AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.1.1.4

Power

Past-paper questions

Tier	**Foundation**
Question groups	**23**
Available paper years	**2018–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

6.1.1.4 Power

Question 01

June 2018 | 8464/P/1F | Original Q1

0 1 There are many different energy resources.

0 1 . 1 Which **two** energy resources are renewable?

[2 marks]

Tick **two** boxes.

- Biofuel ☐
- Coal ☐
- Gas ☐
- Geothermal ☐
- Nuclear fuel ☐

0 1 . 2 Some non-renewable energy resources are more reliable than others.

Which statement correctly describes a reliable resource?

[1 mark]

Tick **one** box.

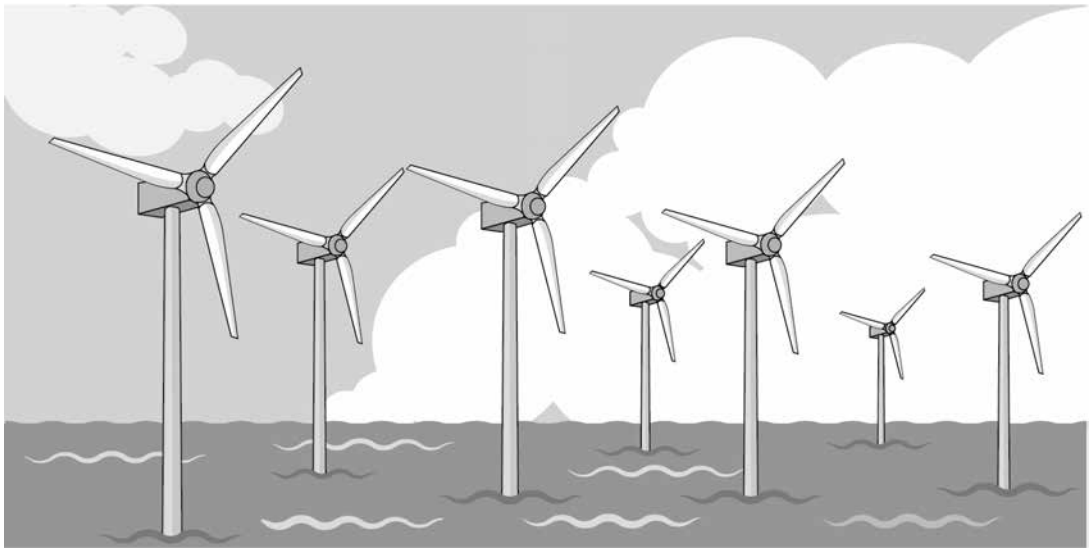
- It does not burn fuel. ☐
- It is predictable. ☐
- It will never run out. ☐
- It is cheap to use. ☐

6.1.1.4 Power

Question 01 · continued

0 1 . 3 **Figure 1** shows a wind farm.

Figure 1



The total power output of the wind farm is 19.6 MW

All of the wind turbines have the same power output.

What is the power output of **one** wind turbine?

[1 mark]

Tick **one** box.

2.7 MW ☐

2.8 MW ☐

2.9 MW ☐

3.2 MW ☐

3.3 MW ☐

0 1 . 4 Give **two** reasons why people might **not** like having wind turbines near their homes.

[2 marks]

1 _____

2 _____

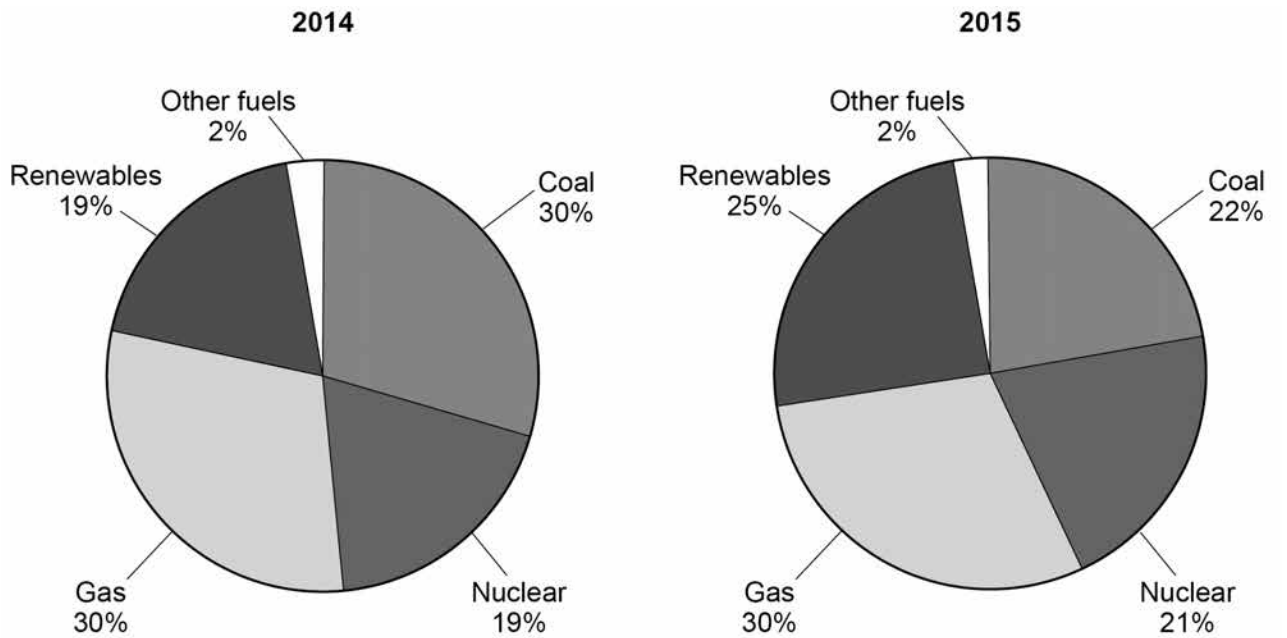
6.1.1.4 Power

Question 01 · continued

0 1 . 5 **Figure 2** shows the electricity generated by different energy resources in the UK.

The total amount of electricity generated was the same in 2014 and in 2015

Figure 2



There are changes in the amounts of different energy resources used between 2014 and 2015

Explain the environmental impacts of the changes.

[4 marks]

10

6.1.1.4 Power

Question 02

June 2018 | 8464/P/1F | Original Q2

0 2 **Figure 3** shows a mobile phone being recharged by a portable power source.

Figure 3



0 2 . 1 Why does the battery in the phone need recharging?

[1 mark]

Tick **one** box.

- The store of chemical energy in the battery has reduced. ☐
- The store of thermal energy in the battery has reduced. ☐
- The store of kinetic energy in the battery has reduced. ☐
- The store of gravitational energy in the battery has reduced. ☐

Question 2 continues on the next page

6.1.1.4 Power

Question 02 · continued

0 2 . 2 The power source provides a current of 1.86 A at a potential difference of 3.90 V

Calculate the power of the power source.

Use the equation:

power = potential difference × current

Choose the correct unit from the box.

[3 marks]

C	J	W

Power = _____

Unit _____

6.1.1.4 Power

Question 02 · continued

0 2 . 3 A student needs a new power source.

Figure 4 shows three different sized power sources.

Figure 4

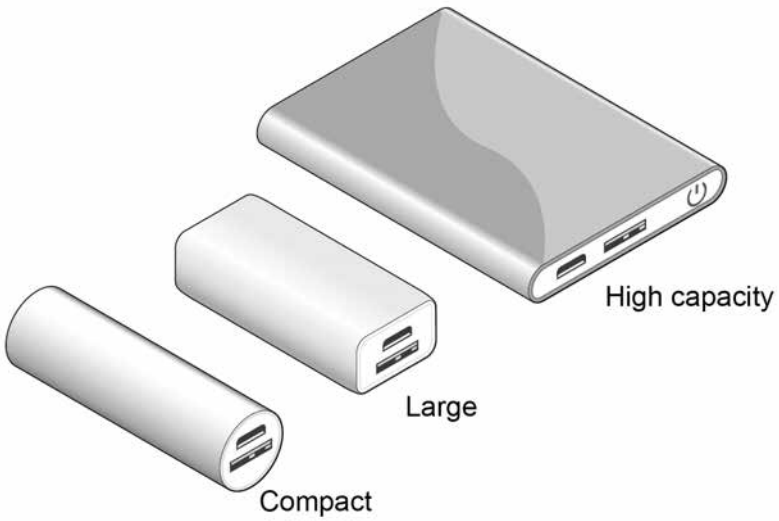


Table 1 gives data about the different power sources.

Table 1

Power source	Number of charges	Mass in grams
Compact	1	100
Large	5	200
High capacity	10	600

The student chose the large power source.

Suggest why the student chose the large power source.

[4 marks]

8

6.1.1.4 Power

Question 03

June 2018 | 8464/P/1F | Original Q5

0 5 Radioactive nuclei can emit alpha, beta or gamma radiation.

0 5 . 1 Which type of radiation is the most penetrating?

[1 mark]

Tick **one** box.

Alpha (α) ☐

Beta (β) ☐

Gamma (γ) ☐

0 5 . 2 Which type of radiation is the most ionising?

[1 mark]

Tick **one** box.

Alpha (α) ☐

Beta (β) ☐

Gamma (γ) ☐

0 5 . 3 Which type of radiation has the longest range in air?

[1 mark]

Tick **one** box.

Alpha (α) ☐

Beta (β) ☐

Gamma (γ) ☐

Question 5 continues on the next page

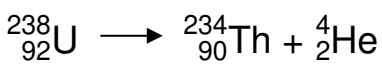
Question 03 · continued

When radioactive isotopes in the Earth's crust decay they release energy.

The decay causes the heating of rocks in the crust.

0 5 . 4 **Figure 8** shows the decay of uranium–238 (U–238) into thorium–234 (Th–234).

Figure 8



$$^{238}_{92}U \longrightarrow {}^{234}_{90}Th + {}^{4}_{2}He$$

Complete **Table 2** to show the number of neutrons and protons in the nuclei.

[2 marks]

Table 2

Isotope	Number of neutrons	Number of protons
uranium–238	146	
thorium–234		90

0 5 . 5 Geothermal power stations pump water through heated rocks.

The temperature of the water increases from 20 °C to its boiling point of 100 °C

Calculate the change in thermal energy when the mass of water heated is 150 kg

Specific heat capacity = 4 200 J/kg °C

Use the Physics Equations Sheet.

[3 marks]

Change in thermal energy = _____ J

8

6.1.1.4 Power

Question 04

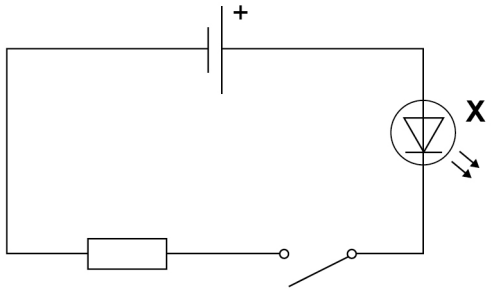
June 2019 | 8464/P/1F | Original Q1

0 1 A designer made some shoes that have lights in them.

Each shoe has a switch which closes when a person puts their foot on the floor.

Figure 1 shows the circuit.

Figure 1



0 1 . 1 What is component **X**?

[1 mark]

Tick (✓) **one** box.

Lamp ☐

LDR ☐

LED ☐

0 1 . 2 Complete the sentence.

Choose the answer from the box.

[1 mark]

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

When the switch was closed, the current in component **X** was

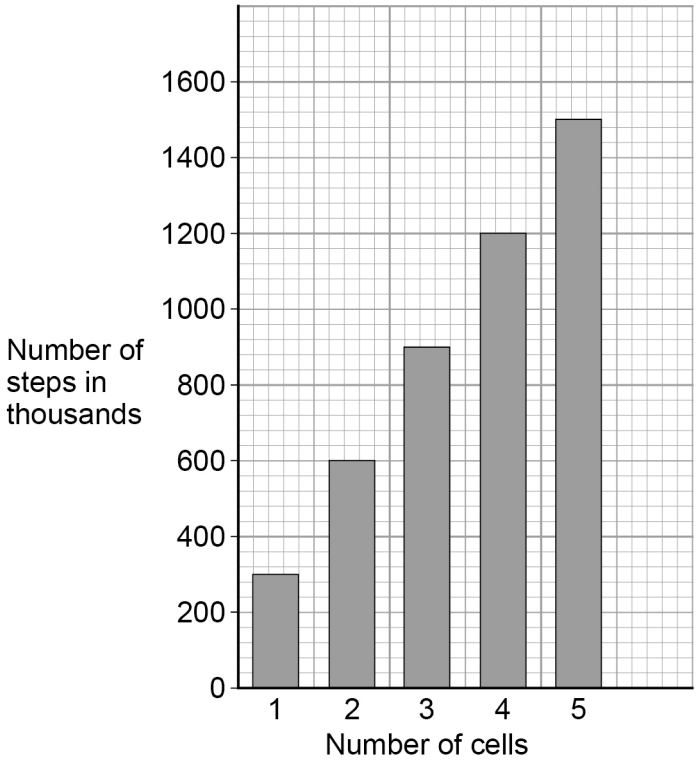
_____ the current in the resistor.

Question 04 · continued

The designer tested how the number of cells affected the number of steps that could be taken before the lights stopped working.

Figure 2 shows the results.

Figure 2



0 1 . 3 Determine how many more steps could be taken when the number of cells was increased from 3 to 5

[2 marks]

Number of steps = _____ thousand

Question 1 continues on the next page

Question 04 · continued

0 1 . 4 How could the designer check the repeatability of the results?

[1 mark]

Tick (✓) **one** box.

Repeat the experiment with a different resistor in the circuit. ☐

Repeat the experiment using exactly the same method. ☐

Repeat the experiment with different types of shoe. ☐

0 1 . 5 When the potential difference across the resistor was 0.80 V, the current in the resistor was 0.020 A

Calculate the power dissipated by the resistor.

Use the equation:

power = potential difference × current

[2 marks]

Power = _____ W

0 1 . 6 Which other equation can be used to calculate the power dissipated by a resistor?

[1 mark]

Tick (✓) **one** box.

Power = $(\text{current})^2 \times \text{resistance}$ ☐

Power = $\frac{\text{current}}{(\text{resistance})^2}$ ☐

Power = $\text{current} \times (\text{resistance})^2$ ☐

6.1.1.4 Power

Question 04 · continued

0 1 . 7 What happens to the temperature of the resistor when there is a current in it?

[1 mark]

0 1 . 8 There was a current of 0.020 A in the resistor for 180 seconds.

Calculate the charge flow through the resistor.

Use the equation:

charge flow = current × time

[2 marks]

Charge flow = _____ C

11

6.1.1.4 Power

Question 05

0 2 A student investigated how the area of a solar panel affected the output potential difference of the solar panel.

The student placed different sized solar panels under a lamp.

Figure 3 shows a solar panel under a lamp.

Figure 3



0 2 . 1 Which variable should be controlled?

[1 mark]

Tick (✓) **one** box.

The area of the solar panels ☐

The brightness of the lamp ☐

The output potential difference of the solar panels ☐

6.1.1.4 Power

Question 05 · continued

0 2 . 2 The student measured the output potential difference using a voltmeter.

When the voltmeter was **not** connected, the reading on the voltmeter was 0.7 V

What name is given to this type of error?

[1 mark]

Tick (✓) **one** box.

Zero error ☐

Random error ☐

Measurement error ☐

Question 2 continues on the next page

Table 1 shows the results of the investigation.

Table 1

Solar panel	Area of solar panel in cm^2	Output potential difference in volts			
		Test 1	Test 2	Test 3	Mean
A	10	2.5	2.4	2.6	2.5
B	20	5.0	5.0	4.9	5.0
C	30	7.5	11.9	7.5	7.5
D	50	12.4	12.6	12.5	12.5

0 2 . 3 The readings for which solar panel show an anomalous result?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 2 . 4 The student did **not** have a solar panel with an area of 40 cm^2

Determine the most likely value for the mean output potential difference of a 40 cm^2 solar cell.

[1 mark]

Mean output potential difference = _____ V

6.1.1.4 Power

Question 05 · continued

0 2 . 5 The total input energy transfer to one of the solar panels was 8.0 joules.

The useful output energy transfer was 0.96 joules.

Calculate the efficiency of the solar panel.

Use the equation:

$$\text{efficiency} = \frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$$

[2 marks]

Efficiency = _____

0 2 . 6 Solar power is a renewable energy resource.

Complete the sentence.

Choose the answer from the box.

[1 mark]

burned	**replenished**	**consumed**

A renewable energy resource is one that is _____ as it is used.

Question 2 continues on the next page

Question 05 · continued

0 2 . 7 Some homes have solar panels which generate electricity.

On a sunny day the potential difference across a solar panel is 31 volts.

A charge of 490 coulombs flows through the solar panel.

Calculate the energy transferred by the solar panel.

Use the equation:

energy transferred = charge flow × potential difference

Give your answer to 2 significant figures.

[3 marks]

Energy transferred = _____ J

0 2 . 8 Why do solar panels on homes help reduce the environmental impact of using electrical devices?

[1 mark]

Tick (✓) **one** box.

Less electricity is used in the home. ☐

Less fossil fuel is burned. ☐

The electricity from the solar panels is cheaper. ☐

11

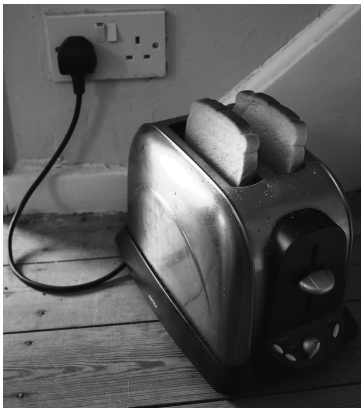
6.1.1.4 Power

Question 06

June 2019 | 8464/P/1F | Original Q5

0 5 **Figure 7** shows a toaster.

Figure 7



The toaster is connected to the mains supply using a three-core cable.

0 5 . 1 What is the function of the earth wire inside the cable?

[1 mark]

Tick (✓) **one** box.

To carry the current from the supply to the toaster ☐

To complete the circuit in the toaster ☐

To melt if a fault occurs inside the toaster ☐

To stop the metal case of the toaster becoming live if a fault occurs ☐

0 5 . 2 Complete the sentences.

Choose answers from the box.

[3 marks]

blue	**brown**	**orange**	**white**	**yellow**

The insulation around the earth wire is green and _____ .

The insulation around the live wire is _____ .

The insulation around the neutral wire is _____ .

6.1.1.4 Power

Question 06 · continued

0 5 . 3 The toaster is switched on for 120 seconds.

The power of the toaster is 850 watts.

Calculate the energy transferred by the toaster.

Use the equation:

energy transferred = power × time

[2 marks]

Energy transferred = _____ J

0 5 . 4 Complete the sentences.

Choose answers from the box.

[2 marks]

chemical	**elastic potential**	**kinetic**	**thermal**

When bread is lowered into the toaster, a spring is stretched. The stretched spring stores _____ energy.

After the bread is toasted, the spring makes the toast move upwards. As the speed of the toast increases, the _____ energy of the toast increases.

6.1.1.4 Power

Question 06 · continued

0 5 . 5 Write the equation which links gravitational field strength, gravitational potential energy, height and mass.

[1 mark]

0 5 . 6 The toast was moved upwards by the spring.

The change in gravitational potential energy of the toast was 0.049 J

The mass of the toast was 0.050 kg

gravitational field strength = 9.8 N/kg

Calculate the change in height of the toast.

[3 marks]

Change in height = _____ m

12

6.1.1.4 Power

Question 07

June 2019 | 8464/P/2F | Original Q5

0 5 The Sun emits all types of electromagnetic waves.

Figure 7 shows the electromagnetic spectrum.

Figure 7

Radio waves	Microwaves	Infrared	Visible light	Ultraviolet	X-rays	Gamma rays

0 5 . 1 Complete the sentences.

Choose answers from the box.

[3 marks]

frequency	**mass**	**power**
velocity		**wavelength**

In a vacuum, all electromagnetic waves travel at the same _____ .

Gamma waves have the greatest _____ .

Radio waves have the greatest _____ .

0 5 . 2 Explain why it is important that the Earth's atmosphere absorbs gamma rays emitted by the Sun.

[2 marks]

_____

_____

_____

_____

0 5 . 3 Some microwaves are **not** absorbed by the Earth's atmosphere.

Why is this useful?

[1 mark]

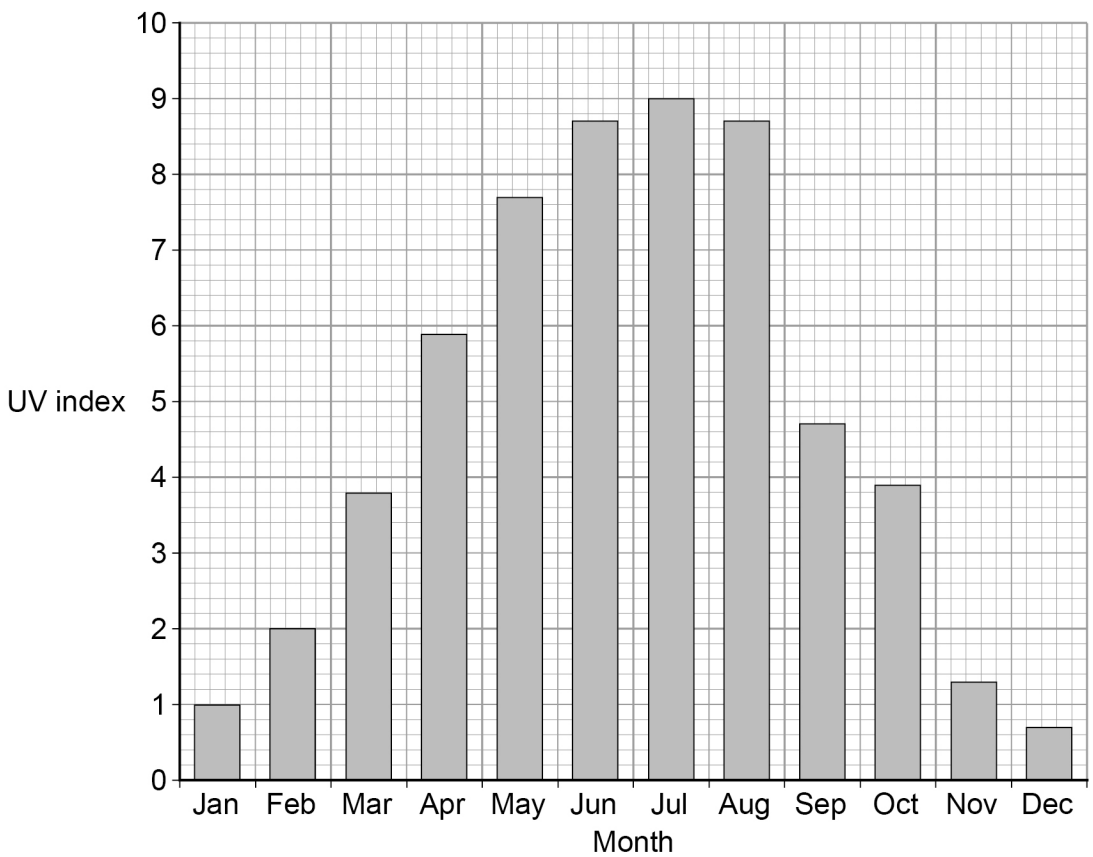
_____

Some ultraviolet (UV) radiation from the Sun passes through the atmosphere and reaches the surface of the Earth.

The amount of UV radiation that reaches the surface of the Earth can be measured on a scale called the UV index.

Figure 8 shows the average midday UV index in the UK for 1 year.

Figure 8



0 5 . 4 Why is exposure to UV radiation harmful to humans?

[1 mark]

6.1.1.4 Power

Question 07 · continued

0 5 . 5 Compare the risk from UV radiation at different times of year in the UK.

Use data from **Figure 8**.

[2 marks]

9

Turn over for the next question

6.1.1.4 Power

Question 08

June 2019 | 8464/P/2F | Original Q6

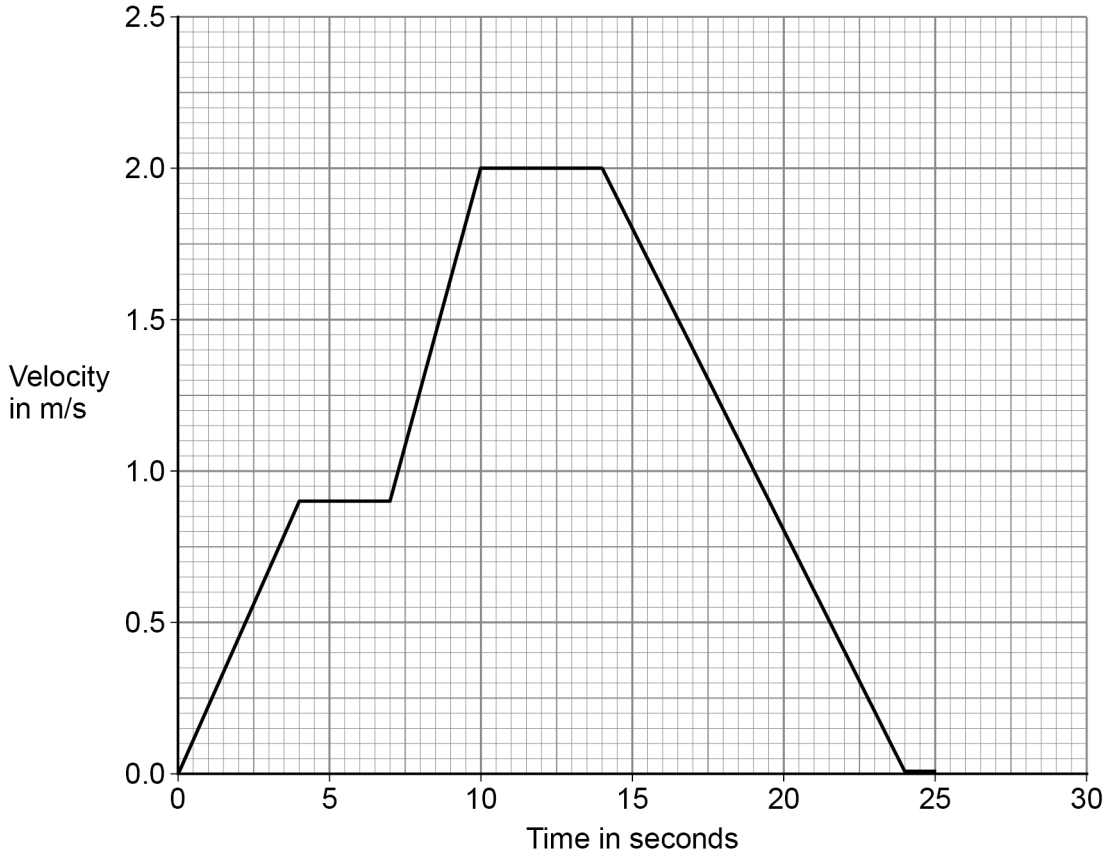
0 6 **Figure 9** shows a runner using a smart watch and a mobile phone to monitor her run.

Figure 9



Figure 10 is a velocity–time graph for part of the runner's warm-up.

Figure 10



6.1.1.4 Power

Question 08 · continued

0 6 . 1 Determine the total time for which the velocity of the runner was increasing.

[2 marks]

Time = _____ s

0 6 . 2 Determine the deceleration of the runner.

[2 marks]

Deceleration = _____ m/s^2

Question 6 continues on the next page

6.1.1.4 Power

Question 08 · continued

The smart watch and mobile phone are connected to each other by a system called Bluetooth.

Bluetooth is wireless and uses electromagnetic waves for communication.

0 6 . 3 Suggest why the phone and watch being connected by a wireless system is an advantage when running.

[1 mark]

0 6 . 4 Write down the equation that links frequency, wave speed and wavelength.

[1 mark]

0 6 . 5 The electromagnetic waves have a frequency of 2 400 000 000 Hz

The speed of electromagnetic waves is 300 000 000 m/s

Calculate the wavelength of the electromagnetic waves.

[3 marks]

Wavelength = _____ m

6.1.1.4 Power

Question 08 · continued

0 6 . 6 **Table 3** shows some information about four types of Bluetooth.

Table 3

Type	Power in milliwatts	Range in metres
1	100	100
2	2.50	10.0
3	1.00	1.00
4	0.50	0.50

Mobile phones use type **2** Bluetooth to communicate with other devices.

Suggest **two** reasons why.

[2 marks]

1 _____

_____

2 _____

_____

11

6.1.1.4 Power

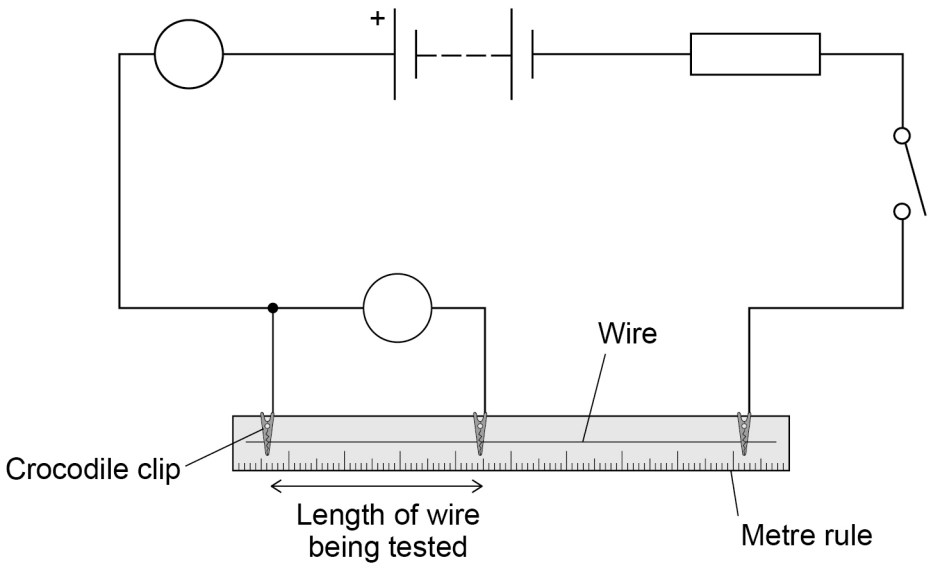
Question 09

November 2020 | 8464/P/1F | Original Q1

0 1 A student investigated how the resistance of a wire varies with the length of the wire.

Figure 1 shows the circuit used.

Figure 1



0 1 . 1 The symbols for the voltmeter and ammeter in **Figure 1** are **not** complete.

Complete the symbols for the voltmeter and ammeter in **Figure 1**.

[1 mark]

0 1 . 2 Which variable is the independent variable?

[1 mark]

Tick (✓) **one** box.

- The current in the wire ☐
- The length of the wire being tested ☐
- The resistance of the wire ☐
- The thickness of the wire ☐

Question 09 · continued

0 1 . 3 Which variable is the dependent variable?

[1 mark]

Tick (✓) **one** box.

- The current in the wire ☐
- The length of the wire being tested ☐
- The resistance of the wire ☐
- The thickness of the wire ☐

0 1 . 4 The student took repeat readings of potential difference for a 30 cm length of the wire.

The readings were:

0.16 V 0.17 V 0.15 V

Calculate the mean potential difference.

[2 marks]

Mean potential difference = _____ V

Question 1 continues on the next page

6.1.1.4 Power

The length of the wire was increased to 60 cm

The current in the wire was 0.50 A

The mean potential difference across the wire was 0.32 V

0 1 . 5 Calculate the resistance of the 60 cm length of wire.

Use the equation:

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

[2 marks]

Resistance = _____ Ω

0 1 . 6 Calculate the power dissipated in the 60 cm length of wire.

Use the equation:

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

[2 marks]

Power = _____ W

6.1.1.4 Power

Question 09 · continued

0 1 . 7 Calculate the charge flow when there is a current of 0.50 A in the wire for 17 s

Use the equation:

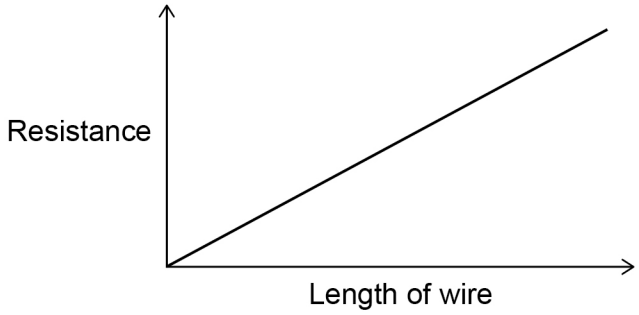
charge flow = current × time

[2 marks]

Charge flow = _____ C

0 1 . 8 **Figure 2** is a sketch graph of the results.

Figure 2



The student repeated the investigation using a thicker wire made from the same metal. For the same length, the thicker wire has a lower resistance.

Draw a line on **Figure 2** to show how the resistance of the thicker wire varies with length.

[1 mark]

12

6.1.1.4 Power

Question 10

0 2 In a sport called far-leaping, an athlete uses a long pole to cross a river.

Figure 4 shows an athlete far-leaping.

Figure 4

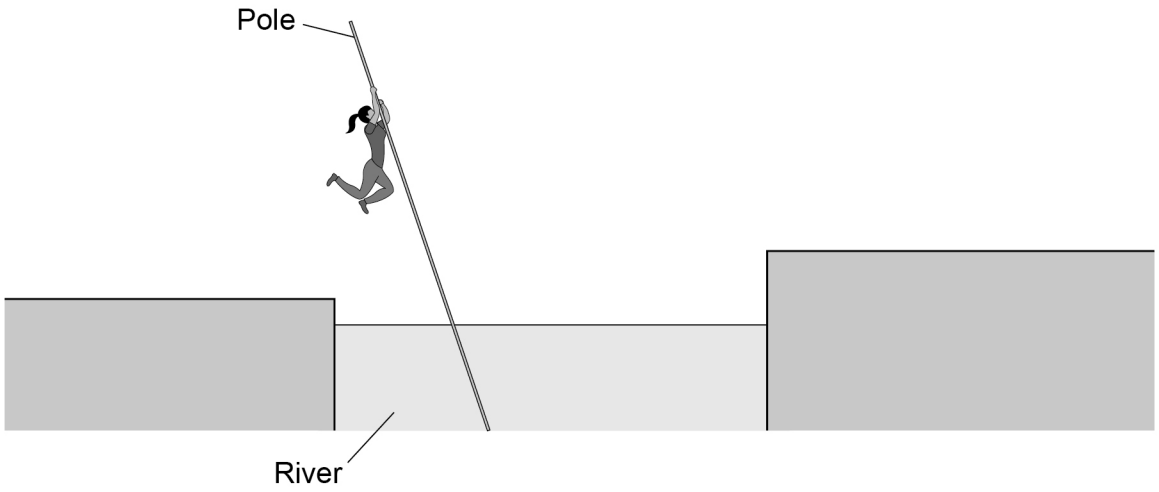
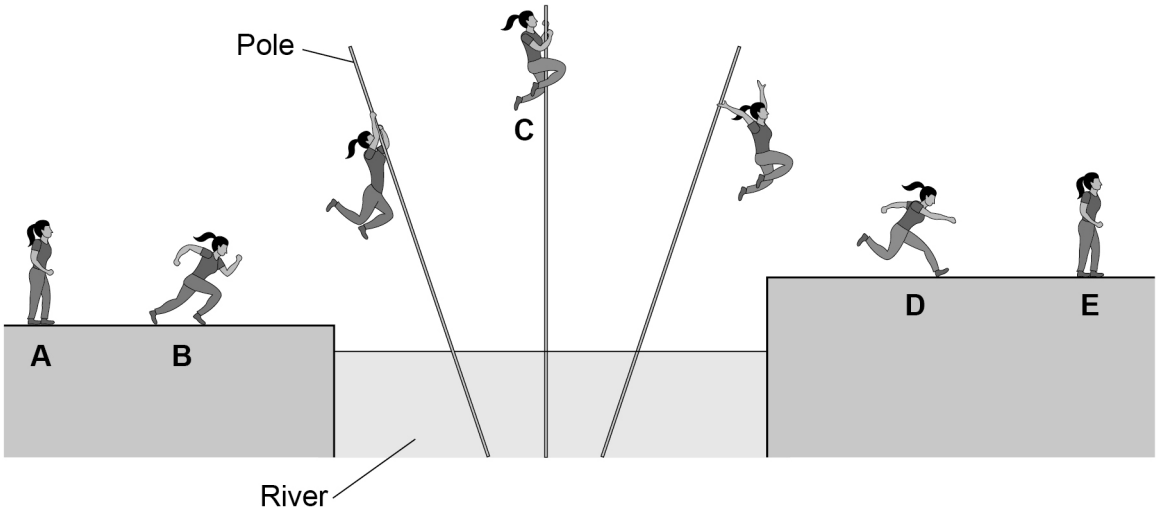


Figure 5 shows the athlete in different stages of far-leaping.

Figure 5



Question 10 · continued

0 2 . 1 Complete the sentence.

Choose answers from the box.

[2 marks]

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

Between positions **A** and **B** the athlete speeds up. There is

an increase in the athlete's _____ energy and

a decrease in the athlete's _____ store of energy.

0 2 . 2 Between positions **B** and **C** the athlete jumps to the pole and climbs up it.

Which statement describes a change in the athlete's energy between positions **B** and **C**?

[1 mark]

Tick (✓) **one** box.

- Elastic potential energy decreases. ☐
- Elastic potential energy increases. ☐
- Gravitational potential energy decreases. ☐
- Gravitational potential energy increases. ☐

Question 2 continues on the next page

6.1.1.4 Power

Question 10 · continued

0 2 . 3 The pole falls over from position **C**. The athlete lets go of the pole and lands at position **D**.

The change in height of the athlete between positions **C** and **D** is 3.0 m.

mass of athlete = 50 kg

gravitational field strength = 9.8 N/kg

Calculate the change in gravitational potential energy of the athlete between positions **C** and **D**.

Use the equation:

change in gravitational potential energy = mass × gravitational field strength × change in height

[2 marks]

Change in gravitational potential energy = _____ J

6.1.1.4 Power

Question 10 · continued

0 2 . 4 The kinetic energy of the athlete at position **D** is 1600 J.

mass of athlete = 50 kg

Calculate the speed of the athlete at position **D**.

Use the equation:

$$\text{speed} = \sqrt{\frac{2 \times \text{kinetic energy}}{\text{mass}}}$$

Choose the unit from the box.

[3 marks]

m/s	J/kg	J/s

Speed = _____ Unit _____

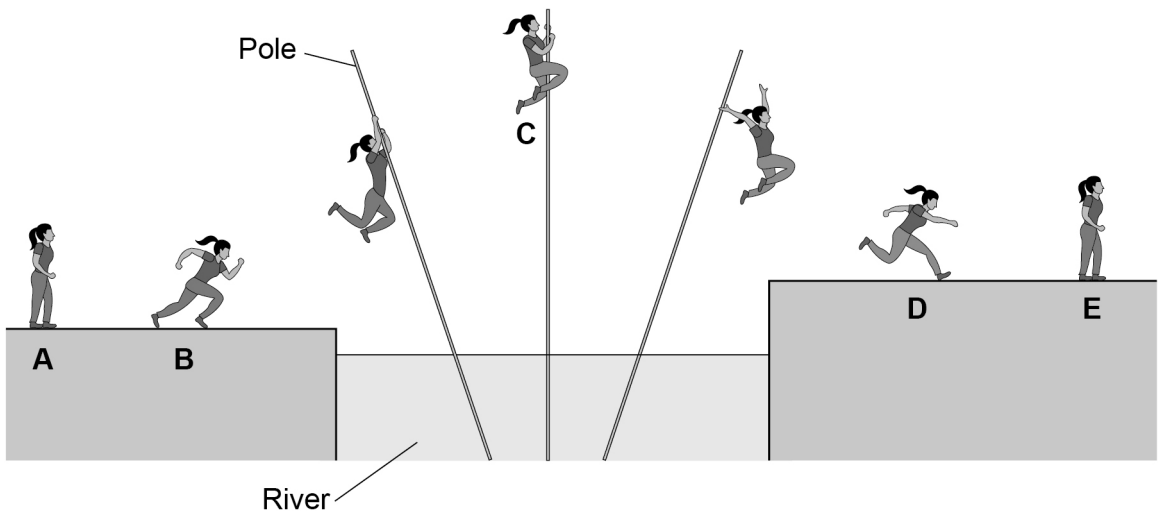
Question 2 continues on the next page

6.1.1.4 Power

Question 10 · continued

Figure 5 is repeated below.

Figure 5



0 2 . 5 At positions **A** and **E**, the athlete is standing still.

Why does the athlete have less energy in position **E** than in position **A**?

[1 mark]

Tick (✓) **one** box.

Energy has been transferred from the athlete to the air. ☐

The air temperature has decreased. ☐

The height of the athlete above the water has increased. ☐

6.1.1.4 Power

Question 10 · continued

0 2 . 6 Athletes have a large power output when they are far-leaping.

What is meant by the power of an athlete?

[1 mark]

Tick (✓) **one** box.

The rate at which the athlete transfers energy. ☐

The size of the maximum force exerted by the athlete. ☐

The total energy transferred by the athlete. ☐

0 2 . 7 A second athlete crossed the same river by far-leaping.

The second athlete had less power than the first athlete when running between position **A** and position **B**.

Complete the sentences.

Choose answers from the box.

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

[2 marks]

less than	**the same as**	**more than**

Two factors that could explain why the second athlete had less power than the first athlete are:

1. The time taken by the second athlete to run between position **A** and position **B**

was _____ the first athlete.

2. The work done by the second athlete was _____

the first athlete.

12

6.1.1.4 Power

Question 11

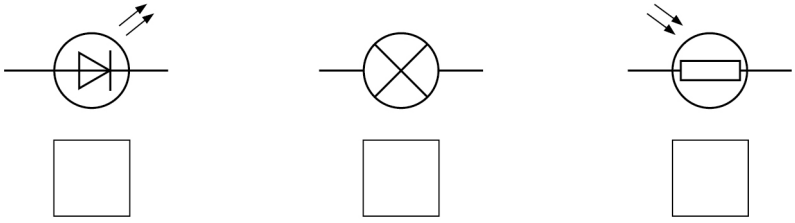
November 2021 | 8464/P/1F | Original Q3

0 3 A filament lamp breaks if the electric current in the filament becomes too big.

0 3 . 1 What is the correct symbol for a filament lamp?

[1 mark]

Tick (✓) **one** box.



0 3 . 2 What is meant by an electric current?

[1 mark]

Tick (✓) **one** box.

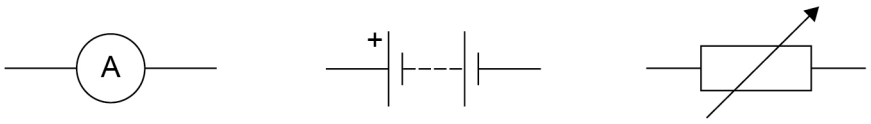
- The energy carried by each unit of charge ☐
- The flow of electrical charge ☐
- The number of electrons in a circuit ☐
- The speed at which charge moves ☐

Question 11 · continued

A manufacturer investigated the maximum current value of some filament lamps.

0 3 . 3 **Figure 6** shows the symbols for an ammeter, a battery and a variable resistor.

Figure 6



Ammeter Battery Variable resistor

The manufacturer connected an ammeter, battery, filament lamp and variable resistor in series.

Draw a circuit diagram to show the manufacturer's circuit.

Include the symbol for a filament lamp from Question **03.1**

[1 mark]

0 3 . 4 How could the manufacturer increase the current in the filament lamp?

[1 mark]

Tick (✓) **one** box.

Add an extra ammeter to the circuit. ☐

Decrease the resistance of the variable resistor. ☐

Use a battery with a smaller potential difference. ☐

6.1.1.4 Power

Question 11 · continued

0 3 . 5 When the potential difference across a filament lamp was 0.75 V, the current in the filament lamp was 0.16 A.

Calculate the power of the filament lamp.

Use the equation:

power = potential difference × current

[2 marks]

Power = _____ W

0 3 . 6 Write down the equation which links charge flow (Q), current (I) and time (t).

[1 mark]

0 3 . 7 The manufacturer increased the current in the filament lamp to 200 mA.

Calculate the charge flow through the filament lamp in 15 s.

[3 marks]

Charge flow = _____ C

6.1.1.4 Power

Question 11 · continued

0 3 . 8 The manufacturer increased the current in the filament lamp from 200 mA.

The filament in the lamp broke when the current reached 320 mA.

How many times greater than 200 mA was the current at which the filament broke?

[1 mark]

_____

_____

_____ times greater

0 3 . 9 The manufacturer tested lots of filament lamps.

The current at which the filament lamps broke was 320 ± 60 mA.

What is the range of currents at which the filament lamps broke?

[1 mark]

Tick (✓) **one** box.

60 mA to 320 mA ☐

260 mA to 320 mA ☐

320 mA to 380 mA ☐

260 mA to 380 mA ☐

12

6.1.1.4 Power

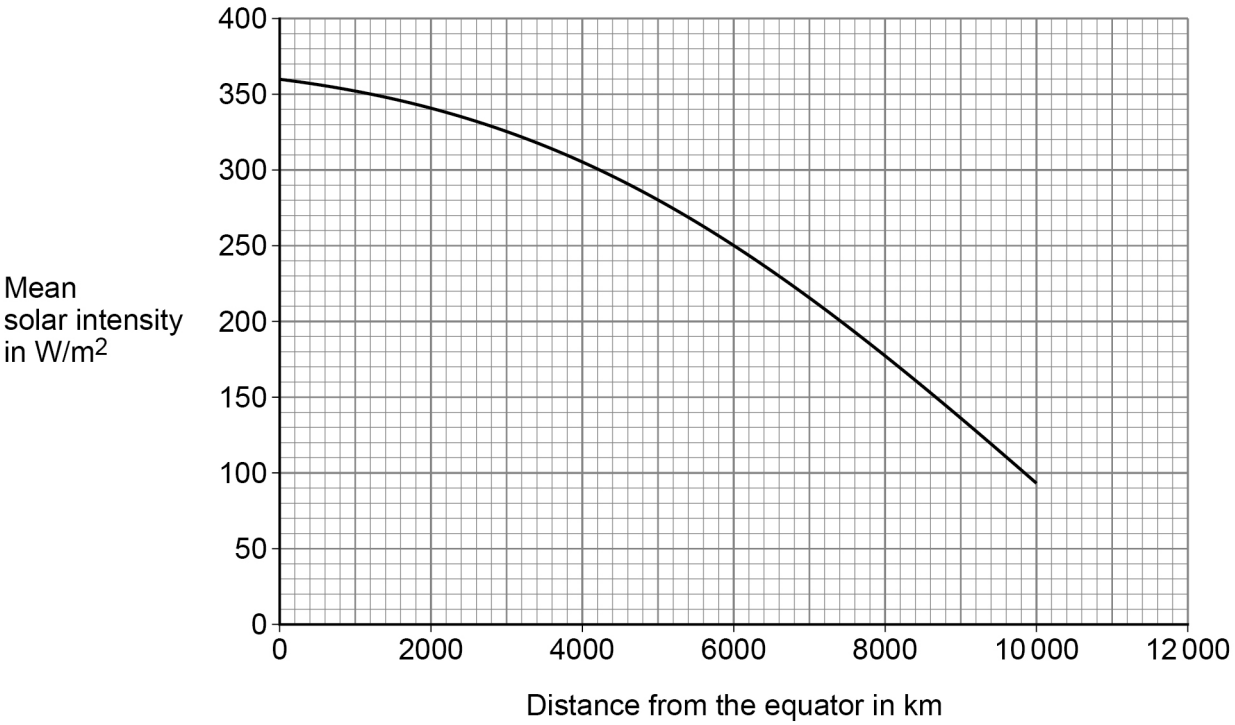
Question 12

November 2021 | 8464/P/1F | Original Q4

0 4 Solar intensity is a measure of the radiation received from the Sun at the surface of the Earth.

Figure 7 shows how the mean solar intensity changes with the distance from the equator.

Figure 7



0 4 . 1 The city of Athens is 4200 km from the equator.

What is the mean solar intensity in Athens?

[1 mark]

Mean solar intensity = _____ W/m^2

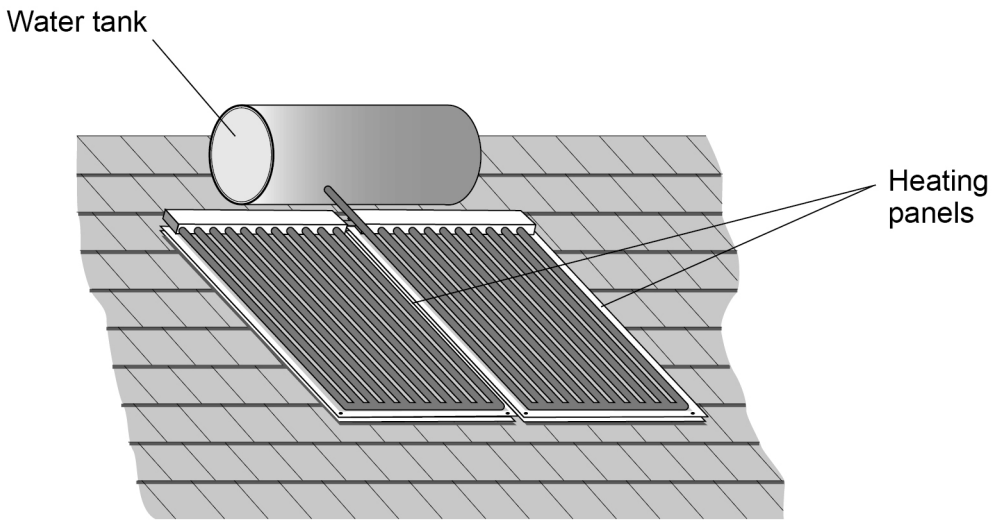
Question 12 · continued

Solar water heaters use radiation from the Sun to heat water.

The heated water is stored in a water tank.

Figure 8 shows a solar water heater on the roof of a building.

Figure 8



0 4 . 2 Cities closer to the equator have many more buildings with solar water heaters than cities further away from the equator.

Suggest why.

[1 mark]

0 4 . 3 The use of solar water heaters may reduce the need to burn fossil fuels.

Complete the sentence.

Choose the answer from the box.

[1 mark]

carbon dioxide	**nitrogen**	**oxygen**

Burning fossil fuels contributes to global warming because there is an increase in the amount of _____ in the atmosphere.

6.1.1.4 Power

Question 12 · continued

0 4 . 4 The efficiency of the solar water heater is 0.61

Calculate the useful power output when the total power input to the solar water heater is 1100 W.

Use the equation:

useful power output = efficiency × total power input

[2 marks]

Useful power output = _____ W

0 4 . 5 Different solar water heaters have different sized heating panels.

Suggest how the size of the heating panels affects the input power to a solar water heater.

[1 mark]

0 4 . 6 Water has a high specific heat capacity.

What is meant by the specific heat capacity of water?

[1 mark]

Tick (✓) **one** box.

- The energy required to change the state of 1 kg of water from liquid to gas. ☐
- The energy required to increase the temperature of 1 kg of water by 1 °C. ☐
- The power required to change the state of 1 kg of water from liquid to gas. ☐
- The power required to increase the temperature of 1 kg of water by 1 °C. ☐

Question 12 · continued

0 4 . 7 The water tank contained 80 kg of water.

The change in thermal energy of the water was 8 400 000 J.

specific heat capacity of water = 4200 J/kg °C

Calculate the temperature change of the water.

Use the Physics Equations Sheet.

[3 marks]

Temperature change = _____ °C

0 4 . 8 The water tank is thermally insulated.

How does thermal insulation affect the rate of energy transfer from the water in the tank?

[1 mark]

Tick (✓) **one** box.

- Thermal insulation decreases the rate of energy transfer. ☐
- Thermal insulation does not change the rate of energy transfer. ☐
- Thermal insulation increases the rate of energy transfer. ☐

Question 4 continues on the next page

Question 12 · continued

0 4 . 9 **Table 1** shows information about different materials.

Table 1

Material	Thermal conductivity in arbitrary units
A	3
B	2
C	8
D	4

Which material in **Table 1** is the best thermal insulator?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

12

6.1.1.4 Power

Question 13

November 2021 | 8464/P/1F | Original Q5

0 5 **Figure 9** shows a mobile phone with its battery removed.

Figure 9



A student measured the potential difference across the battery and then put the battery into the phone.

0 5 . 1 What is the equation linking current (I), potential difference (V) and resistance (R)?

[1 mark]

Tick (✓) **one** box.

- $I = V R$ ☐
- $R = I V$ ☐
- $V = I R$ ☐
- $V = I^2 R$ ☐

Question 5 continues on the next page

6.1.1.4 Power

Question 13 · continued

0 5 . 2 The current in the electronic circuit in the mobile phone was 0.12 A.

The potential difference across the battery was 3.9 V.

Calculate the resistance of the electronic circuit in the mobile phone.

[3 marks]

Resistance = _____ Ω

6.1.1.4 Power

Question 13 · continued

0 5 . 3 Write down the equation which links energy (*E*), power (*P*) and time (*t*).

[1 mark]

0 5 . 4 The battery was fully charged when it was put into the mobile phone.

The battery discharged when the mobile phone was switched on.

The average power output of the battery as it discharged was 0.46 watts.

The time taken to fully discharge the battery was 2500 minutes.

Calculate the energy transferred by the battery.

[3 marks]

Energy transferred = _____ J

Question 5 continues on the next page

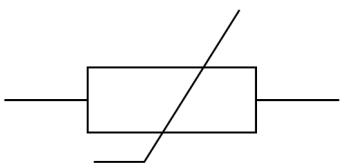
6.1.1.4 Power

Question 13 · continued

The mobile phone includes a sensor to monitor the temperature of the battery.

Figure 10 shows the circuit symbol for a component used in the sensor.

Figure 10



0 5 . 5 What component does the circuit symbol shown in **Figure 10** represent?

[1 mark]

0 5 . 6 The temperature of the component in **Figure 10** increases.

The potential difference across the component remains constant.

Explain what happens to the current in the component.

[2 marks]

11

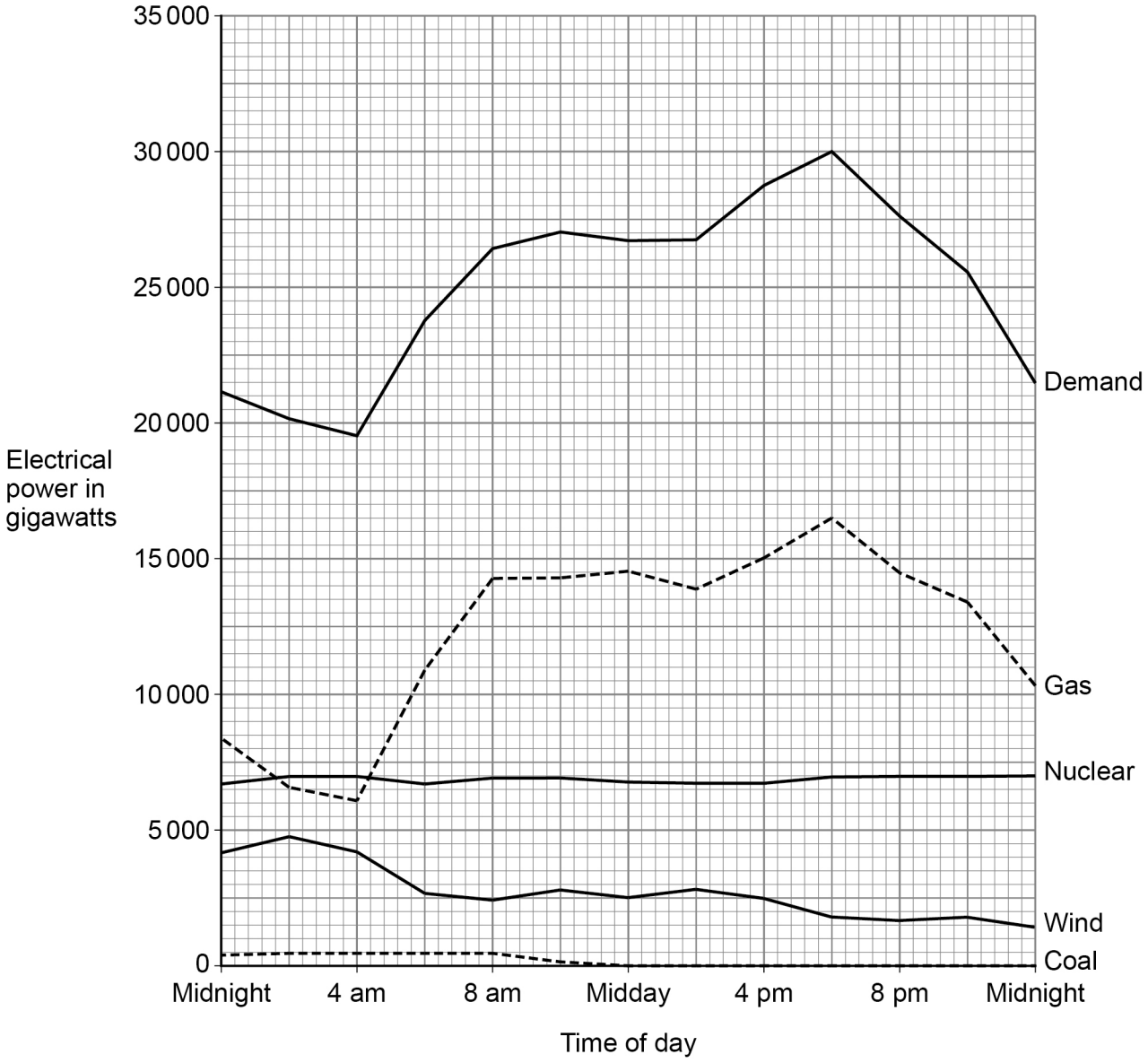
6.1.1.4 Power

Question 14

June 2022 | 8464/P/1F | Original Q5

0 5 **Figure 9** shows some of the energy resources used to meet the demand for electrical power in the UK on one day in 2020.

Figure 9



6.1.1.4 Power

Question 14 · continued

0 5 . 1 The maximum demand for electrical power on that day was at 6 pm.

Determine the percentage of the maximum demand for electrical power that was generated using gas.

[3 marks]

Percentage = _____ %

0 5 . 2 The UK government wants to reduce carbon emissions as much as possible.

Which energy resources need to be used less to achieve this?

[1 mark]

Tick (✓) **one** box.

- Coal and gas ☐
- Gas and nuclear ☐
- Wind and coal ☐
- Wind and nuclear ☐

Question 5 continues on the next page

6.1.1.4 Power

Question 14 · continued

A network of transformers and transmission cables transfers electrical power from power stations to consumers.

0 5 . 3 What is this network called?

[1 mark]

0 5 . 4 Explain how using step-up transformers makes the network efficient.

[3 marks]

8

6.1.1.4 Power

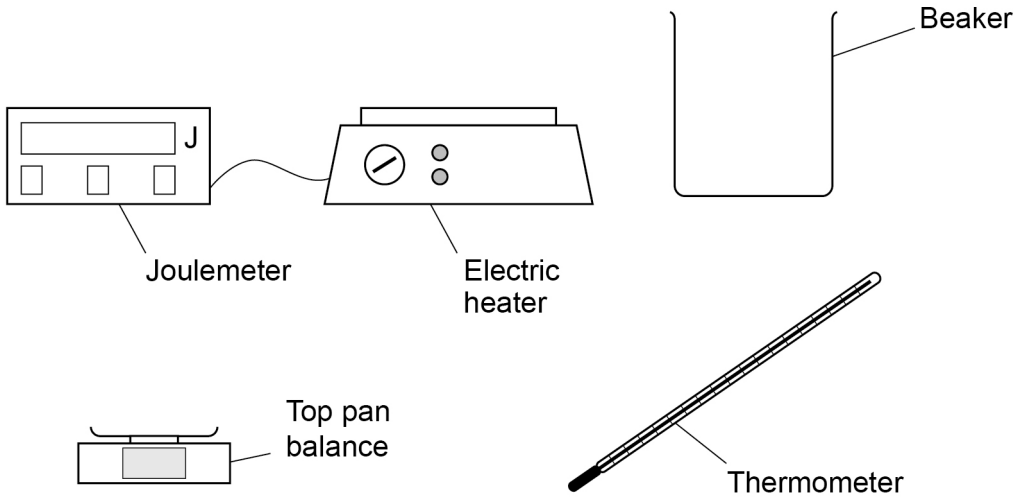
Question 15

June 2022 | 8464/P/1F | Original Q6

0 6 A student made measurements to determine the specific heat capacity of vegetable oil.

Figure 10 shows the equipment used.

Figure 10



0 6 . 1 Describe how the student could use the equipment shown in **Figure 10** to determine the specific heat capacity of vegetable oil.

[6 marks]

6.1.1.4 Power

Question 15 · continued

0 6 . 2 Give **one** risk when using the equipment in **Figure 10**.

[1 mark]

A different student did not have a joulemeter and calculated the energy transferred by the electric heater.

Use the Physics Equations Sheet to answer questions **06.3** and **06.4**.

0 6 . 3 Write down the equation linking energy transferred (*E*), power (*P*) and time (*t*).

[1 mark]

0 6 . 4 The electric heater had a power output of 50 watts.

Calculate the time taken for the electric element to transfer 4750 joules of energy to the vegetable oil.

[3 marks]

Time taken = _____ s

Question 6 continues on the next page

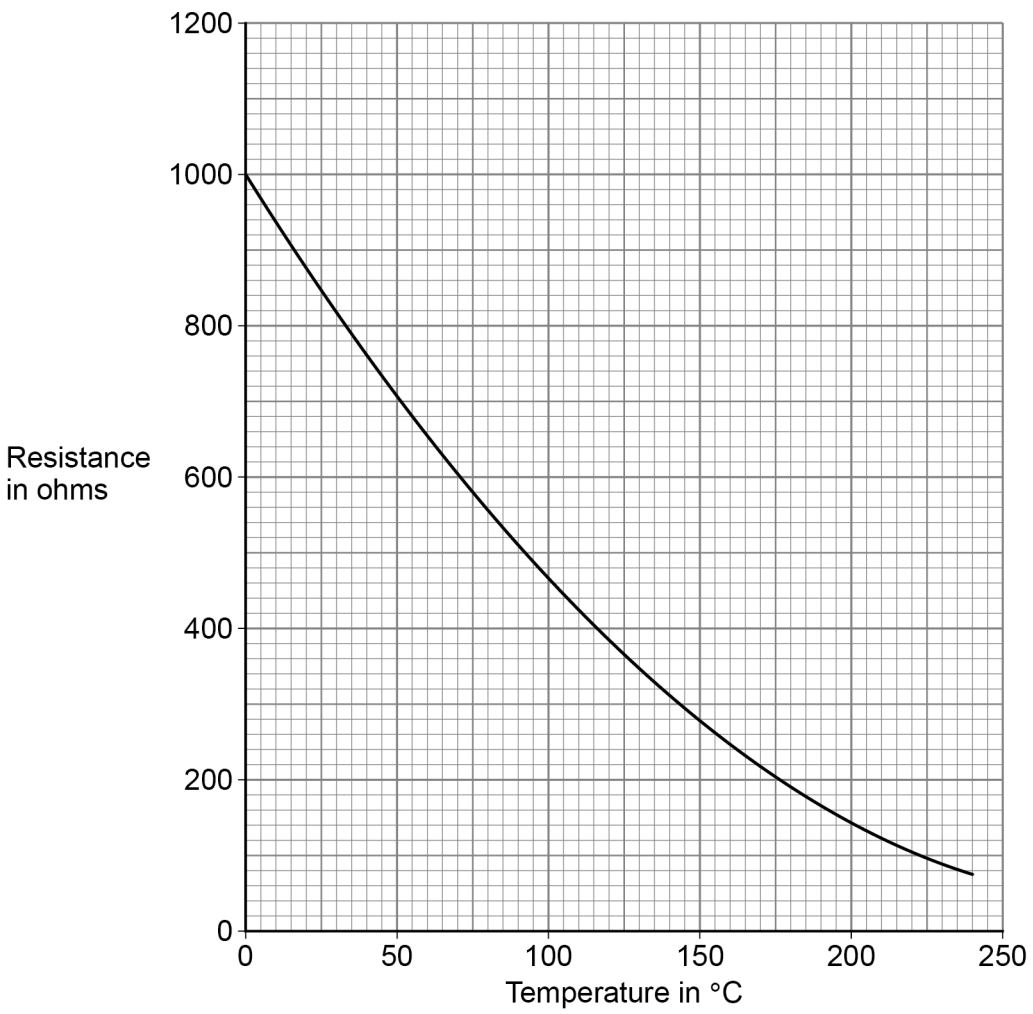
Question 15 · continued

In a deep fryer, vegetable oil is heated by an electric heating element. Food is then cooked in the hot vegetable oil.

The deep fryer contains an electrical component to monitor the temperature of the vegetable oil.

Figure 11 shows how the resistance of this electrical component changes with temperature.

Figure 11



0 6 . 5 What electrical component is used to monitor the temperature of the vegetable oil?

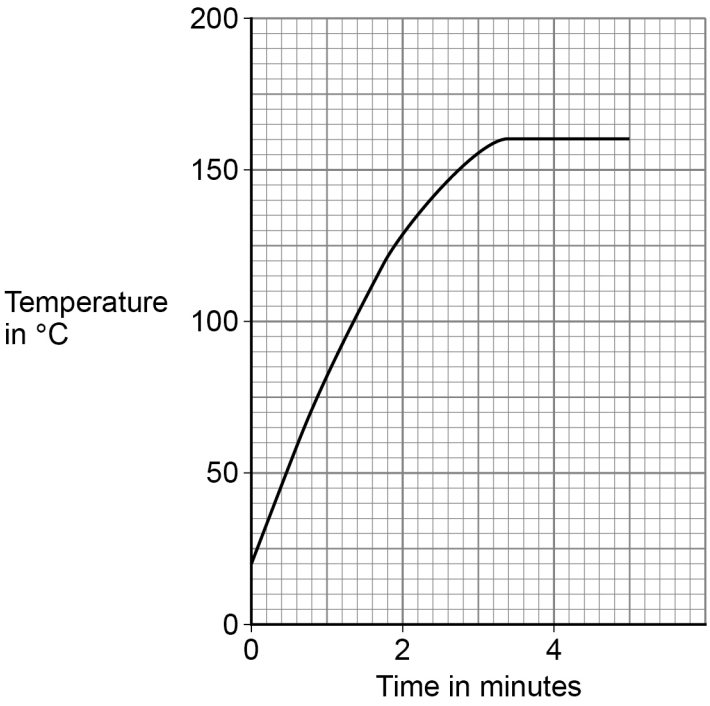
[1 mark]

Question 15 · continued

0 6 . 6 The electric heating element in the deep fryer automatically switches off when the vegetable oil reaches a certain temperature.

Figure 12 shows how the temperature of the vegetable oil changed after the deep fryer was switched on.

Figure 12



Determine the resistance of the electrical component when the electric heating element automatically switched off.

Use **Figure 11** and **Figure 12**.

[2 marks]

Resistance = _____ Ω

Question 6 continues on the next page

6.1.1.4 Power

Question 15 · continued

June 2022 | 8464/P/1F | Original Q6

0 6 . 7 Some chips were put in the deep fryer.

In the deep fryer, water in the chips underwent a physical change and became steam.

Why is this a physical change?

[1 mark]

Tick (✓) **one** box.

All water can change to steam. ☐

No chemicals are involved when water changes to steam. ☐

The change from water to steam can be detected visually. ☐

The water will recover its original properties if the steam is cooled. ☐

15

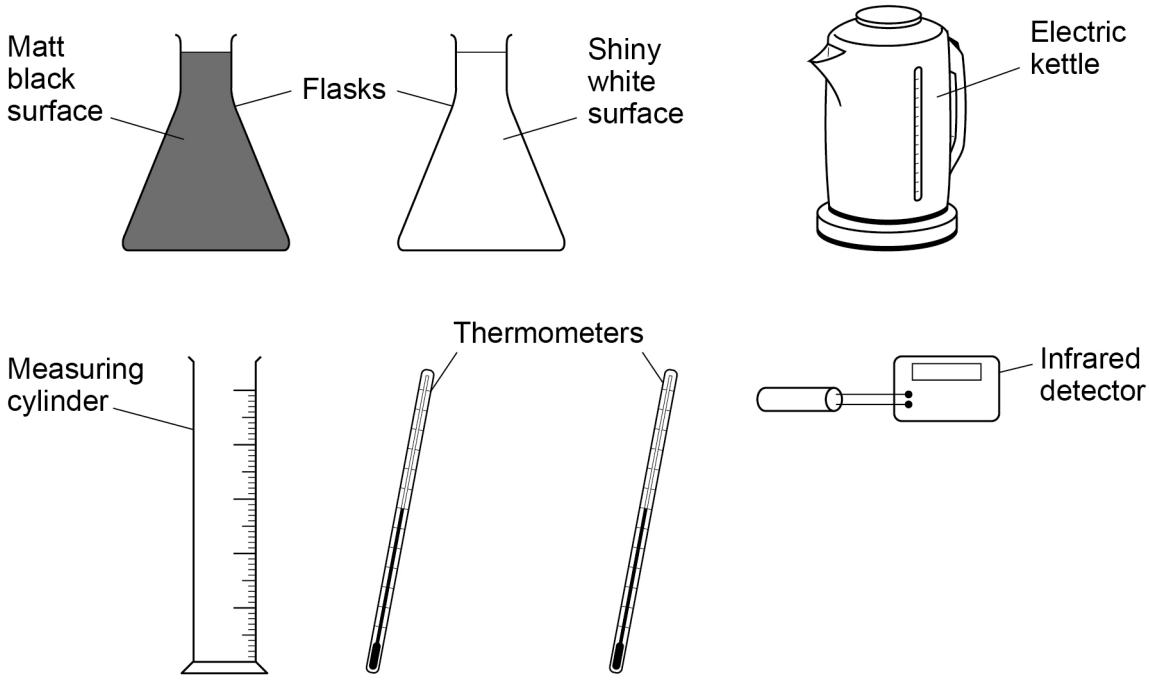
6.1.1.4 Power

Question 16

0 2 A student investigated how the colour of a surface affects the power of the infrared radiation emitted by the surface.

Figure 2 shows the equipment used.

Figure 2



6.1.1.4 Power

Question 16 · continued

The infrared detector measures the power of the infrared radiation emitted by the flasks.

0 2 . 1 The student poured hot water into each flask.

What should the student do to reduce the risk of burning herself with the hot water?

[1 mark]

0 2 . 2 Describe how the student should use the equipment in **Figure 2** to compare the power of the infrared radiation emitted by each surface.

[4 marks]

Question 2 continues on the next page

Question 16 · continued

A student investigated how the power of the infrared radiation emitted from a flask changed with time.

Table 1 shows the results.

Table 1

Time in seconds	Power in watts
0	8.0
60	7.2
120	6.5
180	5.9
240	5.4
300	5.0
360	4.7
420	4.5

0 2 . 3 Describe the pattern shown by the data in **Table 1**.

[2 marks]

0 2 . 4 What is the most likely value for the power of the infrared radiation emitted after 480 seconds?

Use **Table 1**.

[1 mark]

Tick (✓) **one** box.

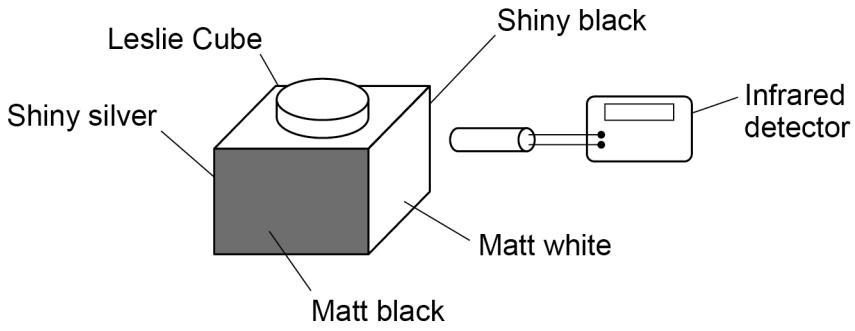
4.0 W ☐ 4.2 W ☐ 4.4 W ☐ 4.6 W ☐

Question 16 · continued

A Leslie Cube is used to demonstrate that different surfaces emit different amounts of infrared radiation.

Figure 3 shows an infrared detector and a Leslie Cube filled with hot water.

Figure 3



0 2 . 5 Give **one** advantage of using a Leslie Cube rather than the equipment in **Figure 2** on page 4.

[1 mark]

0 2 . 6 The teacher improved the demonstration by using four infrared detectors connected to a data logger and computer. Each detector was pointed at a different surface of the Leslie Cube.

The distance between the surface and the detector was the same in each case.

Give **two** reasons why this improved the demonstration.

[2 marks]

1

2

11

6.1.1.4 Power

Question 17

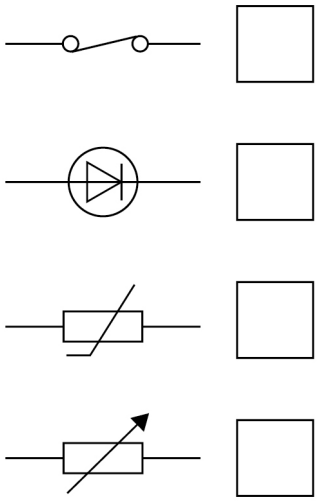
June 2023 | 8464/P/1F | Original Q4

0 4 A gardener wanted to build an electrical circuit to monitor the temperature in a greenhouse.

0 4 . 1 Which symbol represents an electrical component with a resistance that decreases as its temperature increases?

[1 mark]

Tick (✓) **one** box.



0 4 . 2 When the resistance of an electrical circuit decreases, the current in the circuit increases.

Complete the sentence.

Choose the answer from the box.

[1 mark]

charge	**energy**	**potential difference**	**power**

Electrical current is a flow of _____ .

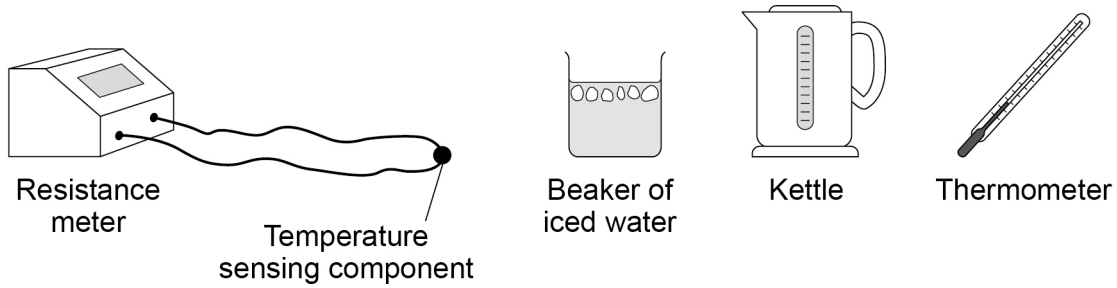
6.1.1.4 Power

Question 17 · continued

0 4 . 3 The gardener wanted to find how the resistance of the component varies with temperature.

Figure 4 shows the equipment used by the gardener.

Figure 4



The resistance meter displays the resistance of the component.

Plan a method the gardener could use to find how the resistance of the component varies with temperature.

[4 marks]

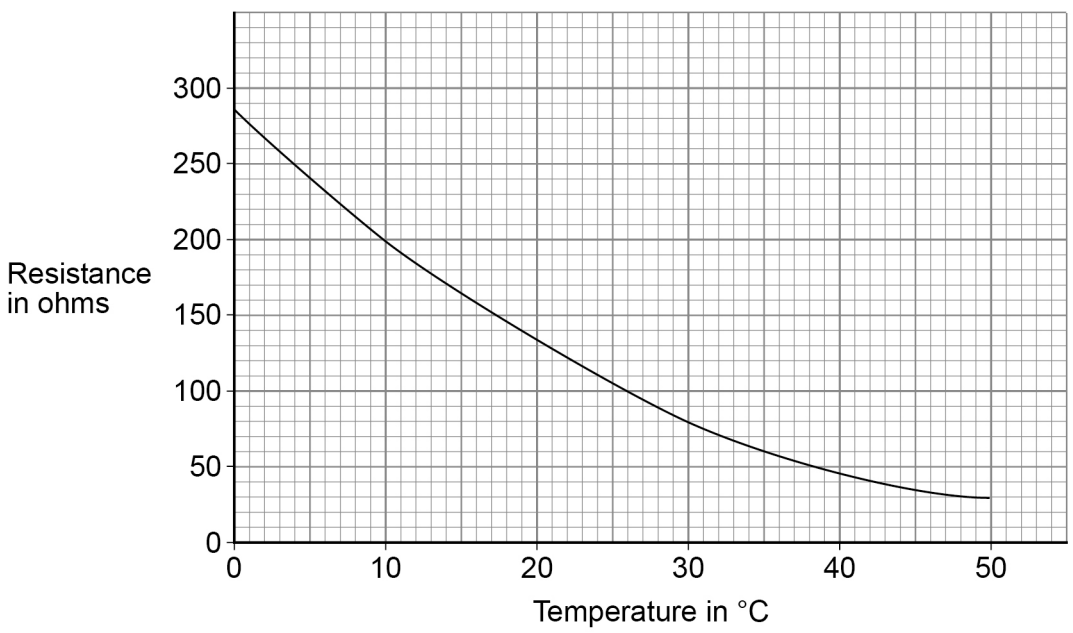
Question 4 continues on the next page

6.1.1.4 Power

Question 17 · continued

Figure 5 shows how the resistance of the component varies with temperature.

Figure 5



0 4 . 4 Complete the sentence.

Choose the answer from the box.

[1 mark]

linear	**non-linear**	**directly proportional**

The relationship between the temperature and the resistance of the component is _____ .

6.1.1.4 Power

Question 17 · continued

0 4 . 5 The temperature in the greenhouse changed from 10 °C to 30 °C.

Determine the change in resistance of the component between these temperatures.

Use **Figure 5**.

[2 marks]

Change in resistance = _____ Ω

Question 4 continues on the next page

6.1.1.4 Power

Question 17 · continued

The gardener builds a circuit that switches a heater on when the greenhouse gets too cold.

Use the Physics Equations Sheet to answer questions **04.6** and **04.7**.

0 4 . 6 Write down the equation that links current (I), potential difference (V) and power (P).

[1 mark]

0 4 . 7 The power of the heater is 2900 W.

The potential difference across the heater is 230 V.

Calculate the current in the heater.

[3 marks]

Current = _____ A

13

6.1.1.4 Power

Question 18

June 2023 | 8464/P/1F | Original Q5

0 5 Wind power and solar power are both renewable energy resources used to generate electricity for the National Grid.

0 5 . 1 Which of the following is also a renewable energy resource?

[1 mark]

Tick (✓) **one** box.

- Geothermal ☐
- Natural gas ☐
- Nuclear fuel ☐

0 5 . 2 The energy transferred by the National Grid in one second was 36 gigajoules (GJ).

Which of the following is the same as 36 gigajoules?

[1 mark]

Tick (✓) **one** box.

- 36×10^3 J ☐
- 36×10^6 J ☐
- 36×10^9 J ☐
- 36×10^{12} J ☐

Question 5 continues on the next page

Question 18 · continued

0 5 . 3 **Figure 6** shows how the mean power output from solar and wind energy resources in the UK varied between 2014 and 2019.

Figure 6

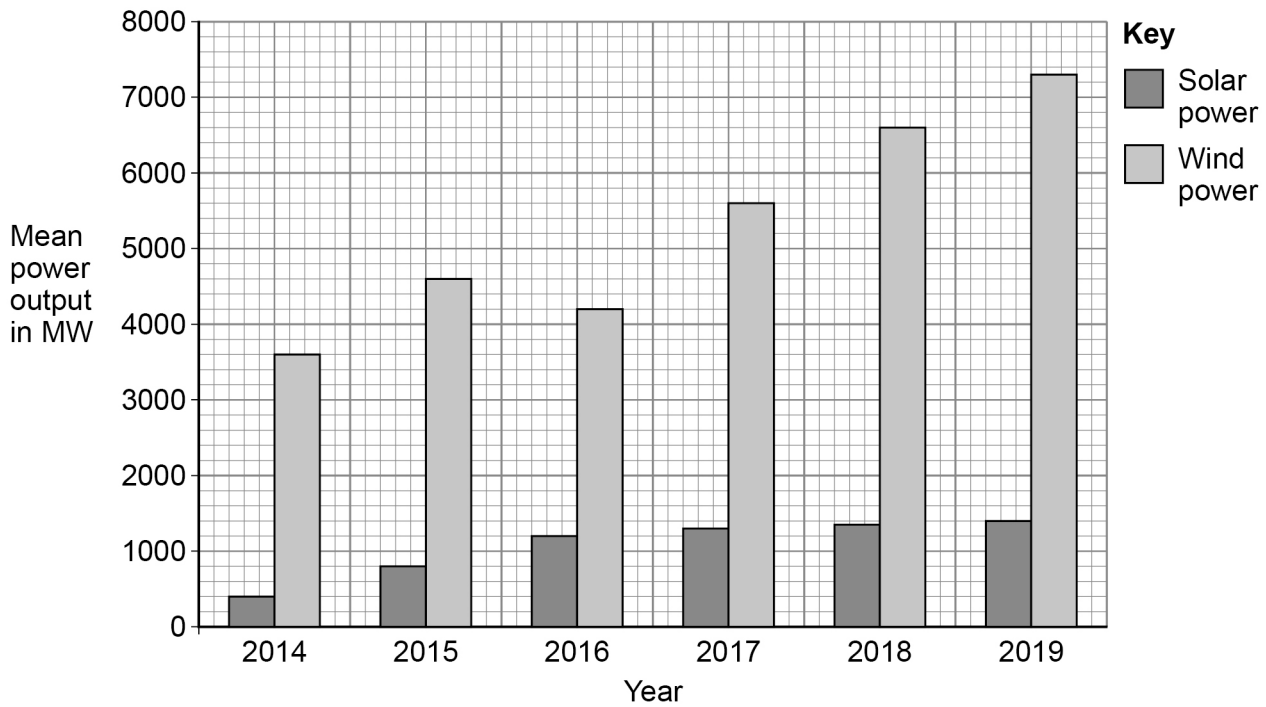
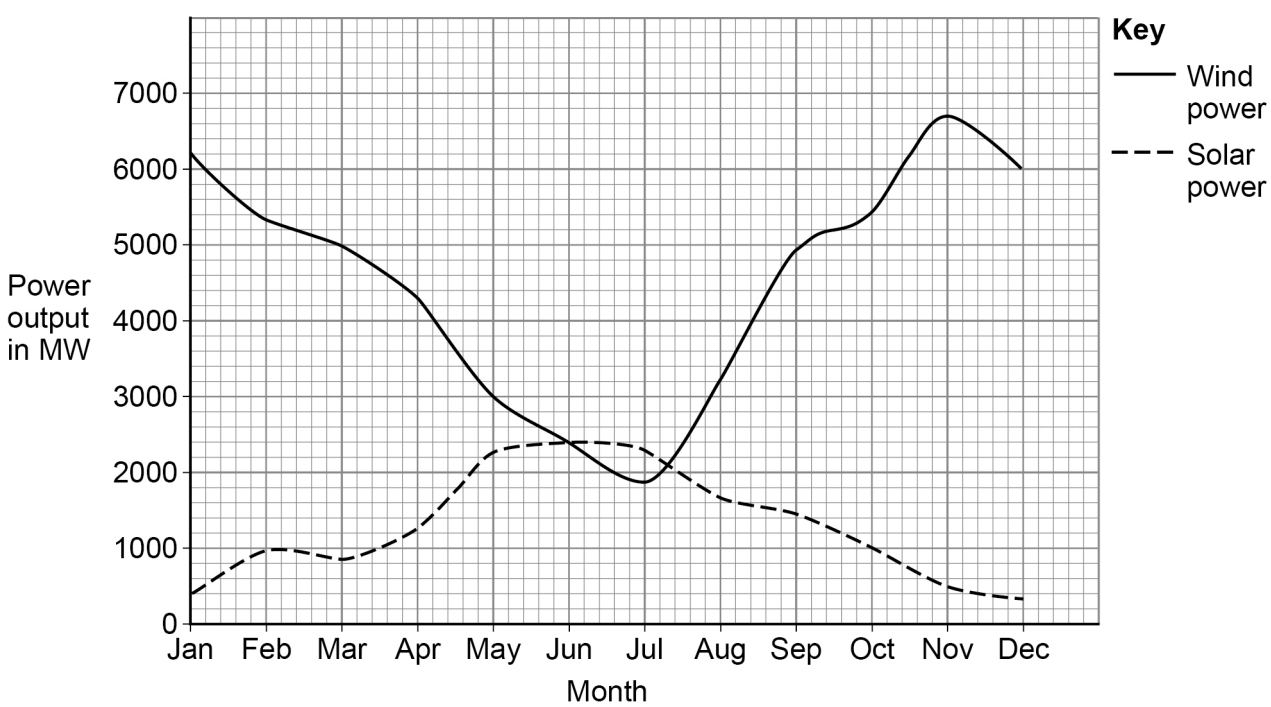


Figure 7 shows how the power output from solar and wind energy resources varies in a typical year.

Figure 7



6.1.1.4 Power

Question 18 · continued

Explain the changes in power output from solar and wind energy resources between 2014 and 2019.

You should include an explanation of the change in power output during a typical year.

[6 marks]

8

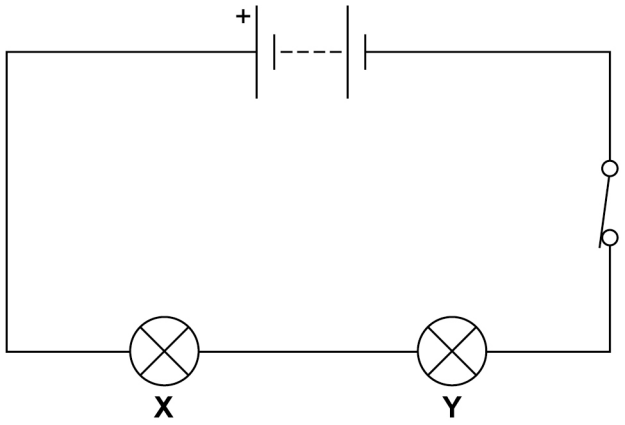
6.1.1.4 Power

Question 19

June 2024 | 8464/P/1F | Original Q1

0 1 **Figure 1** shows a circuit diagram. The circuit contains a battery and two lamps, **X** and **Y**.

Figure 1



0 1 . 1 How does the current in lamp **X** compare with the current in lamp **Y**?

[1 mark]

Tick (✓) **one** box.

The current in lamp **X** is smaller. ☐

The current in both lamps is the same. ☐

The current in lamp **X** is greater. ☐

0 1 . 2 Lamp **X** and lamp **Y** are **not** identical.

The potential difference across the battery is 4.5 V.

The potential difference across lamp **X** is 1.5 V.

Calculate the potential difference across lamp **Y**.

[1 mark]

Potential difference across lamp **Y** = _____ V

6.1.1.4 Power

Question 19 · continued

The current in lamp **X** is 1.2 A.

The potential difference across lamp **X** is 1.5 V.

0 1 . 3 Calculate the power of lamp **X**.

Use the equation:

power = potential difference × current

[2 marks]

Power = _____ W

0 1 . 4 Calculate the resistance of lamp **X**.

Use the equation:

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

[2 marks]

Resistance = _____ Ω

Question 1 continues on the next page

6.1.1.4 Power

Question 19 · continued

0 1 . 5 The current in lamp **X** is 1.2 A.

Calculate the charge flow through lamp **X** in 40 seconds.

Use the equation:

charge flow = current × time

[2 marks]

Charge flow = _____ C

0 1 . 6 The switch can be used to turn the lamps on and off.

Immediately after the lamps are switched on, the resistance of each lamp increases.

Why does the resistance of each lamp increase?

[1 mark]

Tick (✓) **one** box.

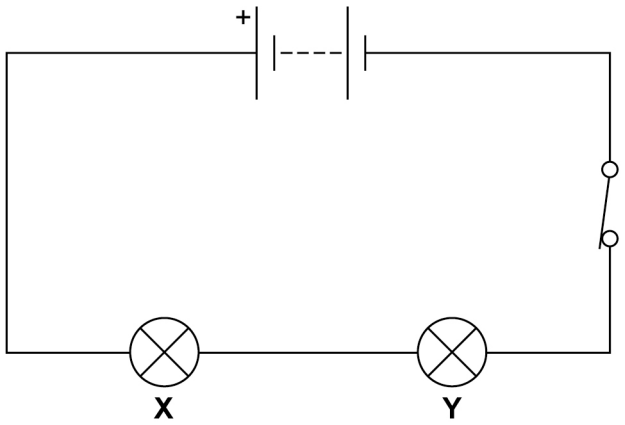
- The current in the battery decreases. ☐
- The potential difference across each lamp decreases. ☐
- The power of the battery increases. ☐
- The temperature of each lamp increases. ☐

6.1.1.4 Power

Question 19 · continued

Figure 1 is repeated below.

Figure 1



0 1 . 7 Lamp **Y** breaks.

What happens to lamp **X**?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

Lamp **X** gets brighter. ☐

Lamp **X** stays the same brightness. ☐

Lamp **X** no longer emits light. ☐

Reason _____

_____

11

6.1.1.4 Power

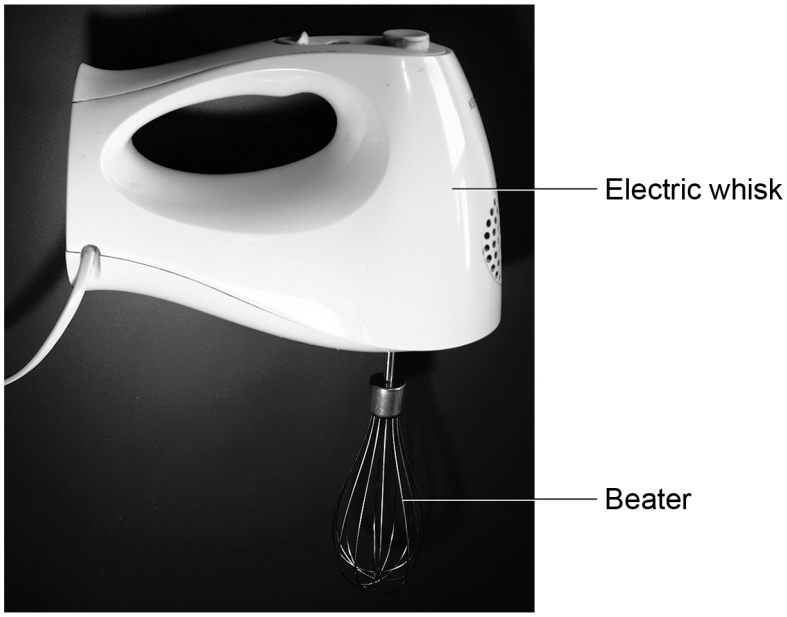
Question 20

June 2024 | 8464/P/1F | Original Q6

0 6 **Figure 10** shows an electric whisk that plugs into the mains electricity supply.

The whisk can mix food by spinning a beater.

Figure 10



0 6 . 1 Give **two** energy stores that increase when the whisk is switched on.

[2 marks]

1 _____

_____

2 _____

_____

6.1.1.4 Power

Question 20 · continued

Use the Physics Equations Sheet to answer questions **06.2** and **06.3**.

0 6 . 2 Work is done by the whisk when it is used to mix food.

Write down the equation that links power (*P*), time (*t*) and work done (*W*).

[1 mark]

0 6 . 3 The power output of the whisk is 92 W.

Calculate the time for the whisk to do 23 000 J of work.

[3 marks]

Time = _____ s

Question 6 continues on the next page

Question 20 · continued

Use the Physics Equations Sheet to answer questions **06.4** and **06.5**.

0 6 . 4 Which equation links current (I), power (P) and resistance (R)?

[1 mark]

Tick (✓) **one** box.

$P = \frac{I}{R^2}$ ☐

$P = I R^2$ ☐

$P = \frac{I^2}{R}$ ☐

$P = I^2 R$ ☐

0 6 . 5 The current in the whisk is 500 mA.

The resistance of the whisk is 640 Ω.

Calculate the power of the whisk.

[3 marks]

Power = _____ W

6.1.1.4 Power

Question 20 · continued

The whisk has several settings that allow the beater to spin at different speeds.

A faster beater speed needs a greater power input from the mains electricity supply.

0 6 . 6 What is the potential difference between the live wire and neutral wire in the mains electricity supply?

[1 mark]

_____ V

0 6 . 7 Changing the beater speed does **not** change the potential difference between the live wire and neutral wire.

The power input to the whisk changes because the current in the whisk changes.

Complete the sentence.

[1 mark]

When the beater speed increases, the current in the whisk increases because the resistance of the whisk _____.

12

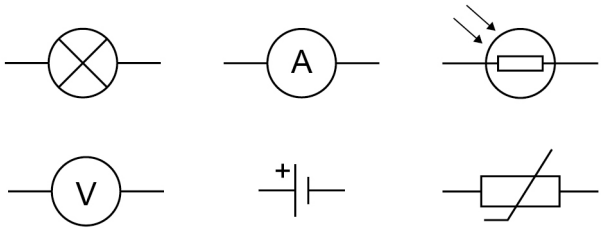
6.1.1.4 Power

Question 21

June 2025 | 8464/P/1F | Original Q2

0 2 **Figure 2** shows circuit symbols for some electrical components.

Figure 2



A student connects a circuit to measure the current in a filament lamp.

The student uses:

- an ammeter
- a cell
- a filament lamp.

0 2 . 1 Draw a circuit diagram for a circuit the student could use to measure the current in a filament lamp.

You should use **three** of the circuit symbols from **Figure 2**.

[3 marks]

6.1.1.4 Power

Question 21 · continued

0 2 . 2 Which component is the source of energy for the circuit?

[1 mark]

Tick (✓) **one** box.

Ammeter ☐

Cell ☐

Filament lamp ☐

0 2 . 3 There is a current of 1.5 A in the filament lamp for a time of 30 s.

Calculate the charge flow in the filament lamp.

Use the equation:

charge flow = current × time

[2 marks]

Charge flow = _____ C

6.1.1.4 Power

Question 21 · continued

0 2 . 4 The current in the filament lamp is 1.5 A when the potential difference across the filament lamp is 12 V.

Calculate the resistance of the filament lamp.

Use the equation:

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

Choose the unit from the box.

[3 marks]

Ω	**°C**	**W**

Resistance = _____ Unit _____

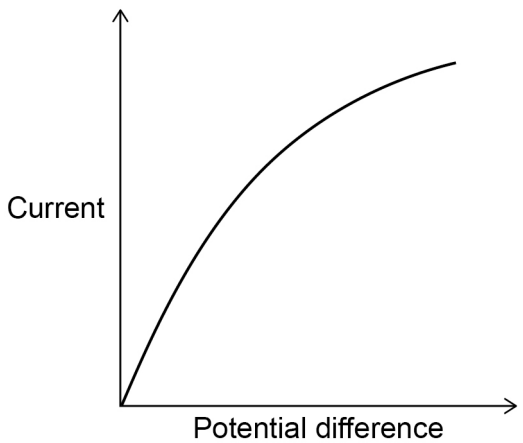
Question 2 continues on the next page

6.1.1.4 Power

Question 21 · continued

Figure 3 shows how the current varies with potential difference for the filament lamp.

Figure 3



0 2 . 5 Describe the relationship between potential difference and current for the filament lamp.

[2 marks]

0 2 . 6 As the current in the filament lamp increases, the temperature of the filament lamp increases.

What happens to the resistance of the filament lamp as the temperature increases?

[1 mark]

6.1.1.4 Power

Question 21 · continued

0 2 . 7 In most homes, filament lamps have been replaced with LED bulbs.

Table 1 shows information about a filament lamp and an LED bulb.

Table 1

	Input power in watts	Brightness in arbitrary units
Filament lamp	40	800
LED bulb	8	800

Explain the advantages of using LED bulbs instead of filament lamps.

You should include a calculation in your answer.

[4 marks]

Extra space

16

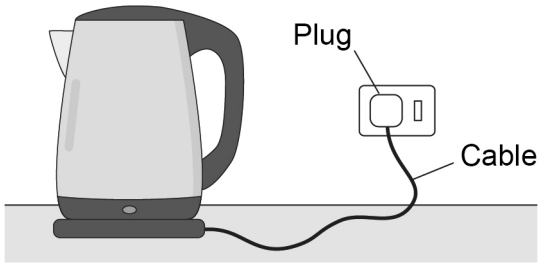
6.1.1.4 Power

Question 22

0 4 **Figure 5** shows a plastic kettle.

The kettle is connected to the mains electricity supply.

Figure 5



0 4 . 1 What is the frequency of the UK mains electricity supply?

[1 mark]

Tick (✓) **one** box.

25 Hz ☐

50 Hz ☐

75 Hz ☐

100 Hz ☐

Question 4 continues on the next page

6.1.1.4 Power

Question 22 · continued

0 4 . 2 The cable that connects the kettle to the plug contains two insulated wires.

Draw **one** line from each wire to the colour of the insulation on the wire.

[2 marks]

Wire	Colour of insulation
Live	Blue
Neutral	Brown
	Green and yellow stripes

Use the Physics Equations Sheet to answer questions **04.3** and **04.4**.

0 4 . 3 Write down the equation that links current (I), potential difference (V) and power (P).

[1 mark]

6.1.1.4 Power

Question 22 · continued

0 4 . 4 The power of the heating element in the kettle is 2100 W.

The potential difference across the heating element is 230 V.

Calculate the current in the heating element.

Give your answer to 2 significant figures.

[4 marks]

Current (2 significant figures) = _____ A

0 4 . 5 The kettle is designed to switch off when the water reaches boiling point.

Before the kettle switches off, 0.0080 kg of water changes state.

The energy transferred to change the state of the water is 18 000 J.

Calculate the specific latent heat of vaporisation of the water.

Use the Physics Equations Sheet.

[3 marks]

Specific latent heat of vaporisation = _____ J/kg

Question 22 · continued

0 4 . 6 A different kettle is used to heat some water.

The useful output energy transferred to the water is 75 600 J.

The total input energy transferred by the kettle is 84 000 J.

Calculate the efficiency of the kettle.

Use the equation:

$$\text{efficiency} = \frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$$

[2 marks]

Efficiency = _____

0 4 . 7 Explain **one** advantage of electrical appliances having a high efficiency.

[2 marks]

15

6.1.1.4 Power

Question 23

June 2025 | 8464/P/1F | Original Q5

0 5 Fossil fuels are burned in car engines and in power stations.

0 5 . 1 Describe how different energy stores change in a car engine when a fossil fuel is burned.

[2 marks]

0 5 . 2 Some car engines burn a fuel that is produced using plants.

Name a fuel produced using plants.

[1 mark]

0 5 . 3 Some cars do **not** contain an engine that burns a fuel.

Suggest how cars that do **not** burn a fuel are powered.

[1 mark]

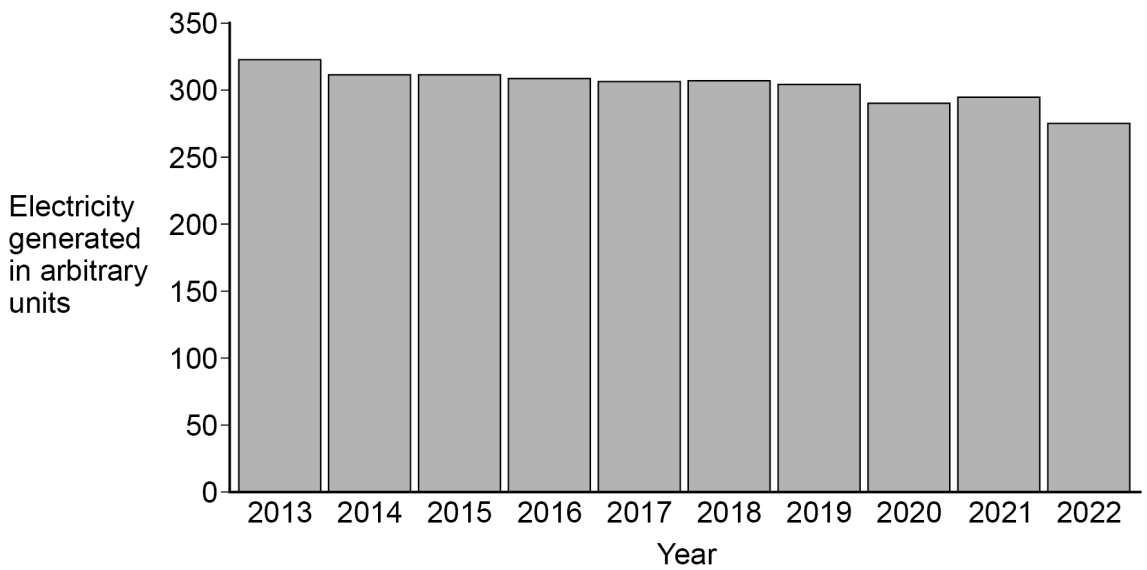
Question 5 continues on the next page

6.1.1.4 Power

Question 23 · continued

Figure 6 shows how the total amount of electricity generated in the UK has changed with time.

Figure 6



0 5 . 4 The proportion of electricity that is generated using renewable energy resources has increased since the year 2013.

Which conclusion is correct?

Use **Figure 6**.

[1 mark]

Tick (✓) **one** box.

The amount of fossil fuel that is burned to generate electricity each year has decreased. ☐

The concentration of carbon dioxide in the atmosphere has decreased. ☐

The rate of increase of the mean temperature of the atmosphere has decreased. ☐

6.1.1.4 Power

Question 23 · continued

0 5 . 5 The UK plans to stop burning fossil fuels to generate electricity.

Explain **one** reason why it will take many years before all electricity is generated using renewable resources.

[2 marks]

0 5 . 6 Renewable energy resources can have a negative impact on the environment.

Give **one** negative environmental impact of hydro-electric power and of wind power.

[2 marks]

Hydro-electric power _____

Wind power _____

9