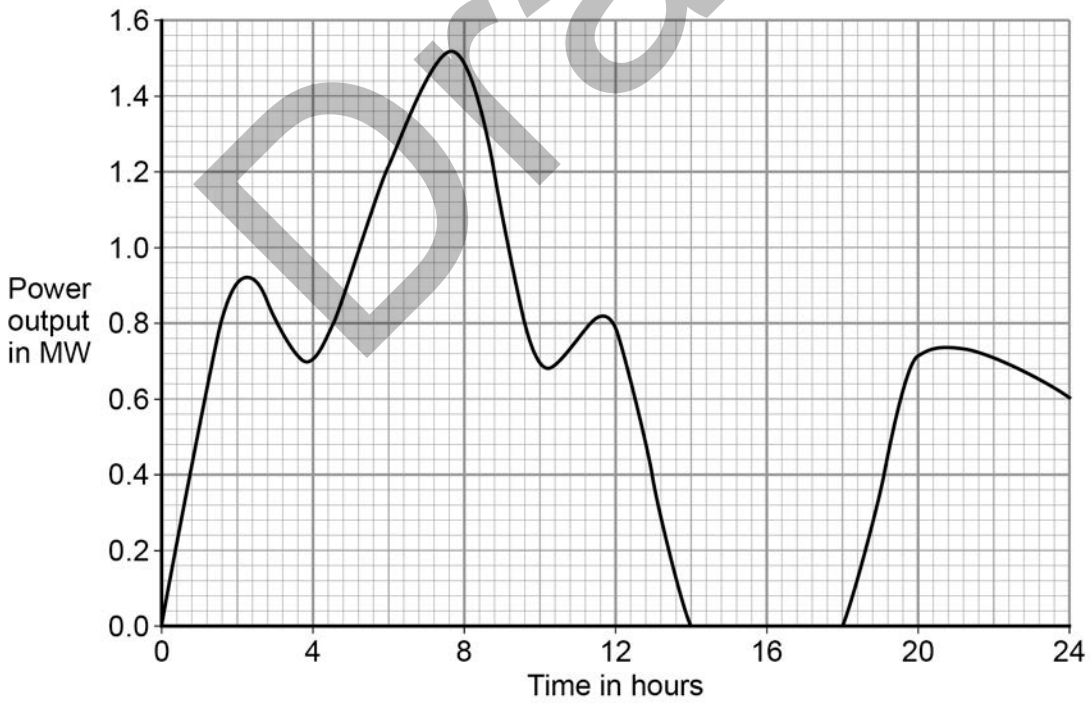
1 _____

2 _____

Wind turbines are used to generate electricity.

Figure 1 shows how the power output of a wind turbine changes over 1 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 A wind turbine has a maximum power output of two mega-watts (MW)

How many watts are there in two mega-watts?

Tick **one** box.

[1 mark]

- two hundred ☐
- two million ☐
- two thousand ☐

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]

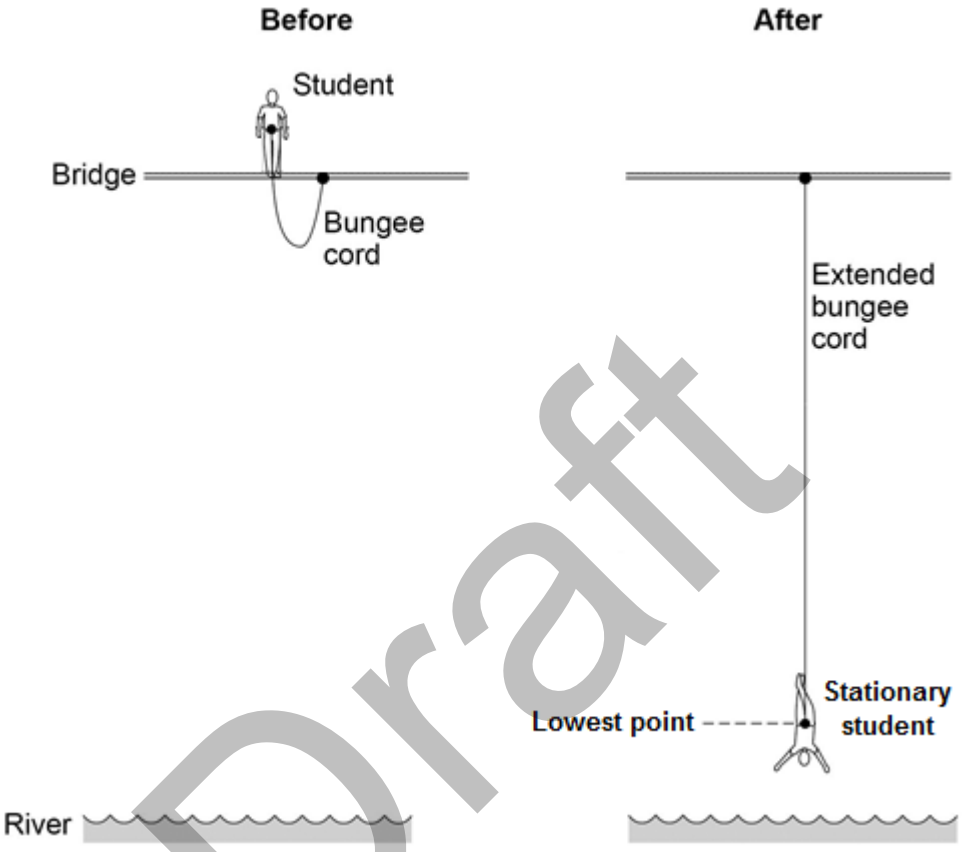
Tick **one** box.

- 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 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 _____ 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 Equation Sheet.

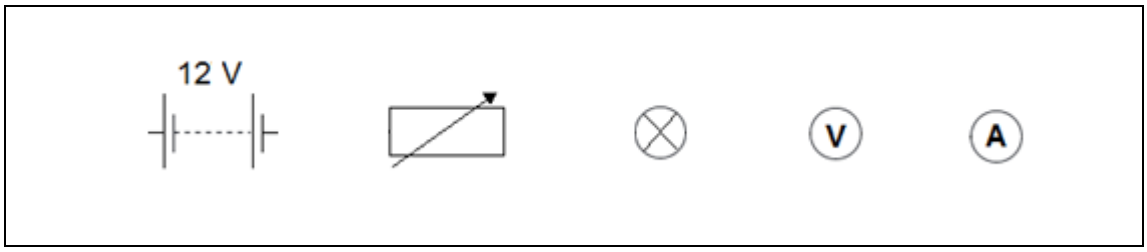
[2 marks]

Energy = _____ J

0 3 A student wants to investigate how the current through a filament lamp affects its resistance.

0 3 . 1 Use the circuit symbols in the box to draw a circuit diagram that she could use.

[2 marks]

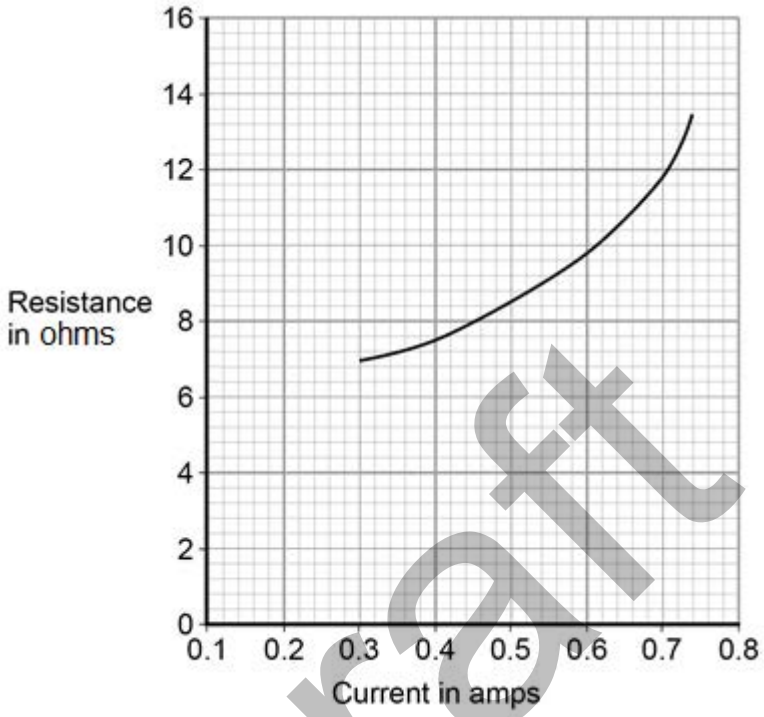


0 3 . 2 Describe how the student could use her circuit to investigate how the current through a filament lamp affects its resistance.

[4 marks]

The student's results are shown in **Figure 3**.

Figure 3



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

[1 mark]

0 3 . 4 Use **Figure 3** 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 4**.

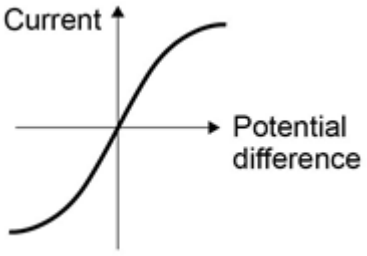
0 3 . 5 Use answers from the box to identify each component.

[3 marks]

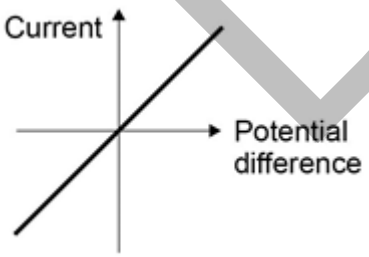
diode	**filament lamp**	**light dependent resistor**
resistor at constant temperature		**thermistor**

Figure 4

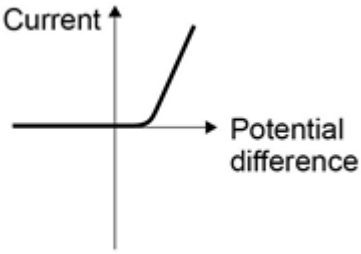
Graph A



Graph B



Graph C



0 3 . 6 Which graph in **Figure 4** shows that current is directly proportional to potential difference?

Give a reason for your answer.

[2 marks]

Graph

Reason

Turn over for the next question

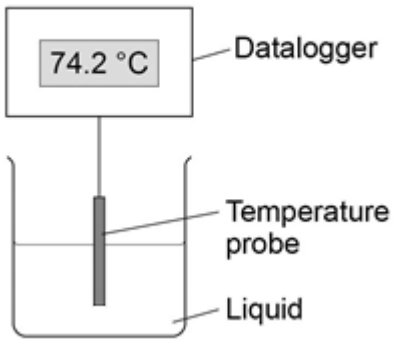
0 4 Two students investigated the change of state of stearic acid from liquid to solid.

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

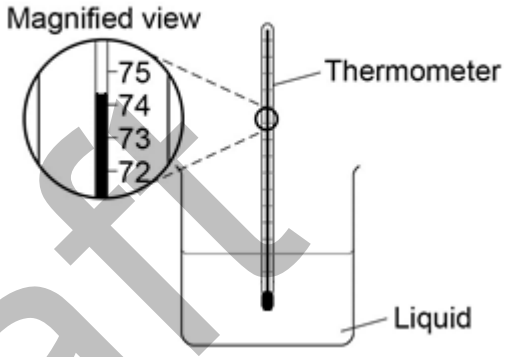
Figure 5 shows the different apparatus the two students used.

Figure 5

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 ☐

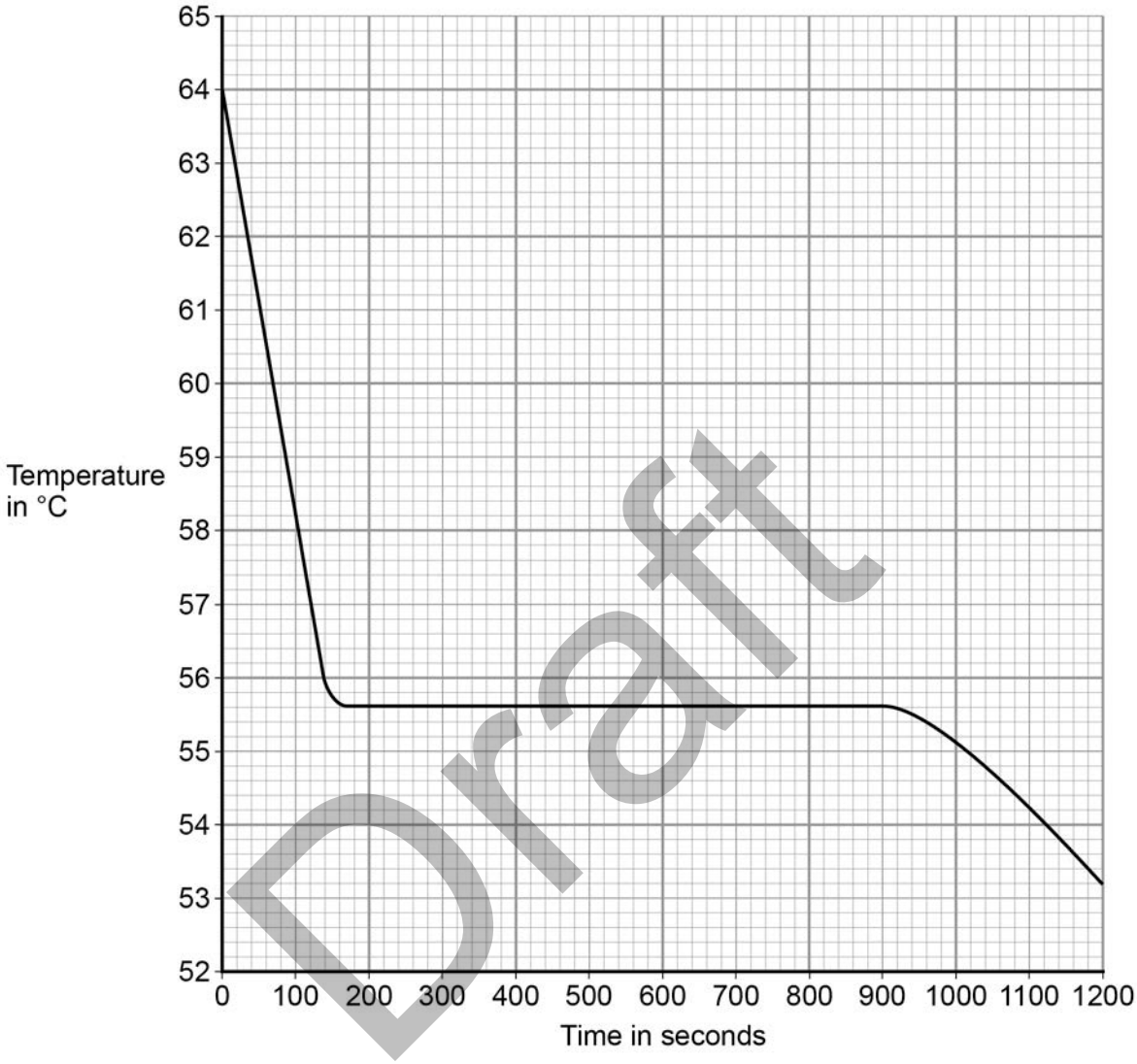
A random error ☐

A zero error ☐

Question 4 continues on the next page

Student A's results are shown in **Figure 6**.

Figure 6



0 4 . 3 At what temperature did the stearic acid start to freeze?

[1 mark]

Tick **one** box.

64.0 °C ☐

58.0 °C ☐

55.6 °C ☐

53.2 °C ☐

0 4 . 4 Use **Figure 6** to determine the time taken for the stearic acid to change from a liquid to a solid.

[1 mark]

Time = _____ seconds

0 4 . 5 After 1200 seconds the temperature of the stearic acid continued to decrease.

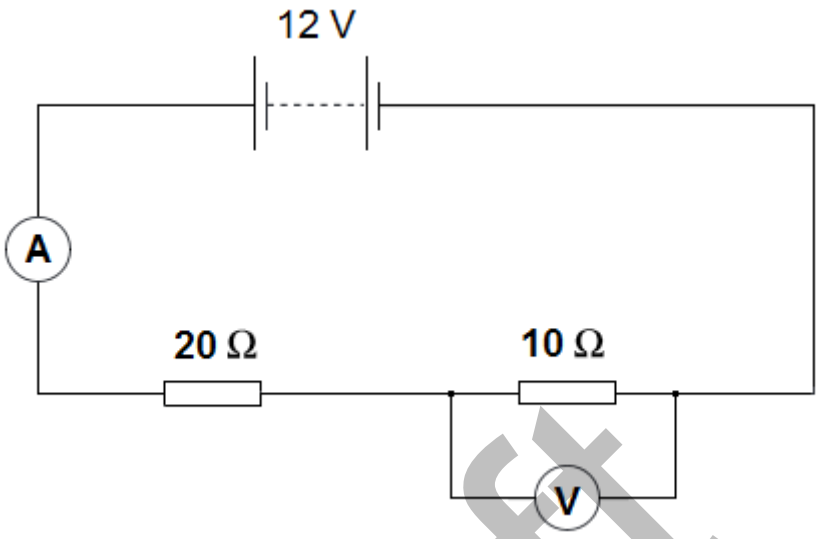
Explain why.

[2 marks]

Turn over for the next question

0 5 An electrical circuit is shown in **Figure 7**.

Figure 7



0 5 . 1 Calculate the total resistance of the circuit.

[1 mark]

Resistance = _____ Ω

0 5 . 2 The potential difference across the 10 Ω resistor is 4 V.

Calculate the potential difference across the 20 Ω resistor.

[1 mark]

Potential difference = _____ V

0 5 . 3 Write down the equation which links current, potential difference and resistance.

Calculate the current in the circuit in **Figure 7**.

[3 marks]

Current = _____ A

0 5 . 4 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. ☐

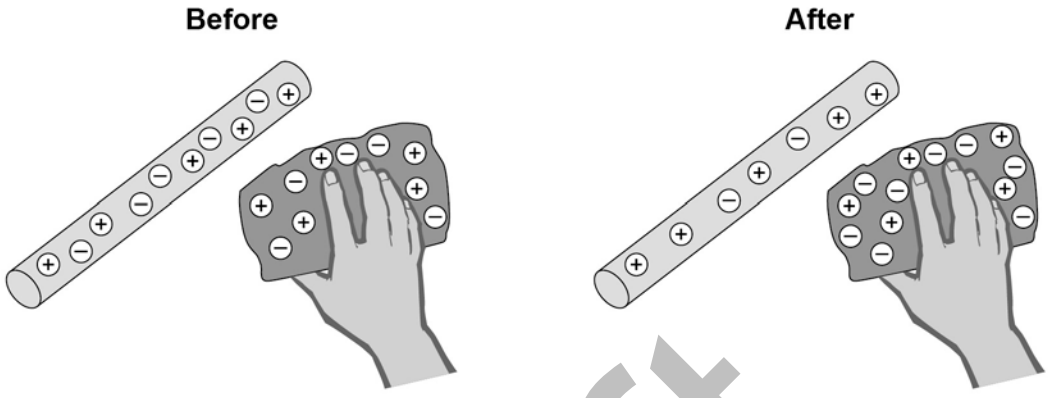
Current that is always in the same direction. ☐

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 the friction between the acetate rod and the cloth causes the rod and cloth to become charged.

[3 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. ☐

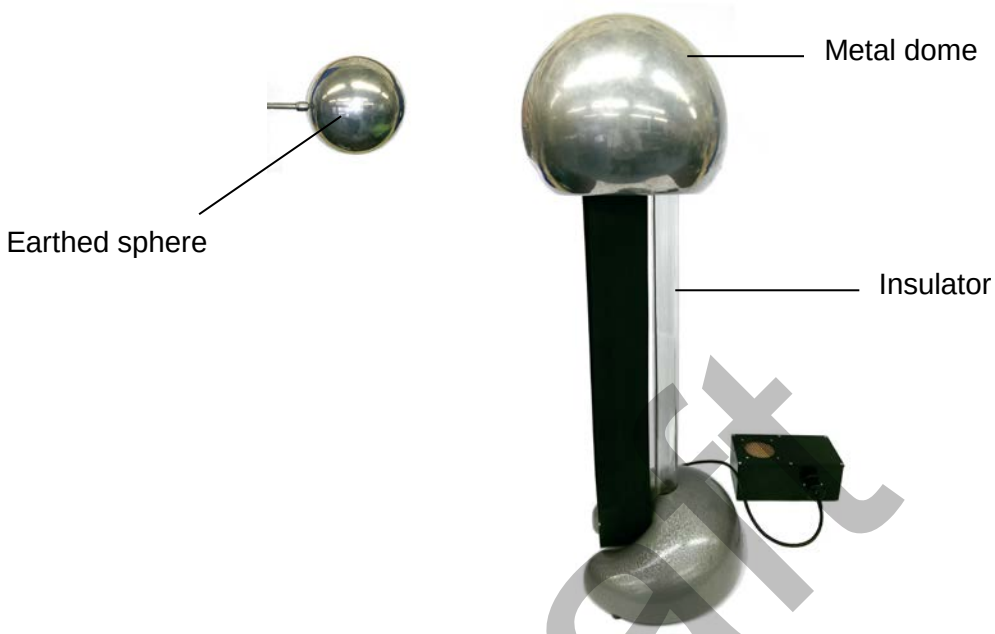
Give a reason for your answer.

[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.

Complete the sentence.

Use an answer from the box.

[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 60 000 volts, 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.

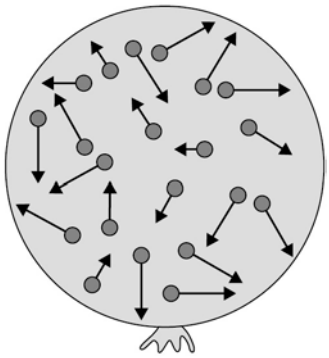
[2 marks]

Energy transferred = _____ J

Turn over for the next question

0 7 **Figure 10** shows a balloon filled with helium gas.

Figure 10



0 7 . 1 Which **two** statements describe the movement of the particles of helium gas inside the balloon?

[2 marks]

Tick **two** boxes.

- Uniform motion ☐
- Random motion ☐
- Vibrating ☐
- Constant speed ☐
- Range of speeds ☐
- Low speed ☐

0 7 . 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 7 . 3 The helium in the balloon has a mass of 0.00254 kg.

The balloon has a volume of 0.0141 m^3.

The equation which links density, mass and volume is:

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

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 =

0 7 . 4 The helium balloon is released and rises into the sky.

As the balloon rises, the air pressure around the balloon decreases.

Describe how the volume of the balloon and the pressure outside the balloon change as the balloon rises.

[2 marks]

Volume

Pressure

0 8 Alpha, beta and gamma are types of nuclear radiation.

0 8 . 1 Draw **one** line from each type of radiation to what the radiation consists of.

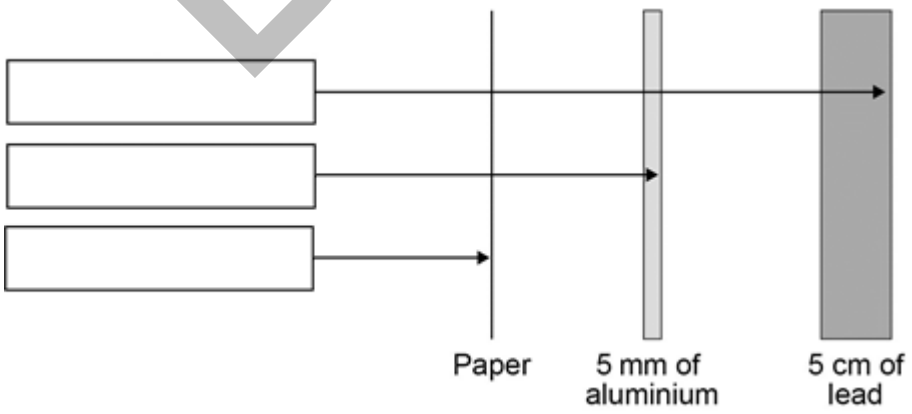
[3 marks]

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

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

The demonstration is shown in **Figure 11**.

Figure 11



0 8 . 2 Complete **Figure 11** by writing the name of the correct radiation in each box.

[2 marks]

0 8 . 3 Give **two** safety precautions the teacher should have taken in the demonstration.

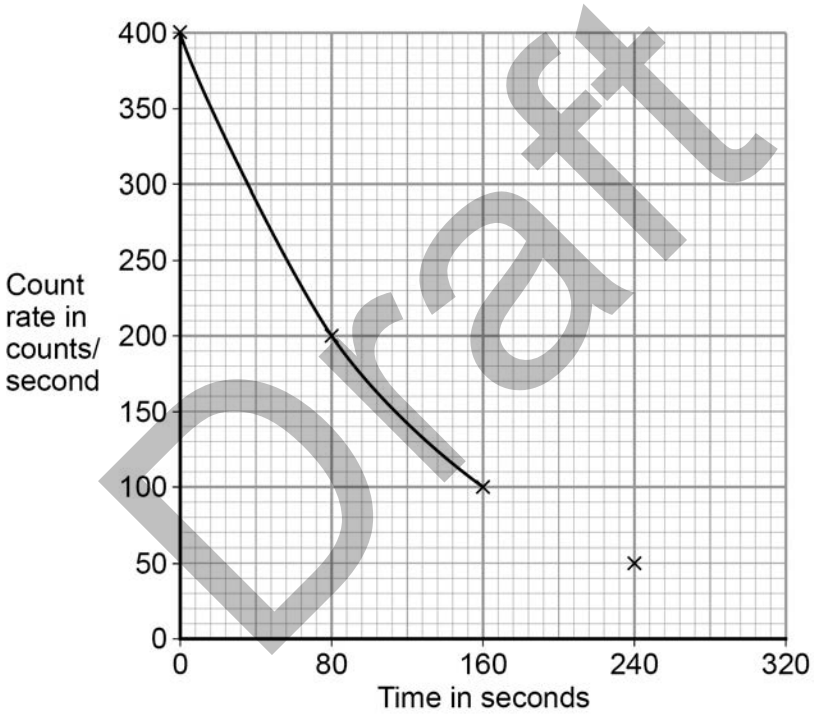
[2 marks]

1

2

Figure 12 shows how the count rate from a radioactive source changes with time.

Figure 12



0 8 . 4 Complete **Figure 12** to show how the count rate would change between 160 and 320 seconds.

[2 marks]

0 8 . 5 The half-life of the radioactive source used was 80 seconds.

State how **Figure 12** can be used to show the half-life.

[1 mark]

0 9 An electrician is replacing an old electric shower with a new one.

The inside of the old shower is shown in **Figure 13**.

Figure 13

0 9 . 1 The electrician should **not** change the shower unless he switches off the mains electricity supply.

Explain why.

[3 marks]

0 9 . 2 The new shower has a potential difference of 230 V and a current of 46 A.

Write down the equation which links current, potential difference and power.

Calculate the power of the new shower.

[3 marks]

Power = _____ W

0 9 . 3 The electrician installs a 45 A circuit breaker in the shower circuit.

Explain what will happen to the circuit breaker when the shower is switched on.

[2 marks]

0 9 . 4 A fuse could have been used instead of a circuit breaker.

Choose **one** advantage of using a circuit breaker instead of a fuse.

Tick **one** box.

[1 mark]

- A fuse can be replaced. ☐
- A circuit breaker can be reset. ☐
- A fuse melts slowly. ☐

1 0 **Figure 14** shows an old house with a tiled roof and single-glazed windows.

The house has solid stone walls and is heated using a coal fire.

Figure 14

Describe how the householder could improve the energy efficiency of the house.

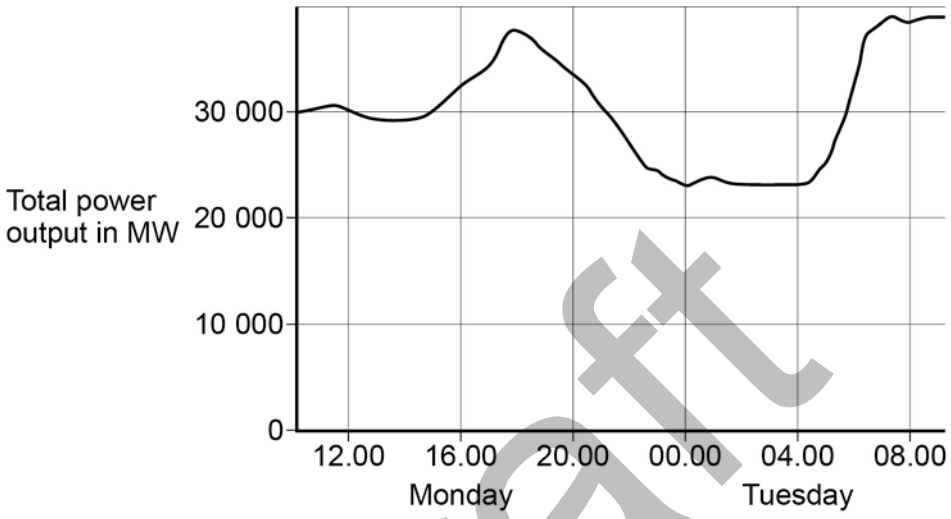
Explain how your chosen methods reduce the rate of energy transfer to the surroundings.

[6 marks]

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

Figure 15 shows how the output from fossil fuel power stations in the UK varied over a 24-hour period.

Figure 15



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 At 18.00 on Monday, one power station stopped producing electricity.

How does **Figure 15** show this?

[1 mark]

Question 11 continues on the next page

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

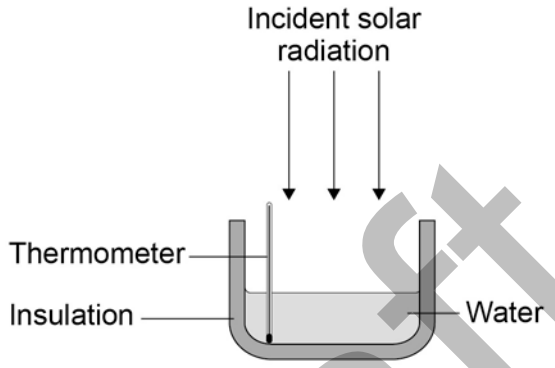
2

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 10 °C.

The apparatus she used is shown in **Figure 16**.

Figure 16



1 2 . 1 The student could have measured the time taken for the water to increase in temperature by 1 °C.

Suggest **one** reason why the student's method was better.

[1 mark]

Question 12 continues on the next page

The energy transferred to the water was 21 000 J.

The time taken for the water temperature to increase by 10 °C was 6000 seconds.

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.

Calculate the average power supplied by the Sun to the water in the pan.

[3 marks]

Average power = _____ W

1 2 . 3 Calculate the mass of water the student used in her investigation.

Use the correct equation from the Physics Equation Sheet.

[2 marks]

Mass = _____ kg

1 2 . 4 The student's results can only be used as an estimate of the average power at her location.

Give **two** reasons why.

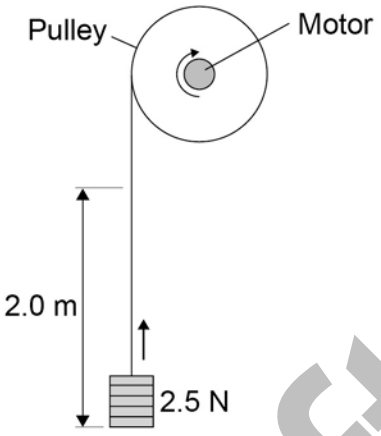
[2 marks]

1

2

1 3 A student investigated the efficiency of a motor using the equipment in **Figure 17**.

Figure 17



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.

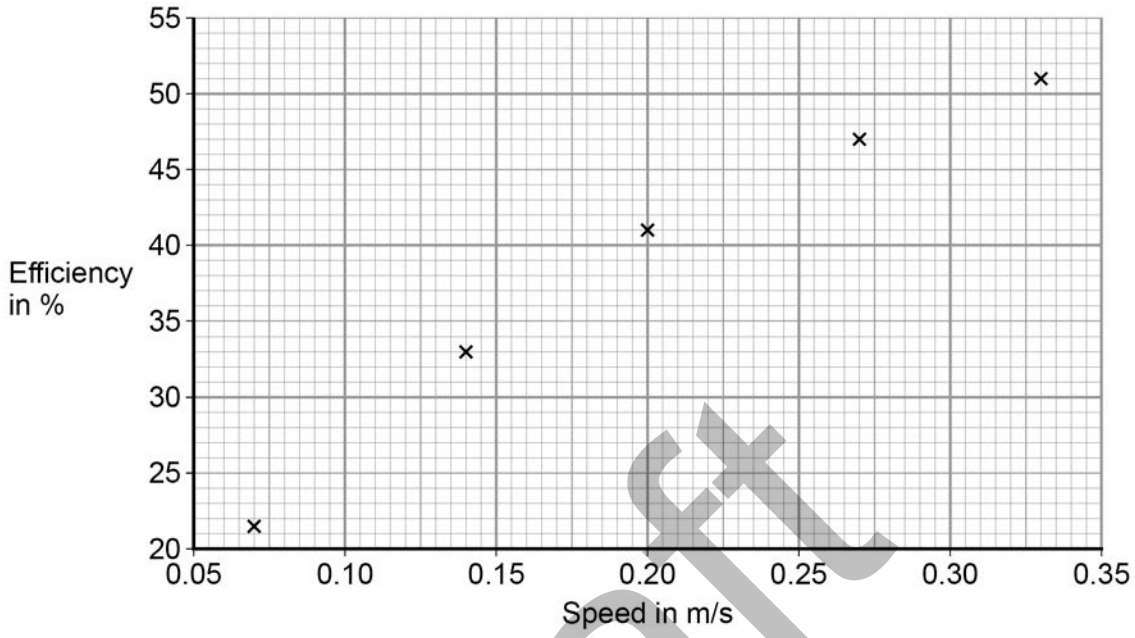
[2 marks]

1

2

Figure 18 shows a graph of the student's results.

Figure 18



1 3 . 3 Draw a line of best fit on the graph.

[1 mark]

1 3 . 4 What conclusions can be made from the data in **Figure 18**?

Explain your answer.

[3 marks]

1 3 . 5 Give **one** way that the motor is likely to waste energy.

[1 mark]

1 3 . 6 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