AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Physics Paper 1F

Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:
- a ruler
- a scientific calculator
- the Physics Equations Sheet (enclosed).

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

Information
- The maximum mark for this paper is 70.
- 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.

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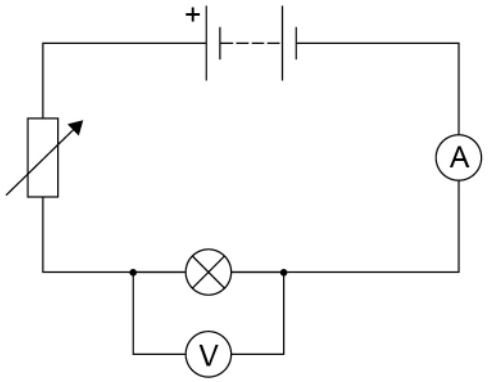
0 1 A student investigated how the potential difference across a filament lamp affects the current in the lamp.

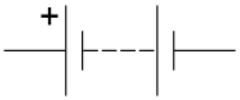
Figure 1 shows the circuit the student used.

Figure 1



0 1 . 1 **Figure 2** shows a circuit symbol.

Figure 2



What component does the symbol represent?

[1 mark]

Tick (✓) **one** box.

Ammeter ☐

Battery ☐

Lamp ☐

Variable resistor ☐

Do not write outside the box

0 1 . 2 Which component from **Figure 1** did the student use to adjust the potential difference across the lamp?

[1 mark]

---

0 1 . 3 When the voltmeter was **not** connected to the circuit it gave a reading of 0.4 volts.

How can the student correct all the readings taken from the voltmeter?

[1 mark]

Tick (✓) **one** box.

Add 0.4 volts to each reading ☐

Divide each reading by 0.4 volts ☐

Multiply each reading by 0.4 volts ☐

Subtract 0.4 volts from each reading ☐

Question 1 continues on the next page

Do not write outside the box

0 1 . 4 The student recorded three values of current for each potential difference.

Table 1 shows the results for 2.5 volts.

Table 1

Potential difference in volts	Current in amps		
	1	2	3
2.5	0.54	0.58	0.53

Calculate the mean current in the lamp.

[2 marks]

Mean current = _____ A

0 1 . 5 Calculate the power of the lamp when the potential difference across the lamp was 4.8 V

The current in the lamp was 0.75 A

Use the equation:

power = potential difference × current

[2 marks]

Power = _____ W

Do not write outside the box

0 1 . 6 Calculate the resistance of the lamp when the potential difference across the lamp was 4.8 V

The current in the lamp was 0.75 A

Use the equation:

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

[2 marks]

Resistance = _____ Ω

0 1 . 7 Complete the sentence.

Choose answers from the box.

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

[2 marks]

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

Increasing the current in a filament lamp makes the temperature

of the lamp _____ and the

resistance of the lamp _____ .

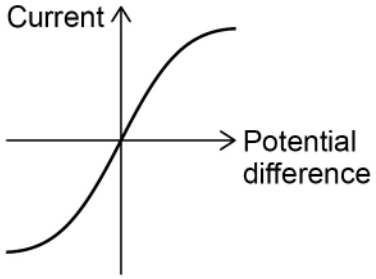
Question 1 continues on the next page

Do not write outside the box

0 1 . 8 Which graph shows the relationship between potential difference and current for a filament lamp?

[1 mark]

Tick (✓) **one** box.



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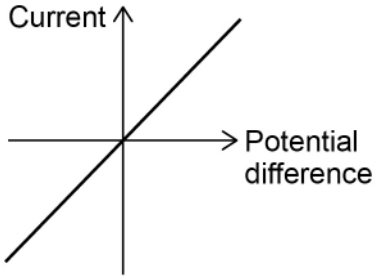

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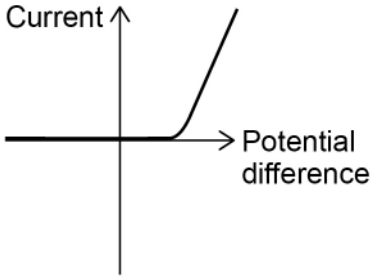

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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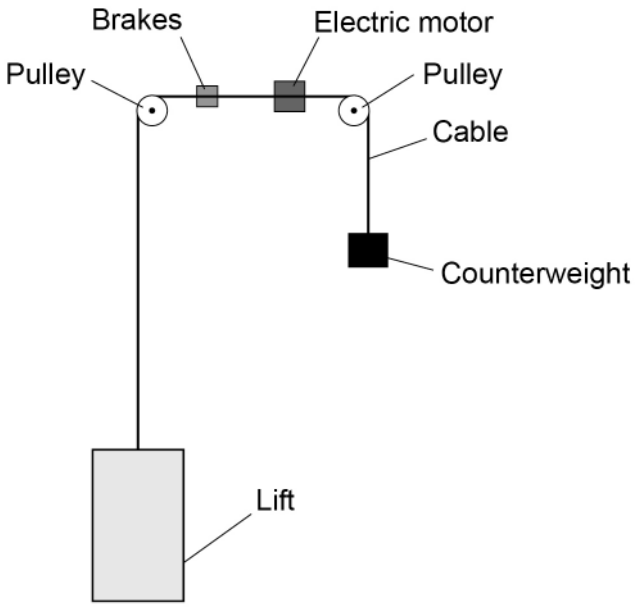
0 2 **Figure 3** shows a lift near the bottom of a building.

The lift is attached by a cable to a counterweight.

An electric motor moves the lift.

The lift is moving up.

Figure 3



0 2 . 1 As the lift moves up, how far does the counterweight move down?

[1 mark]

Tick (✓) **one** box.

A shorter distance than the lift. ☐

The same distance as the lift. ☐

A longer distance than the lift. ☐

Do not write outside the box

0 2 . 2 What happens to the gravitational potential energy of the counterweight as it moves down?

[1 mark]

Tick (✓) **one** box.

It decreases ☐

It stays the same ☐

It increases ☐

0 2 . 3 Calculate the change in gravitational potential energy of the lift when it moves up 4.0 m

The mass of the lift is 1300 kg

gravitational field strength = 9.8 N/kg

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Change in gravitational potential energy = _____ J

Question 2 continues on the next page

Do not write outside the box

0 2 . 4 Complete the sentences.

Choose answers from the box.

[2 marks]

chemical	**elastic potential**	**gravitational potential**
internal		**kinetic**

Friction between the brakes and the cable causes the speed of the lift to decrease.

As the speed decreases, there is a decrease in the _____ energy of the lift.

As the speed decreases, there is an increase in the _____ energy of the brakes.

0 2 . 5 The motor transfers different amounts of energy each time people use the lift.

Which factors affect the amount of energy transferred by the motor as the lift moves?

[2 marks]

Tick (✓) **two** boxes.

- The distance moved by the lift ☐
- The height of the building ☐
- The length of the steel cable ☐
- The maximum power of the motor ☐
- The weight of the people in the lift ☐

Do not write outside the box

0 2 . 6 The weight of the lift and the counterweight stretch the cable by 0.015 m

The cable acts like a spring with a spring constant of 880 000 N/m

Calculate the elastic potential energy of the stretched cable.

Use the equation:

$$\text{elastic potential energy} = 0.5 \times \text{spring constant} \times (\text{extension})^2$$

[2 marks]

Elastic potential energy = _____ J

0 2 . 7 A lift system using a counterweight is more efficient than a lift system that does not use a counterweight.

How does having a more efficient system affect the energy transferred by the motor?

[1 mark]

Tick (✓) **one** box.

- Less energy is transferred. ☐
- The same amount of energy is transferred. ☐
- More energy is transferred. ☐

11

Turn over for the next question

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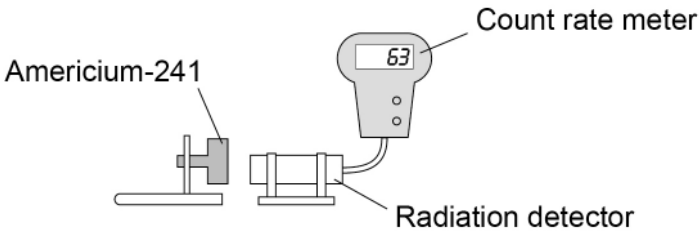
0 3 A teacher demonstrated that the radioactive isotope americium-241 emits alpha particles.

Figure 4 shows the equipment used.

Figure 4



0 3 . 1 An americium-241 nucleus (Am) emits an alpha particle and turns into a neptunium nucleus (Np).

Which is the correct nuclear equation for this decay?

Tick (✓) **one** box.

[1 mark]

$^{241}_{95}Am \longrightarrow {}^{237}_{93}Np + {}^{4}_{2}He$ ☐

$^{241}_{95}Am \longrightarrow {}^{245}_{93}Np + {}^{4}_{2}He$ ☐

$^{241}_{95}Am \longrightarrow {}^{237}_{97}Np + {}^{4}_{2}He$ ☐

0 3 . 2 What is the furthest distance that alpha radiation can travel in air?

Tick (✓) **one** box.

[1 mark]

A few millimetres ☐

A few centimetres ☐

A few metres ☐

Do not write outside the box

0 3 . 3 The teacher placed a piece of paper between the americium-241 and the radiation detector.

The reading on the count rate meter decreased by a large amount.

Why does the decreased reading show that americium-241 emits alpha radiation?

Tick (✓) **one** box.

[1 mark]

Paper stops alpha radiation. ☐

Paper stops all types of radiation. ☐

Paper stops beta and gamma radiation. ☐

The teacher replaced the americium-241 with a source of beta radiation.

0 3 . 4 Which symbol represents a beta particle?

[1 mark]

Tick (✓) **one** box.

$^{0}_{-1}e$ ☐

$^{0}_{0}e$ ☐

$^{-1}_{-1}e$ ☐

$^{-1}_{0}e$ ☐

Question 3 continues on the next page

Do not write outside the box

0 3 . 5 The count rate from the source was 119 ± 7 counts per second.

Calculate the smallest count rate this could have been.

[1 mark]

Smallest count rate = _____ counts per second

A teacher investigated how the distance between a different radioactive source and the detector affects the count rate.

0 3 . 6 Draw **one** line from each type of variable to the description.

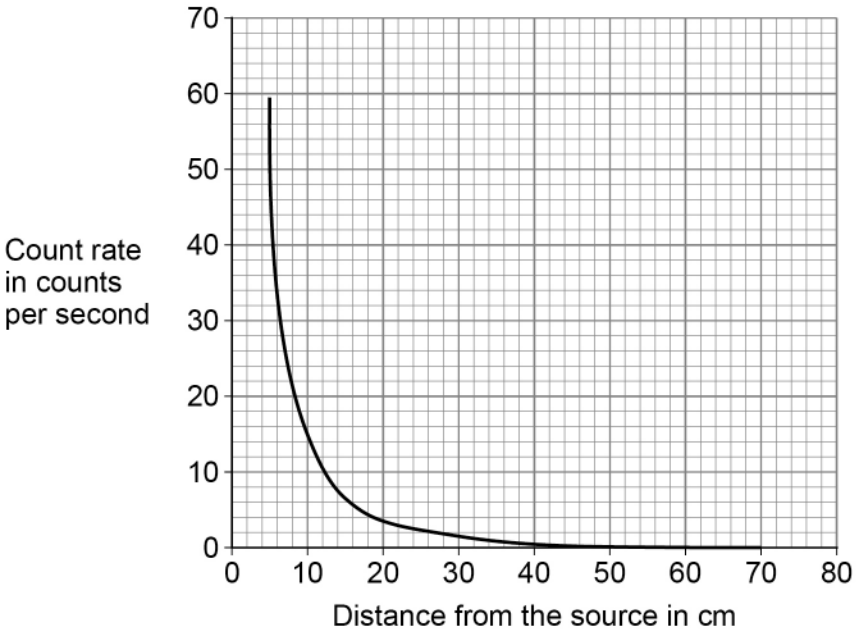
[3 marks]

Type of variable	**Description**
	Count rate
Control variable	
	Distance between the source and detector
Dependent variable	
	Radioactive source
Independent variable	
	Time

Do not write outside the box

0 3 . 7 **Figure 5** shows how the count rate from the different radioactive source changed with the distance from the source.

Figure 5



Describe the relationship between the distance from the source and the count rate.

[2 marks]

10

Turn over for the next question

0 4 **Figure 6** shows a swimmer wearing a wetsuit.

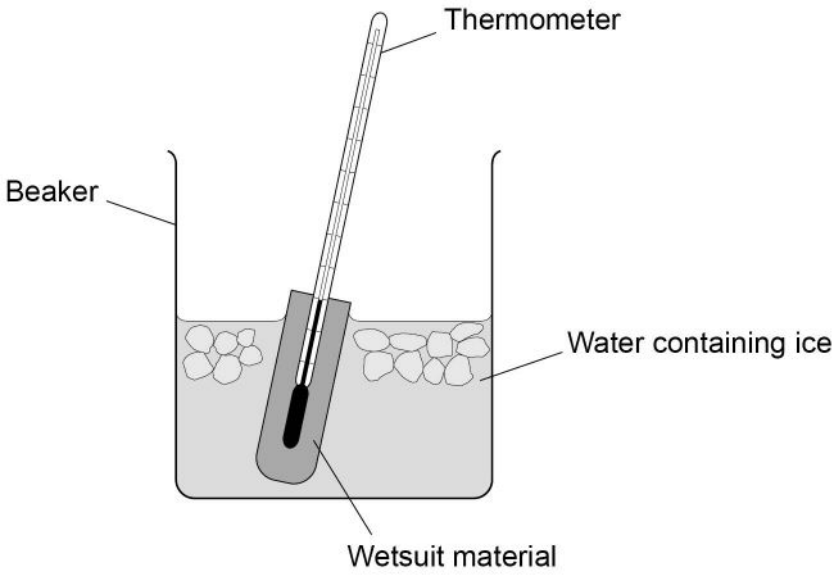
The wetsuit helps to keep the swimmer warm.

Figure 6

A student wrapped a thermometer in a piece of wetsuit material and placed the thermometer in water containing ice.

Figure 7 shows the apparatus.

Figure 7



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0 4 . 1 After 30 seconds in the water the temperature of the thermometer had decreased by 7.5 °C

Calculate the average decrease in temperature each second.

[2 marks]

Average decrease in temperature each second = _____ °C

Question 4 continues on the next page

Do not write outside the box

The student recorded the temperature of the thermometer after 30 seconds for four materials. Each piece of material was the same size and thickness.

In each test the starting temperature of the thermometer was 21.0 °C

Table 2 shows the results.

Table 2

Material	W	X	Y	Z
Temperature in °C	13.5	8.0	16.0	12.0

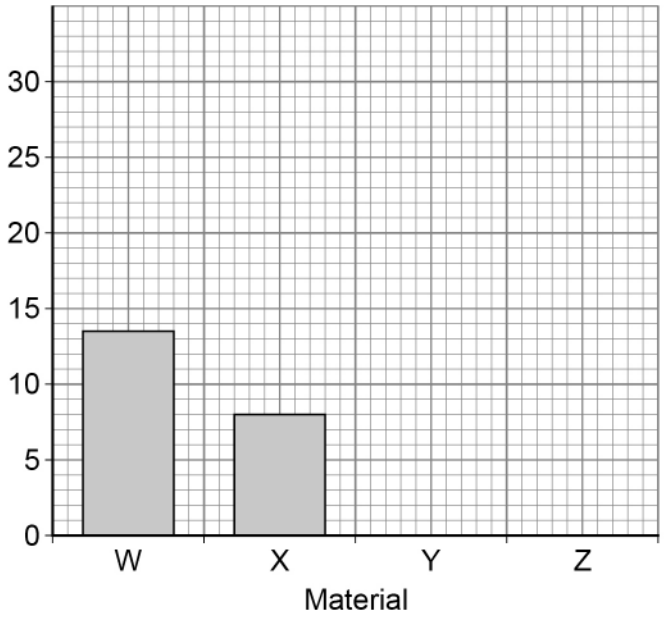
0 4 . 2 Complete **Figure 8** using the data in **Table 2**.

You should:

- label the *y*-axis
- draw the bars for materials Y and Z.

[2 marks]

Figure 8



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0 4 . 3 Which material is the best thermal insulator?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

W ☐ **X** ☐ **Y** ☐ **Z** ☐

Reason _____

_____

0 4 . 4 The student tested a new material with a greater thermal conductivity than material Z.

The piece of new material was the same size and thickness as the piece of material Z.

What was the temperature of the thermometer after 30 seconds?

[1 mark]

Tick (✓) **one** box.

Less than 12.0 °C ☐

Exactly 12.0 °C ☐

Greater than 12.0 °C ☐

Question 4 continues on the next page

Do not write outside the box

0 4 . 5 During the investigation 0.0150 kg of the ice melted. The temperature of the water and ice did not change.

specific latent heat of fusion of ice = 334 000 J/kg

Calculate the energy needed to melt the ice.

Use the equation:

energy to melt the ice = mass × specific latent heat

[2 marks]

Energy needed to melt the ice = _____ J

The student wanted to determine the density of a wetsuit material.

The student measured the length of one side of a cube of wetsuit material with:

- a micrometer
- a ruler.

Table 3 shows the results.

Table 3

Equipment	Length in cm		
	Measurement 1	**Measurement 2**	**Measurement 3**
Micrometer	0.581	0.557	0.576
Ruler	0.6	0.6	0.6

Do not write outside the box

0 4 . 6 Complete the sentence.

Choose the answer from the box.

[1 mark]

calibration	**precision**	**reproducibility**	**resolution**

The results show that compared to the ruler the micrometer has a higher

_____ .

Use the Physics Equations Sheet to answer questions **04.7** and **04.8**.

0 4 . 7 Write down the equation that links density (ρ), mass (m) and volume (V).

[1 mark]

_____

_____

0 4 . 8 The student calculated the volume of the cube of wetsuit material to be 0.186 cm^3

The density of the cube was 0.300 g/cm^3

Calculate the mass of the cube.

Give your answer in grams.

[3 marks]

_____

_____

_____

_____

_____

_____

Mass = _____ g

14

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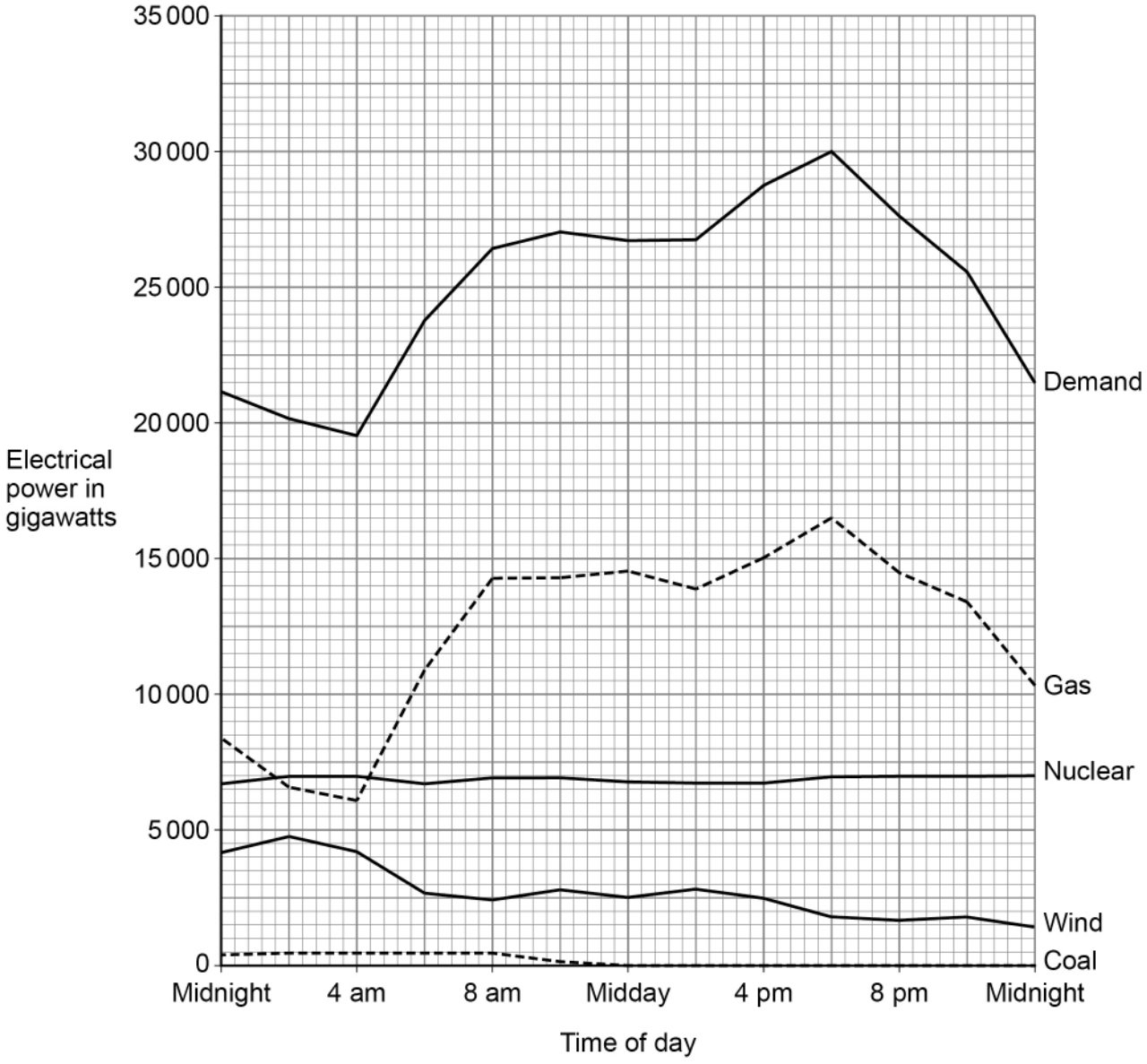
0 5 **Figure 9** shows some of the energy resources used to meet the demand for electrical power in the UK on one day in 2020.

Figure 9



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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

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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

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Turn over for the next question

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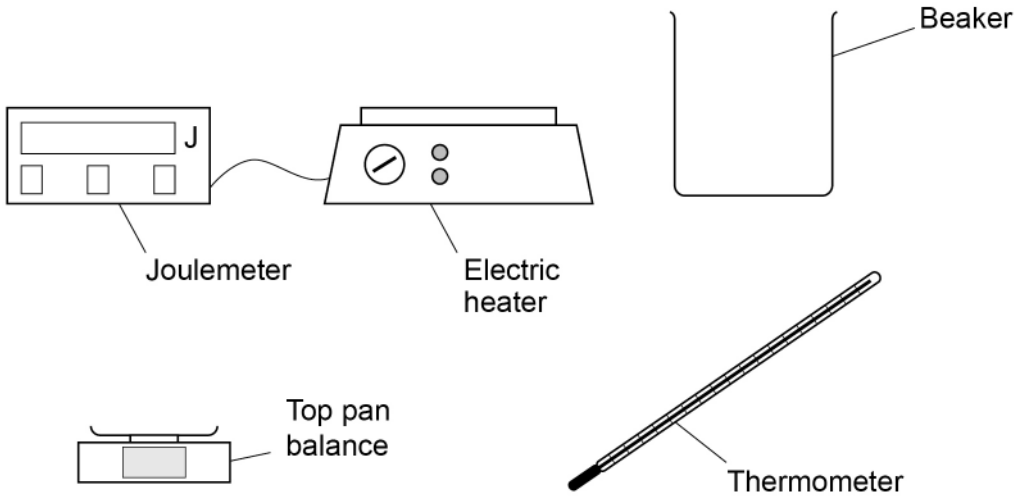
0 6 A student made measurements to determine the specific heat capacity of vegetable oil.

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]

Do not write outside the box

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

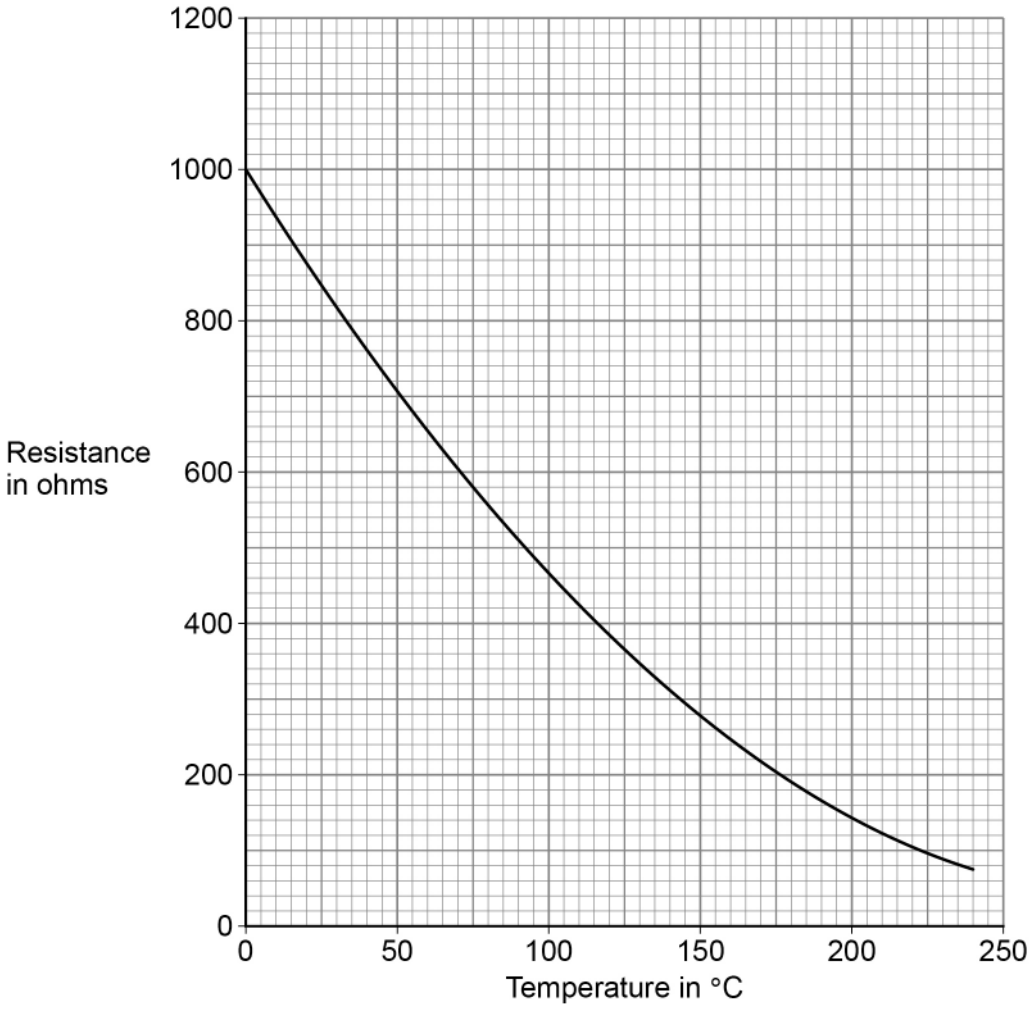
Do not write outside the box

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?

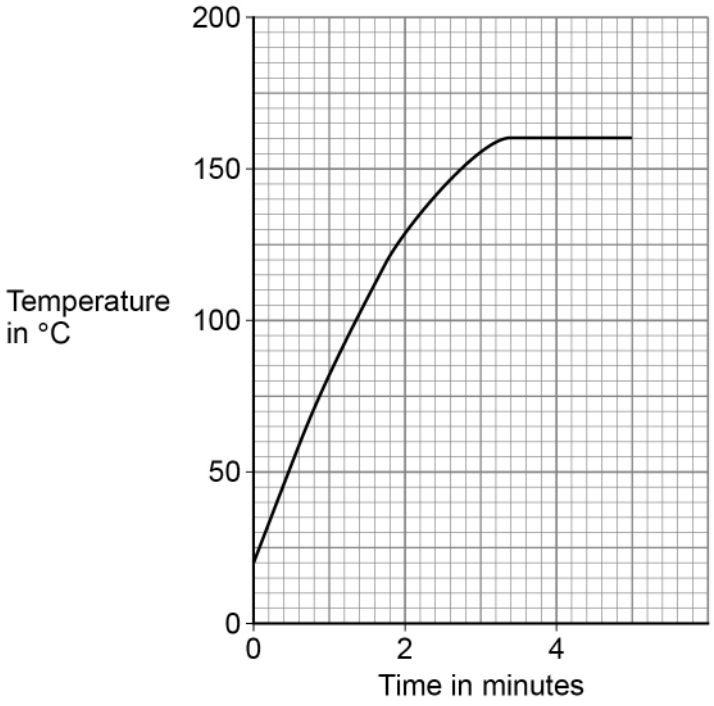
[1 mark]

Do not write outside the box

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

Do not write outside the box

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

END OF QUESTIONS

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