A

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE

COMBINED SCIENCE: TRILOGY

Higher Tier

Physics Paper 1H

H

8464/P/1H

Time allowed: 1 hour 15 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

JUN228464P1H01

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 be used for drawing.**
- **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.**

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.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

0 1

FIGURE 1, on the opposite page, shows some of the energy resources used to meet the demand for electrical power in the UK on one day in 2020.

The key for FIGURE 1 is provided below.

KEY

1 = Demand

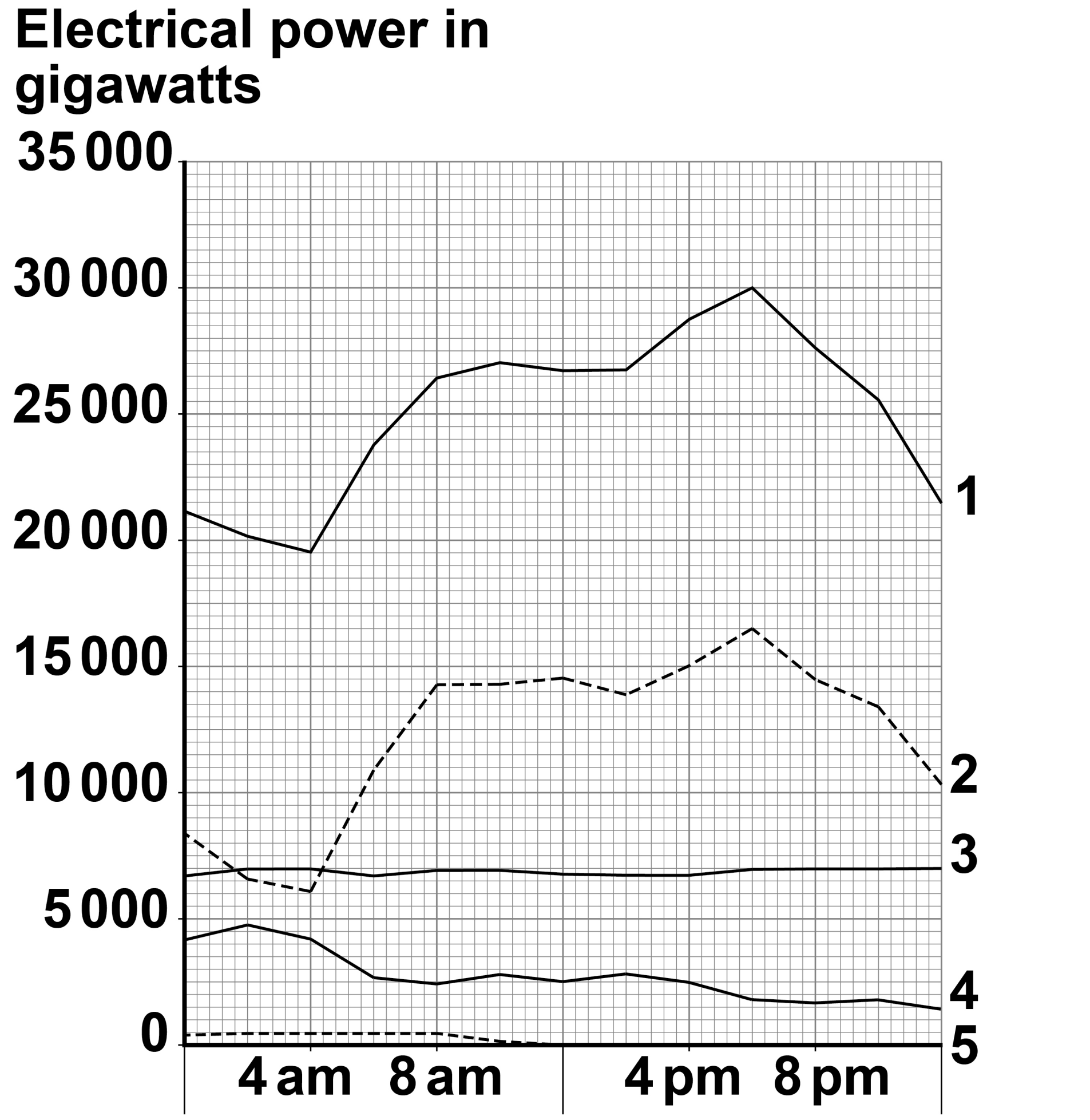
2 = Gas

3 = Nuclear

4 = Wind

5 = Coal

FIGURE 1



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0 1 . 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 = _____ %

[Turn over]

0 1 . 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**

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

0 1 . 3

What is this network called? [1 mark]

0 1 . 4

Explain how using step-up transformers makes the network efficient. [3 marks]

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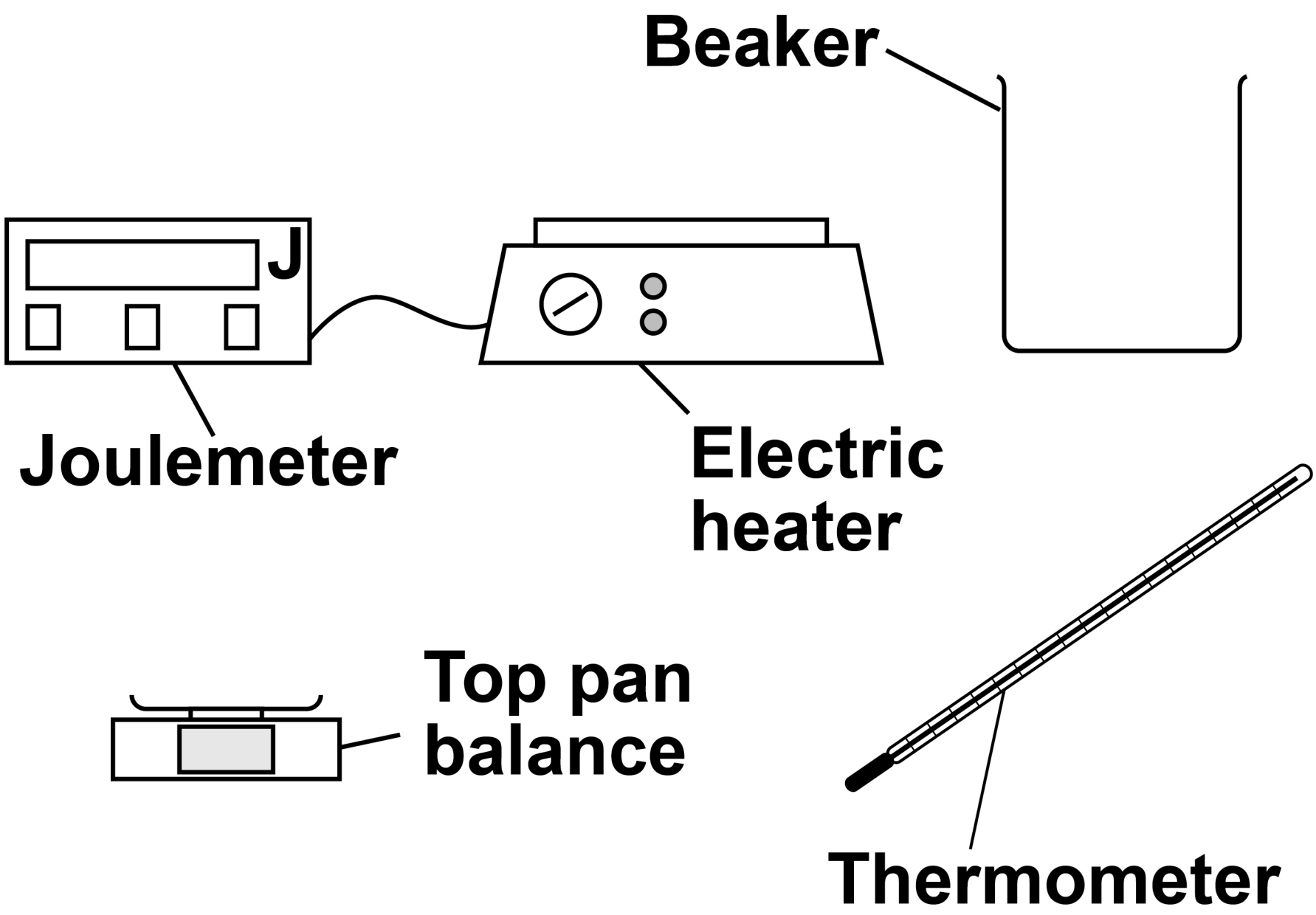
[Turn over]

0 2

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

FIGURE 2 shows the equipment used.

FIGURE 2



0 2 . 1

Describe how the student could use the equipment shown in FIGURE 2 to determine the specific heat capacity of vegetable oil. [6 marks]

0 2 . 2

Give ONE risk when using the equipment in FIGURE 2, on page 12. [1 mark]

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[Turn over]

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 02.3 and 02.4.

0 2 . 3

Write down the equation linking energy transferred (*E*), power (*P*) and time (*t*). [1 mark]

0 2 . 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

[Turn over]

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

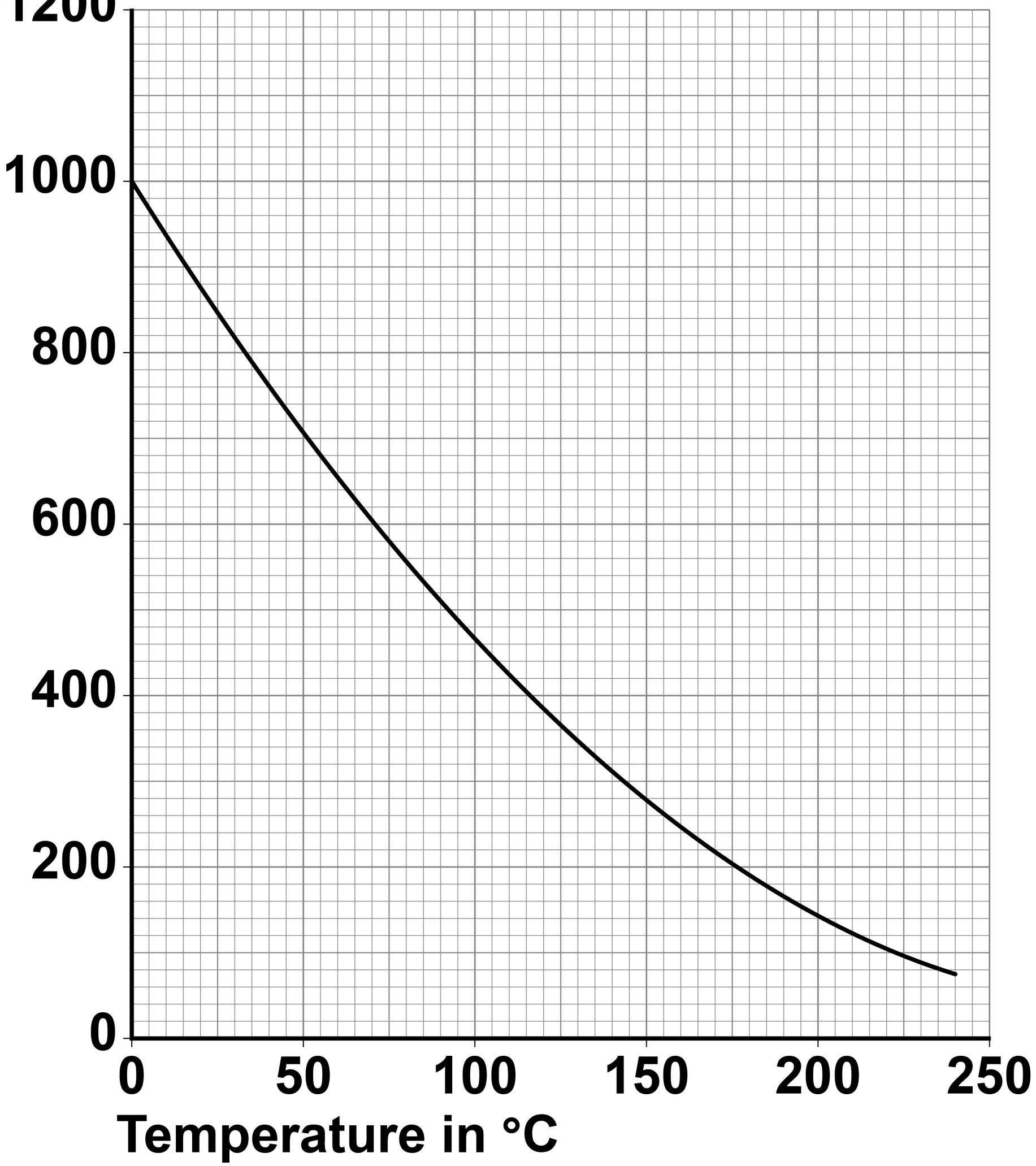
The deep fryer contains an electrical component to monitor the temperature of the vegetable oil.

FIGURE 3, on the opposite page, shows how the resistance of this electrical component changes with temperature.

0 2 . 5

What electrical component is used to monitor the temperature of the vegetable oil? [1 mark]

FIGURE 3



[Turn over]

0 2 . 6

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

FIGURE 4, on page 22, shows how the temperature of the vegetable oil changed after the deep fryer was switched on.

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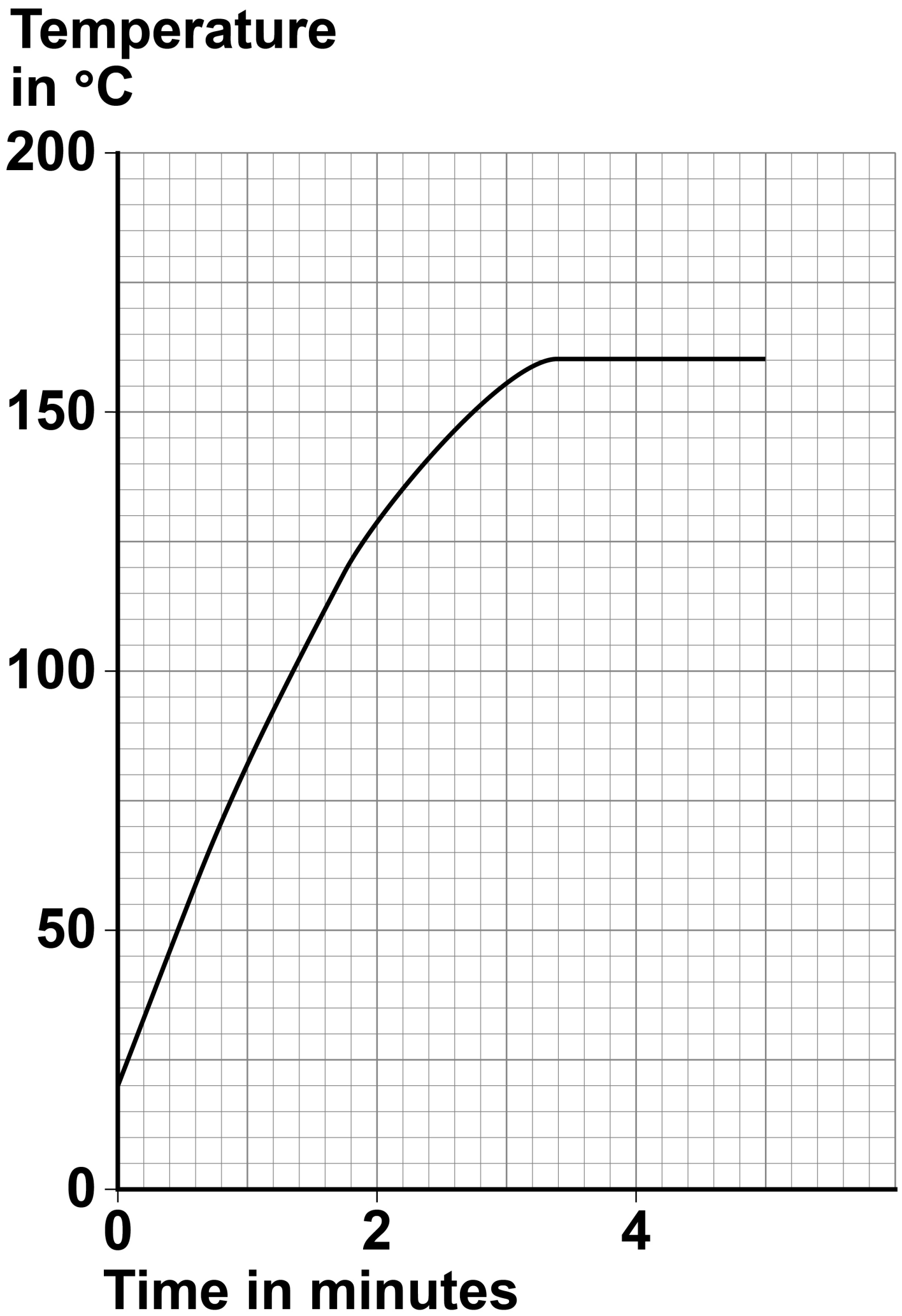
[Turn over]

FIGURE 4



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

Use FIGURE 3, on page 19, and FIGURE 4, on the opposite page.
[2 marks]

Resistance = **Ω**

0 2 . 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.**

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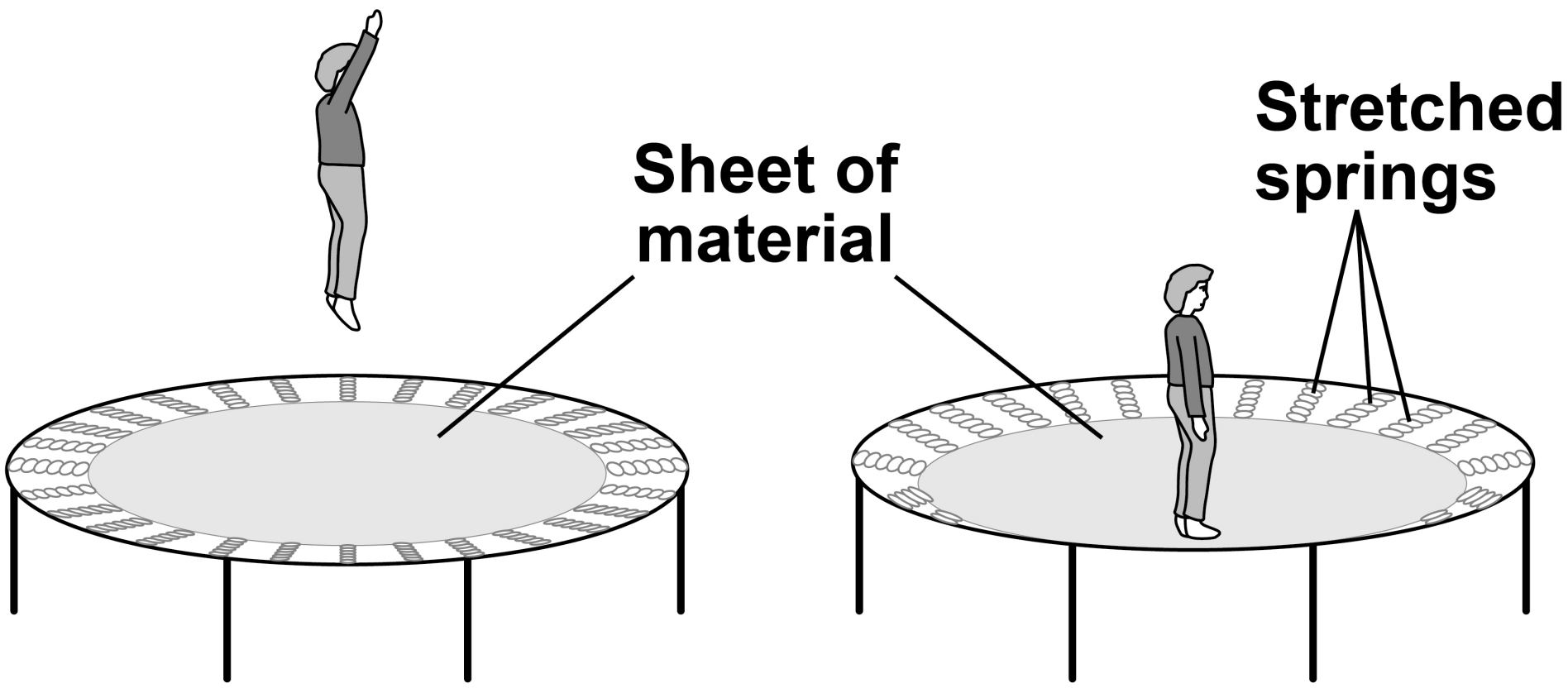
[Turn over]

0 3

A trampoline is made from a sheet of material held in place by stretched springs.

FIGURE 5 shows a child on a trampoline.

FIGURE 5



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[Turn over]

0 3 . 1

Position A shows the child's maximum height above the trampoline.

Position B shows the lowest position reached by the child when landing on the trampoline.

Describe the changes to the stores of energy of the:

- **child**
- **springs**
- **surroundings**

as the child moves from position A to position B. [4 marks]

Child _____

_____

_____

_____

Springs

Surroundings

[Turn over]

0 3 . 2

When the child is at position A, each trampoline spring is stretched by 0.056 m

The elastic potential energy of each spring is 4.9 J

When the child is at position B, the elastic potential energy of each spring increases to 8.1 J

Calculate the extension of each spring when the child is at position B.

Use the Physics Equations Sheet.

[5 marks]

Extension = _____ m

[Turn over]

0 3 . 3

As the child bounces on the trampoline the child does work.

What is the work done by the child equal to? [1 mark]

Tick (✓) ONE box.

☐ **The average force applied by the child**

☐ **The maximum force applied by the child**

☐ **The total energy store of the child**

☐ **The total energy transferred by the child**

10

0 4

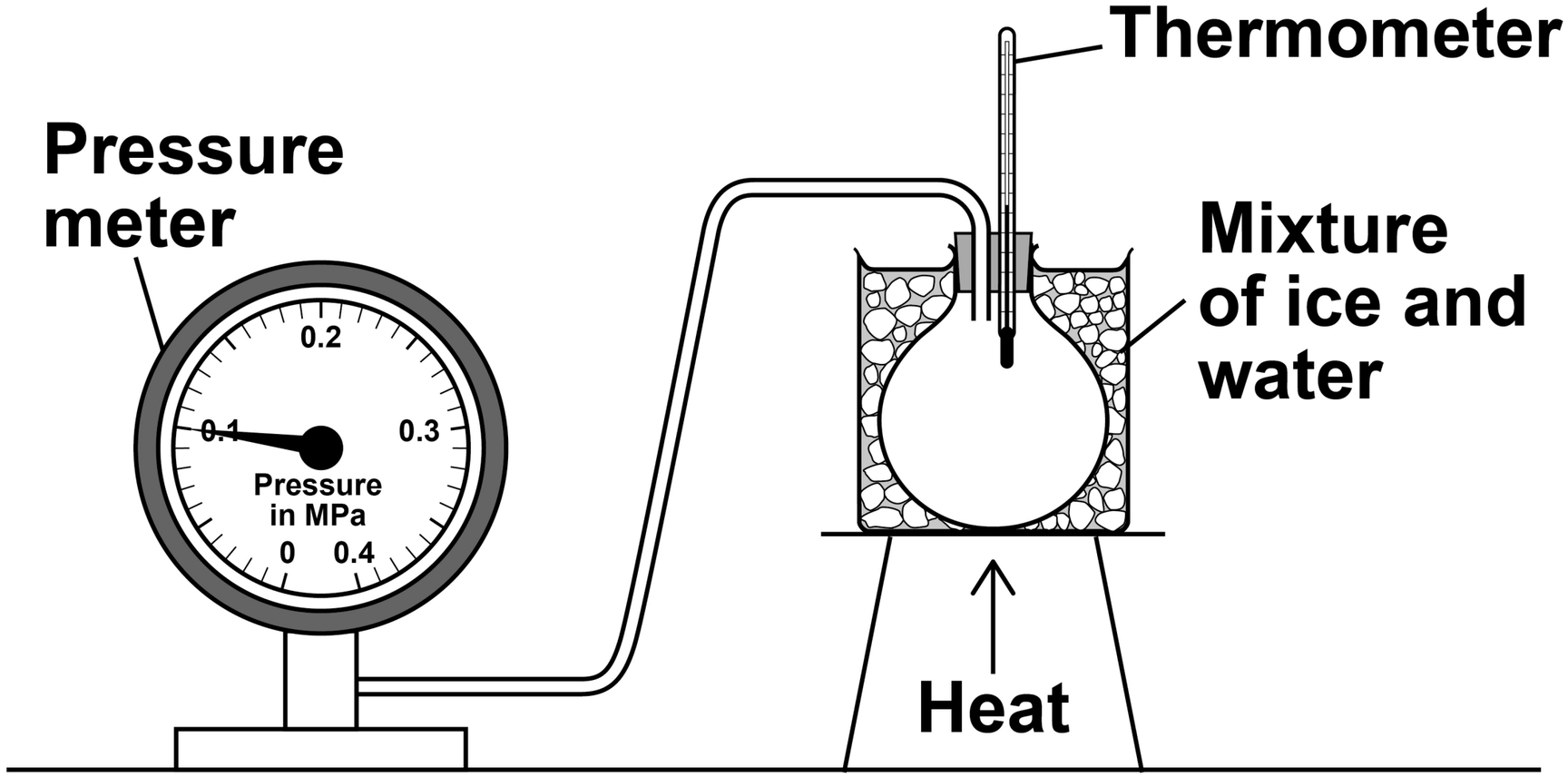
A student investigated how the pressure of a gas depends on its temperature.

The volume of the gas did NOT change.

FIGURE 6, on page 34, shows the equipment used.

[Turn over]

FIGURE 6


Pressure meter
0.2
0.1
0.3
Pressure in MPa
0
0.4
Thermometer
Mixture of ice and water
Heat

0 4 . 1

Pressure is sometimes measured in units called atmospheres.

1 atmosphere is 10^5 pascals (Pa).

What is 1 atmosphere in kilopascals (kPa)? [1 mark]

1 atmosphere = _____ kPa

0 4 . 2

The student took four pressure readings for each temperature.

TABLE 1 shows the pressure readings when the temperature was 50.0 °C

TABLE 1

Temperature in °C	Pressure in MPa			
	1	2	3	4
50.0	0.115	0.120	0.121	0.116

Calculate the uncertainty in the mean pressure. [2 marks]

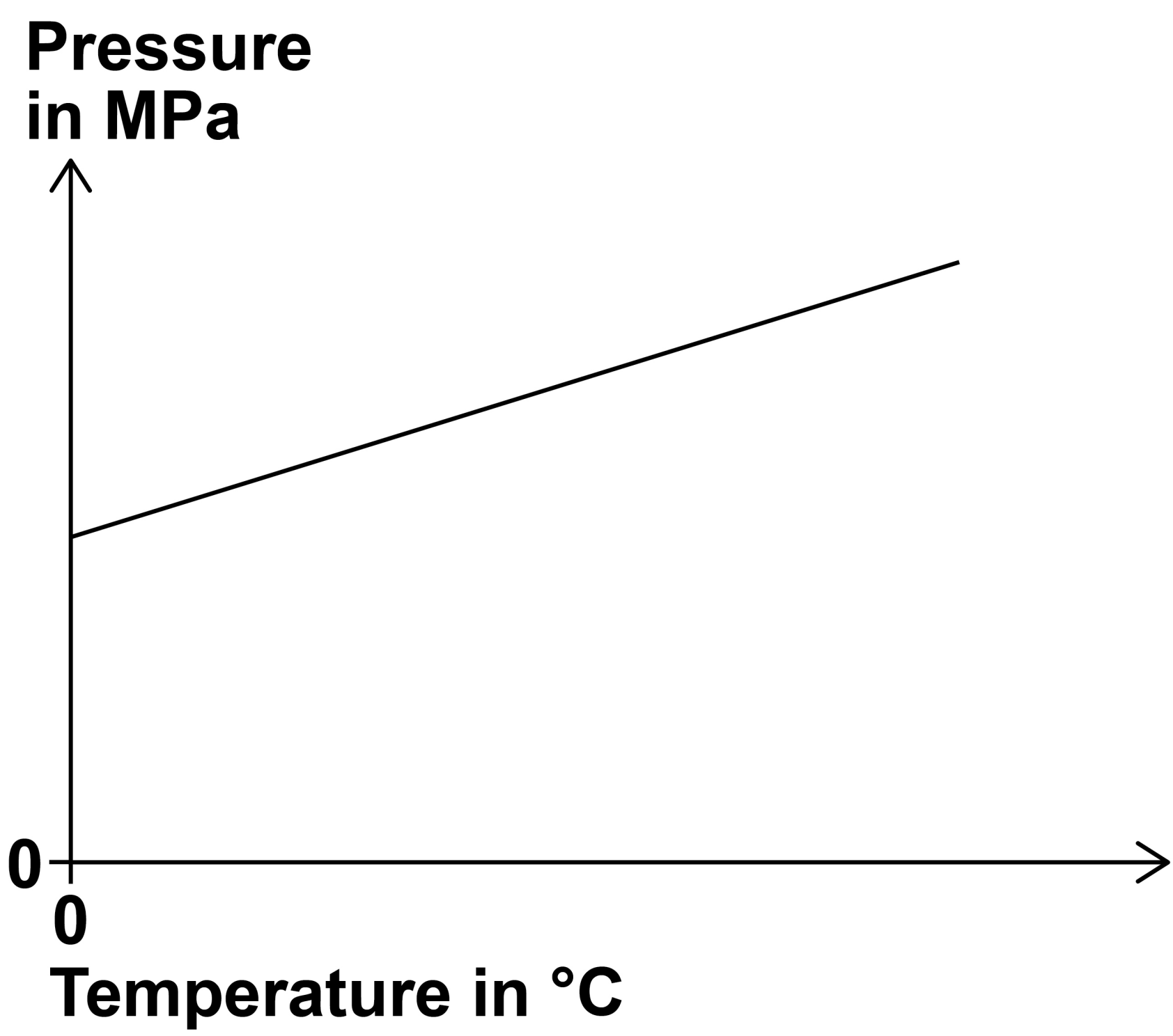
Uncertainty = ± _____ MPa

[Turn over]

0 4 . 3

FIGURE 7 shows a sketch graph of the results.

FIGURE 7



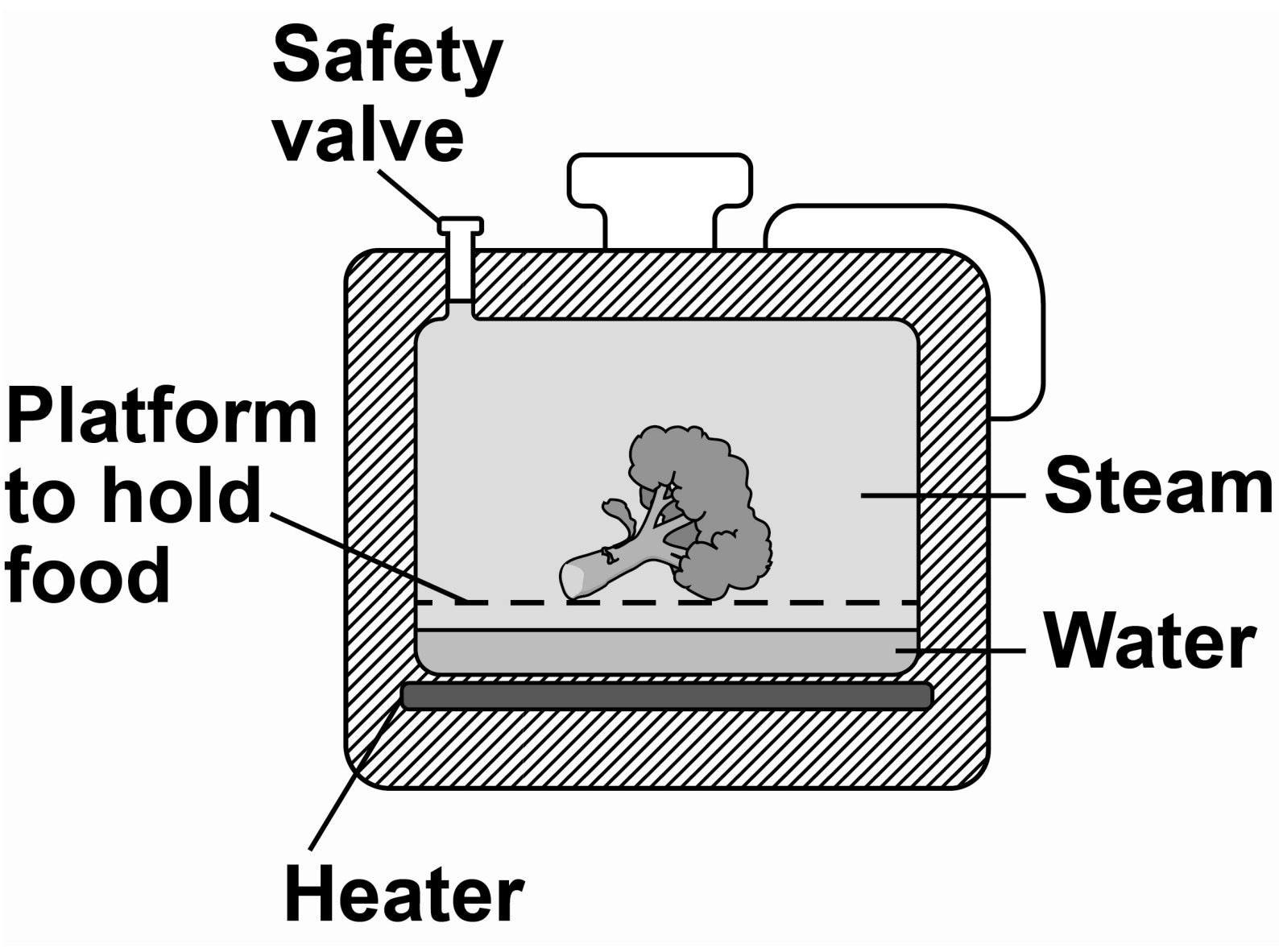
The student said that as the temperature increases the pressure increases.

Give a better description of the relationship between temperature and pressure. [1 mark]

A pressure cooker is a sealed pot that uses steam to cook food.

FIGURE 8 shows a pressure cooker.

FIGURE 8



0 4 . 4

When the water in the pressure cooker starts to boil:

- **the amount of steam in the pressure cooker increases**
- **the temperature of the steam increases above 100 °C**

Explain why these changes make the pressure in the cooker increase.
[5 marks]

0 4 . 5

If the pressure inside the pressure cooker becomes greater than 200 kPa then some of the steam is released through the safety valve.

The released steam expands as it moves into the atmosphere.

Explain how a change in density of the steam is caused by a change in the arrangement of particles in the steam as it is released. [3 marks]

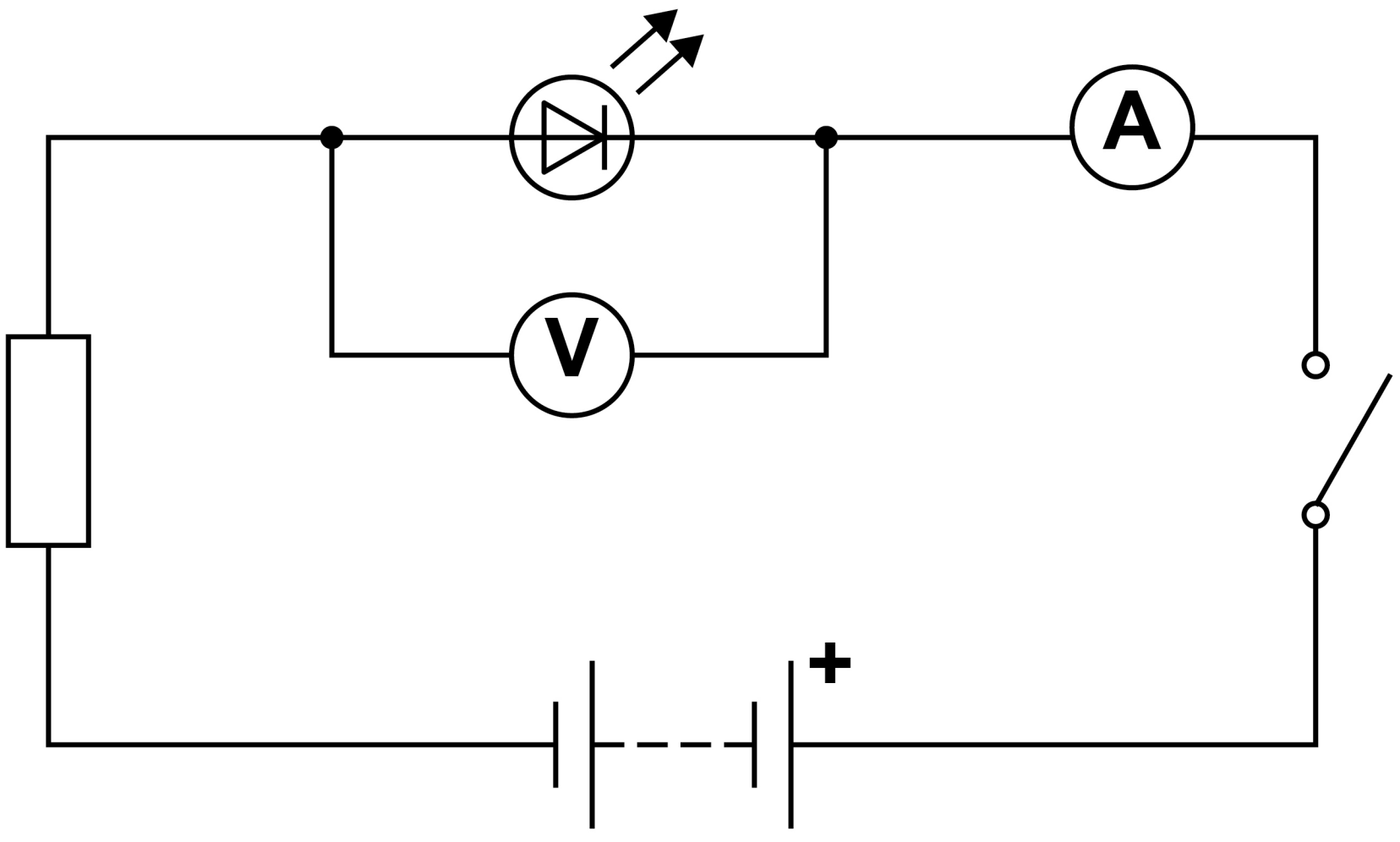
0 5

The camera in a mobile phone uses an LED to provide light when taking a photograph.

A student investigated how the potential difference across an LED varies with the current in it.

FIGURE 9 shows the circuit used.

FIGURE 9



0 5 . 1

The student closed the switch. The voltmeter gave a reading of 5.0 V

The ammeter gave a reading of 0 mA

The LED did not emit any light.

Explain how the student should have changed the circuit to make the LED emit light. [2 marks]

0 5 . 2

The student changed the circuit so that the LED emitted light.

The current in the circuit was 290 mA

The power of the LED was 0.98 W

Calculate the potential difference across the LED.

Use the Physics Equations Sheet.

Give your answer to 2 significant figures.
[5 marks]

Potential difference (2 significant figures) = _____ V

[Turn over]

A traditional camera uses a flash unit to provide light.

FIGURE 10 shows a flash unit on a traditional camera.

FIGURE 10

0 5 . 3

The flash unit emits light from xenon gas in a fluorescent tube.

What happens when a xenon atom emits light? [1 mark]

Tick (✓) ONE box.

- ☐ **Electrons in the atom fall to a lower energy level.**
- ☐ **Electrons in the atom move to a higher energy level.**
- ☐ **Electrons leave the atom, causing ionisation.**
- ☐ **Electrons transfer to the atom from the electrical circuit.**

0 5 . 4

When the flash unit is used there is a mean potential difference of 200 V across the fluorescent tube.

The flash of light lasts for 2.8×10^{-4} s 1.4 J of energy is transferred.

Calculate the mean current.

Use the Physics Equations Sheet.
[6 marks]

Mean current = _____ A

14

[Turn over]

0 6

A smoke detector contains a source of alpha radiation in a plastic case.

0 6 . 1

A source of beta radiation in a smoke detector would be more hazardous than a source of alpha radiation.

Explain why. [2 marks]

0 6 . 2

Actinium (Ac) is one source of alpha radiation.

An actinium (Ac) nucleus emits an alpha particle (α) and turns into a francium (Fr) nucleus.

This can be represented as:

$$^{A}_{Z}Ac \longrightarrow {}^{223}_{87}Fr + \alpha$$

Determine the values of A and Z.
[2 marks]

A = _____

Z = _____

[Turn over]

0 6 . 3

A teacher wanted to find out what nuclear radiation is emitted from a source.

The teacher placed different barriers between the source and a detector.

The teacher recorded the count for 30 seconds after each barrier was put in place.

TABLE 2 shows the results.

TABLE 2

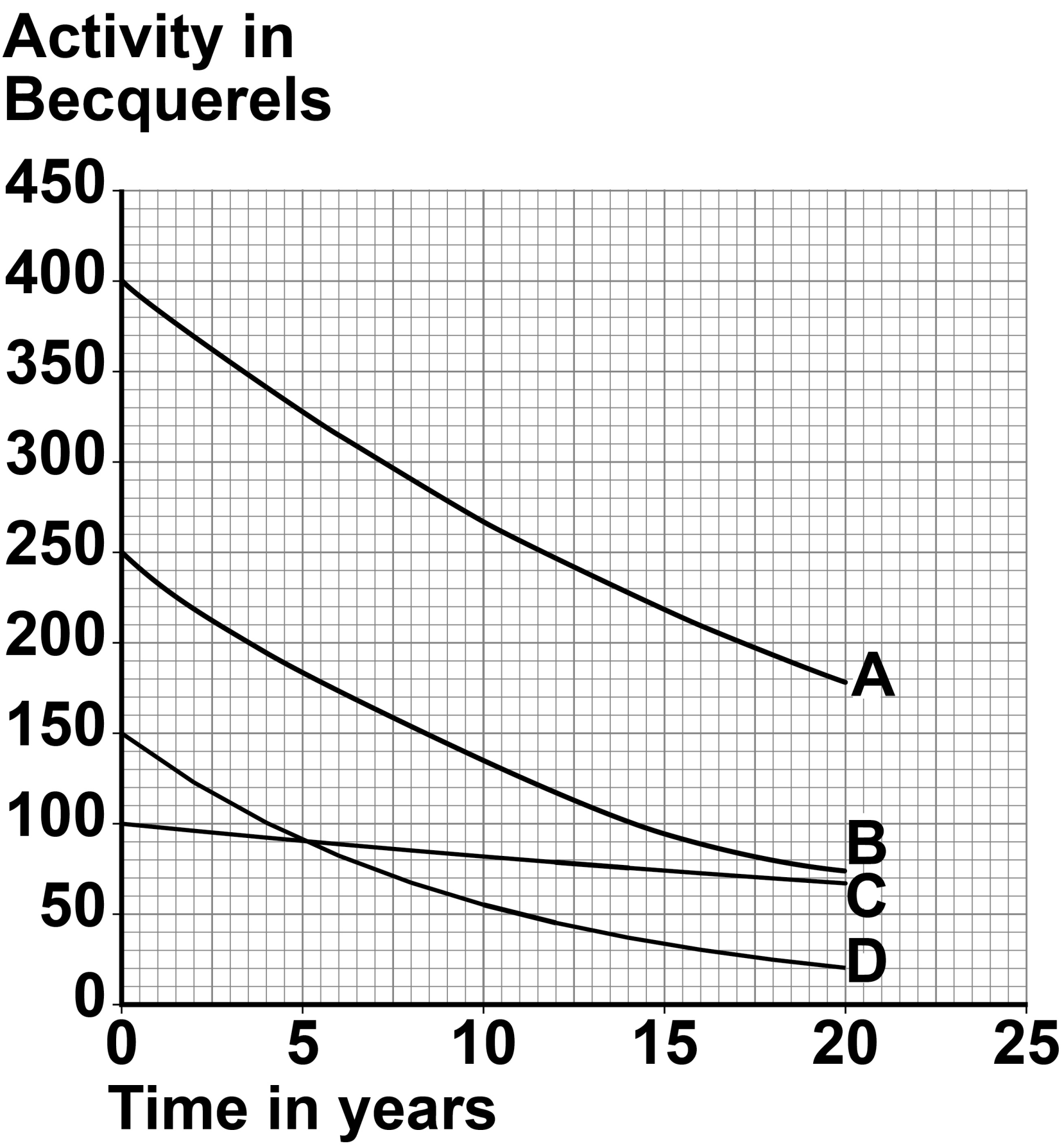
Barrier	Thickness in millimetres	Count after 30 seconds
None		985
Paper	0.1	149
Aluminium	5.0	0
Lead	20.0	0

Explain what nuclear radiation was emitted by the source. [4 marks]

0 6 . 4

FIGURE 11 shows how the activity of four different radioactive isotopes, A, B, C and D, changes over time.

FIGURE 11



Write the isotopes A, B, C and D in order of increasing stability of their nuclei.

Explain your answer. [3 marks]

LEAST STABLE _____ _____ _____ _____ **MOST STABLE**

Explanation _____

_____

_____

_____

_____

_____

_____

_____

_____

END OF QUESTIONS

11

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

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For Examiner's Use	
Question	Mark
1	
2	
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