OCR
Oxford Cambridge and RSA

Thursday 22 May 2025 – Morning

GCSE (9–1) Combined Science A (Gateway Science)

J250/05 Physics (Foundation Tier)

Time allowed: 1 hour 10 minutes

F

You must have:
- a ruler (cm/mm)
- the Equation Sheet for GCSE (9–1) Combined Science A (Physics) (inside this document)

You can use:
- a scientific or graphical calculator
- an HB pencil

Please write clearly in black ink. **Do not write in the barcodes.**

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

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*****).
- This document has **24** pages.

ADVICE
- Read each question carefully before you start your answer.

Section A

You should spend a **maximum** of **20 minutes** on this section.

Write your answer to each question in the box provided.

1 What is the best apparatus to measure the length of a school corridor?

A 30 cm ruler

B Metre ruler

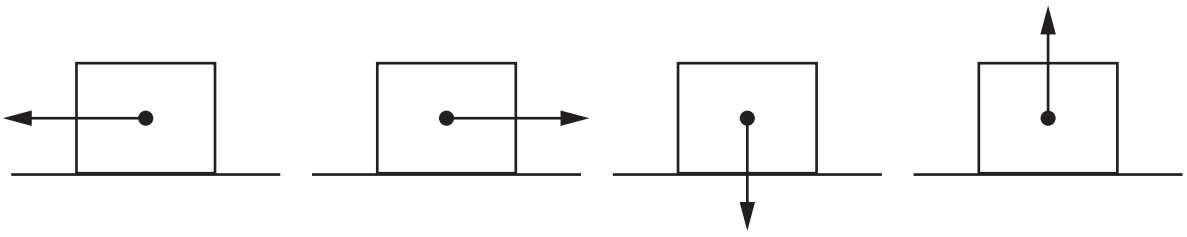
C Protractor

D Tape measure

Your answer ☐ **[1]**

2 A box is at rest on flat ground.

Which diagram shows the correct direction of the **normal contact force** acting on the box?



A **B** **C** **D**

Your answer ☐ **[1]**

3 A runner increases their velocity from 0 m/s to 8 m/s in 2 s.

What is their acceleration?

Use the equation: $\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$

A $0.25\,m/s^2$

B $0.33\,m/s^2$

C $3.0\,m/s^2$

D $4.0\,m/s^2$

Your answer ☐ **[1]**

4 What is an ammeter used to measure?

A Charge

B Current

C Potential difference

D Resistance

Your answer ☐ **[1]**

5 Density can be calculated using the equation: $\text{density} = \frac{\text{mass}}{\text{volume}}$

Which row of the table is correct?

	Mass (kg)	Volume (m^3)	Density (kg/m^3)
A	6.0	3.0	2.0
B	6.0	3.0	3.0
C	6.0	3.0	9.0
D	6.0	3.0	18.0

Your answer ☐ **[1]**

6 A 40 V power supply transfers 10 C of charge.

What is the energy transferred?

Use the equation: energy transferred = charge × potential difference

A 0.25 J

B 4.00 J

C 400 J

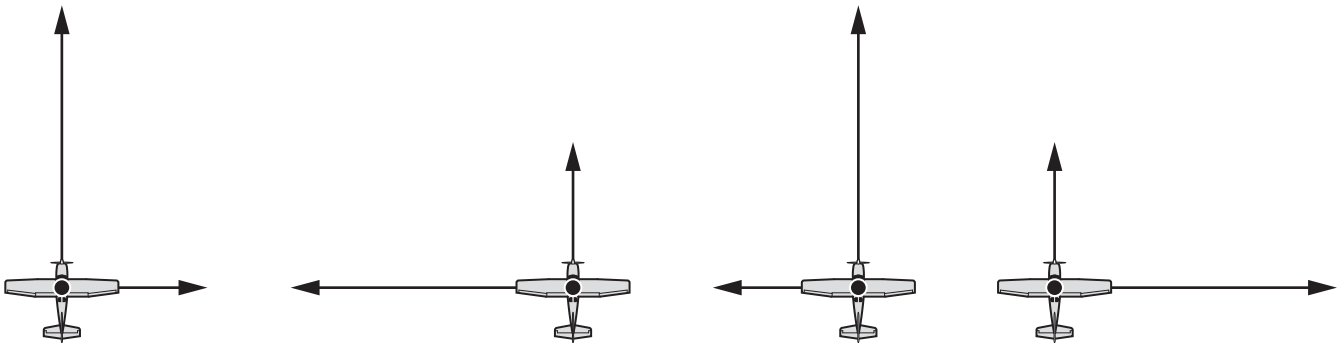
D 4000 J

Your answer ☐ **[1]**

7 The diagram shows an aeroplane moving forwards, looking from above.

There is a large forward force from its engines.
There is also a smaller sideways force from the wind, blowing to the right.

Which is the correct free body force diagram? (Ignore all other forces acting on the aeroplane.)



A **B** **C** **D**

Your answer ☐ **[1]**

8 Quantities such as distance, speed and velocity can be a scalar quantity or a vector quantity.

Which row of this table is correct?

	Distance	**Speed**	**Velocity**
A	scalar	vector	scalar
B	vector	scalar	vector
C	scalar	scalar	vector
D	vector	vector	scalar

Your answer ☐ **[1]**

9 A lamp is turned on for 100 s.

The charge flowing is 12 C.

The current is then **doubled**. The time the lamp is turned on is **doubled**.

What is the charge flowing now?

Use the equation: charge flow = current × time

A 6 C

B 12 C

C 24 C

D 48 C

Your answer ☐ **[1]**

10 A builder carries bricks to the top of the same ladder on four mornings.

All the bricks have the same mass.

On which morning does the builder use the most power?

Morning	Number of bricks carried	Time taken (s)
A	5	10
B	10	10
C	5	5
D	10	5

Your answer ☐ **[1]**

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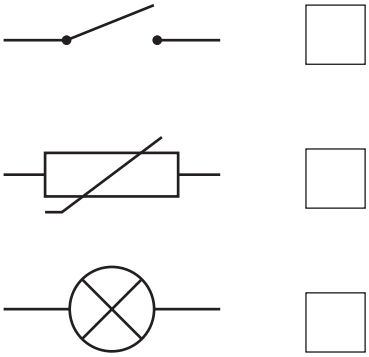
Section B

11 A **thermistor** has a resistance which changes with temperature.

(a) Which symbol is a thermistor?

Tick (✓) **one** box.

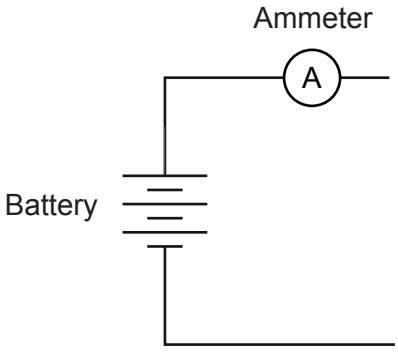


[1]

(b) A student determines the resistance of a thermistor using an ammeter and a voltmeter.

Complete the diagram to show a circuit they can use.

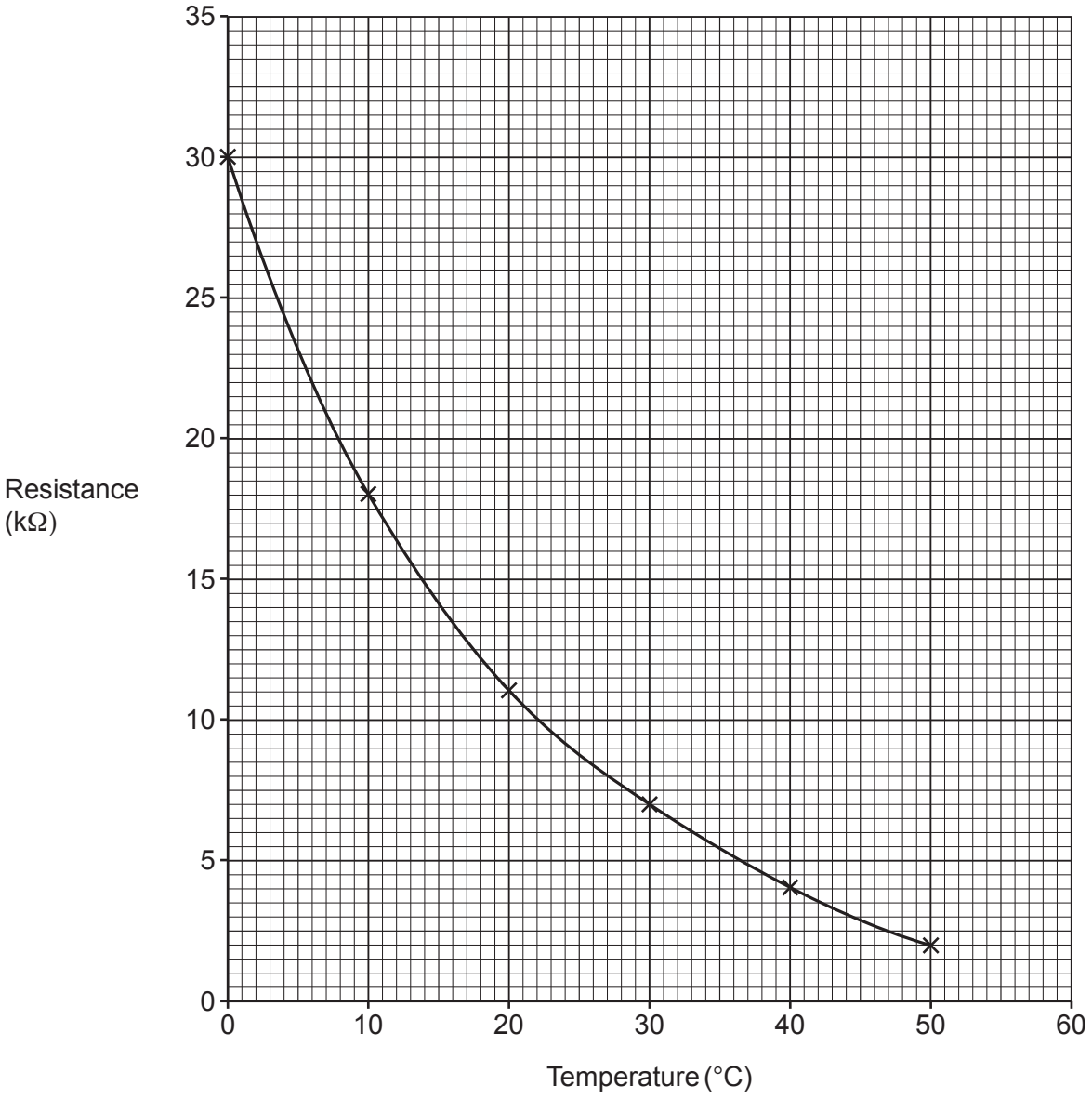
Diagram



[3]

(c) The student finds the resistance of the thermistor at several different temperatures.

The graph shows their results.



(i) Describe the trend between temperature and resistance.
Include data from the graph to support your answer.

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..... **[2]**

(ii) A thermistor is to be used in the range 20 °C to 40 °C.

Its resistance must change by at least 10 kΩ over this range.

Explain why this thermistor is **not** suitable?
Include data from the graph.

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..... **[2]**

(d) What component changes resistance when there is a change in **light level**?

..... **[1]**

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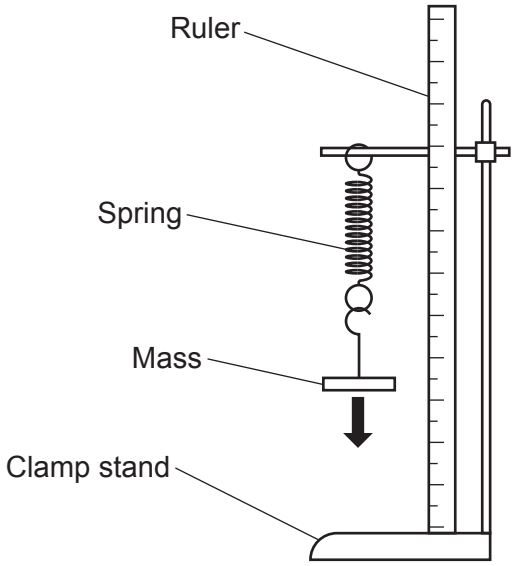
12 A student investigates a spring. They set up this apparatus.



(a) Explain how the student finds the **extension** of the spring.

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.....

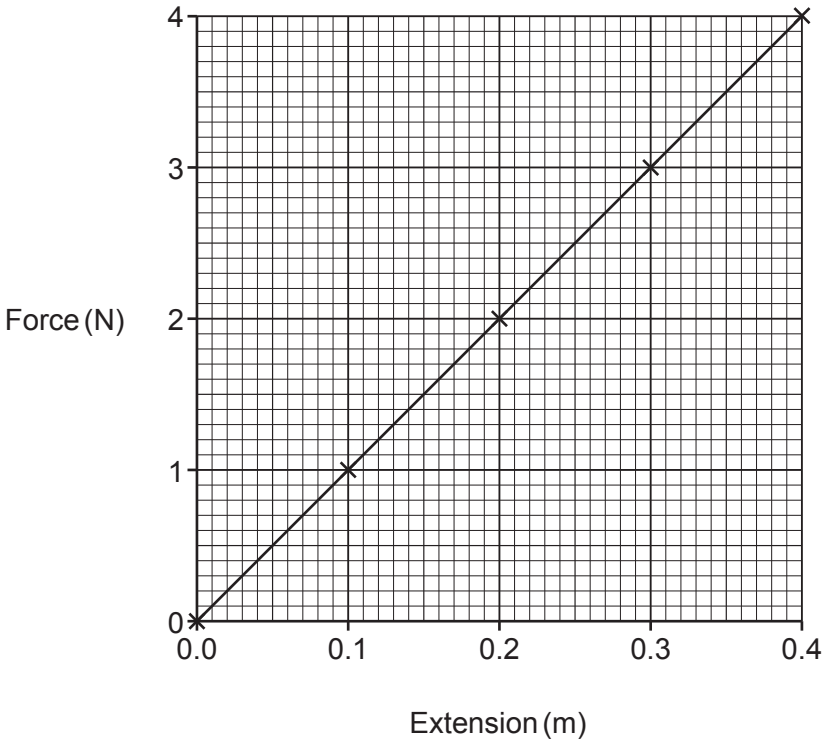
..... **[2]**

(b) When the mass is removed, the spring returns to its original length.

This behaviour is called ..... **[1]**

(c) The student measures the extension of the spring for four different forces.

They plot a graph of force against extension.



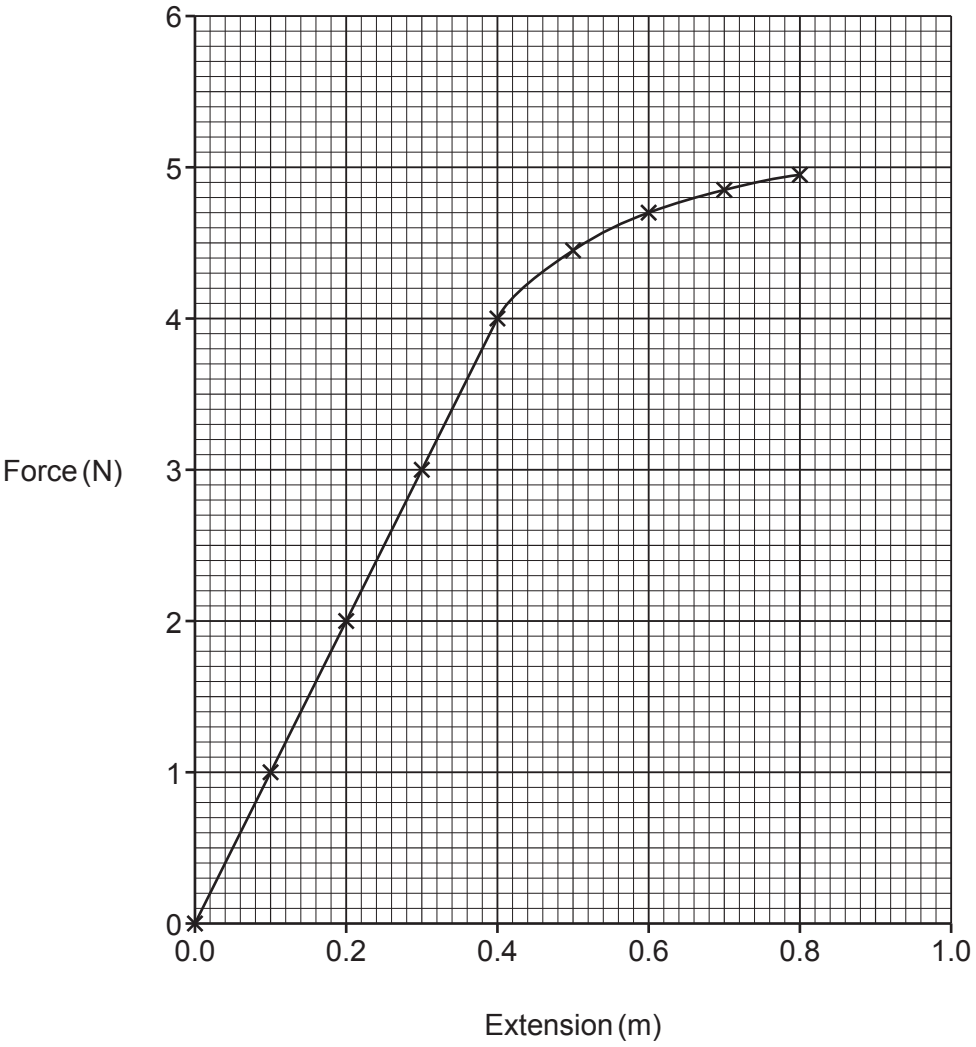
Use any point on the graph to calculate the spring constant for this spring.

Use the equation: force exerted by a spring = spring constant × extension

Spring constant = ... N/m **[3]**

(d) Another student does the experiment. They use more forces.

Here is a graph of their results.



What extra information about **the spring** can be found from this graph?

Tick (✓) **two** boxes.

The elastic limit can be found. ☐

The mean force applied can be found. ☐

It shows that Hooke's Law is not always obeyed. ☐

The maximum force applied can be found. ☐

It shows that the results are accurate. ☐

[2]

13 Cool packs are used to treat injuries by cooling the injured area.

Cool packs are stored in a freezer. The chemical they contain is solid in the freezer, but it melts on contact with warm skin.

(a) When the cool pack melts, the density of the chemical inside **decreases**.

Explain why the density **decreases**.

Use ideas about particles.

.....

.....

.....

..... **[2]**

(b) The cool pack contains 0.125 kg of a chemical with a specific latent heat of 425 000 J / kg.

Calculate the energy needed to **completely** melt the chemical in the cool pack.

Give your answer to **3** significant figures.

Use the Equation Sheet.

Energy = ... J **[4]**

(c) The table gives data on three chemicals which could be used in a cool pack.

Chemical	**A**	**B**	**C**
Melting point (°C)	60	0	–5
Specific latent heat (J / kg)	510 000	334 000	425 000

Explain why most cool packs use chemical **C**.

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.....

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..... **[2]**

14* Some air is in a closed container.

The table shows its pressure at two temperatures.

Temperature (°C)	2	100
Pressure (kN / m^2)	110	140

Explain how the pressure of the air changes.

Use ideas about the movement of particles.

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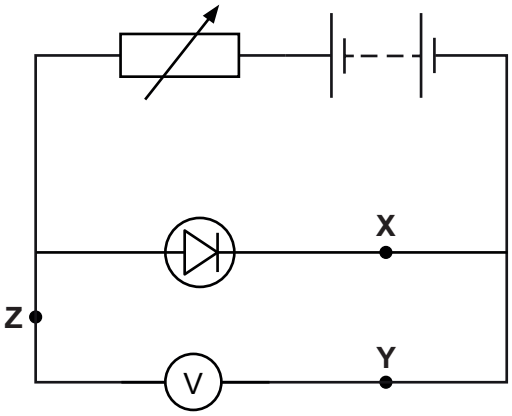
..... **[6]**

15 Student **A** is investigating the question:

'How does the potential difference across a diode affect the current through it?'

They set up this circuit.



(a) **One** component is missing from the circuit.

State the name of this component.

..... **[1]**

(b) Which position should this component be added?

Tick (✓) **one** box.

X ☐

Y ☐

Z ☐

[1]

(c) A variable resistor is placed next to the battery.

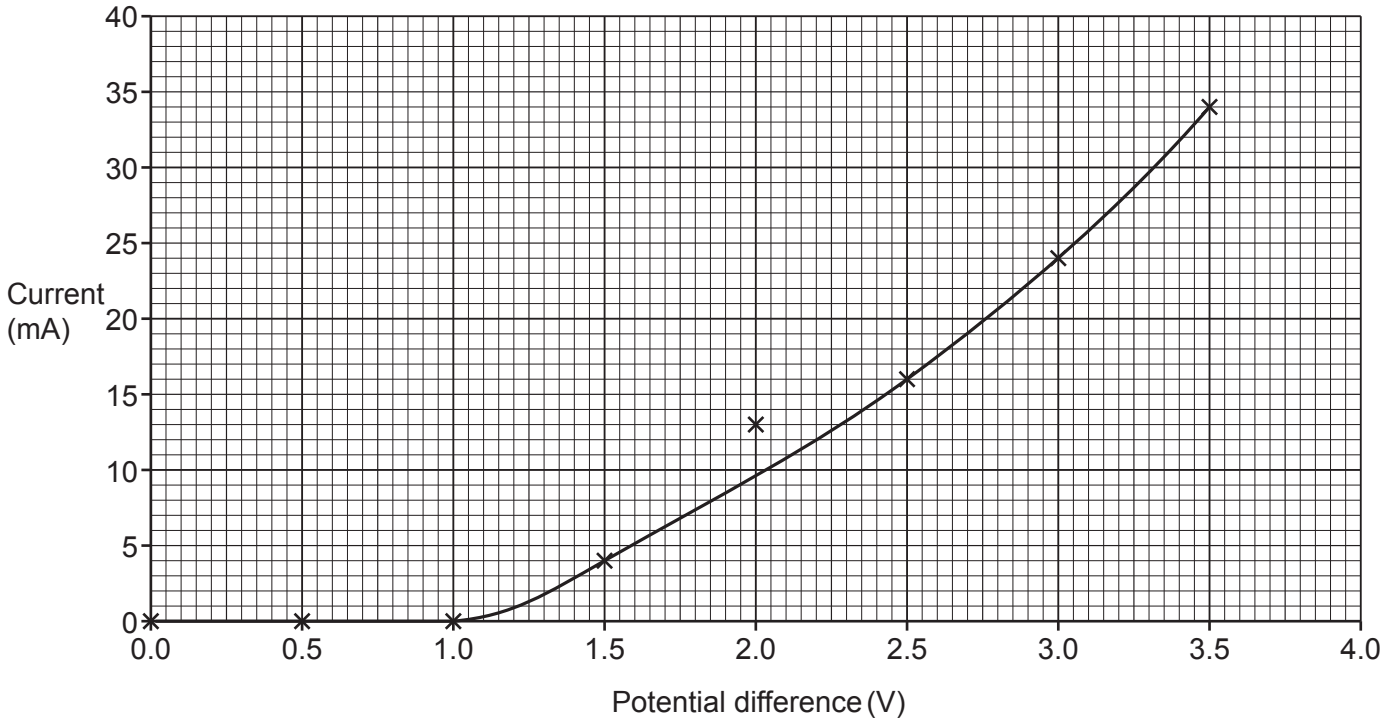
Why is it used in this investigation?

.....

..... **[1]**

(d) Student **A** does the experiment and plots a graph of their results.

The graph shows the relationship between potential difference and current.



(i) Which potential difference shows an **anomalous** result?

Tick (✓) **one** box.

0.0 V ☐

2.0 V ☐

3.5 V ☐

[1]

(ii) Use the graph to find the current when the potential difference is 2.75 V.

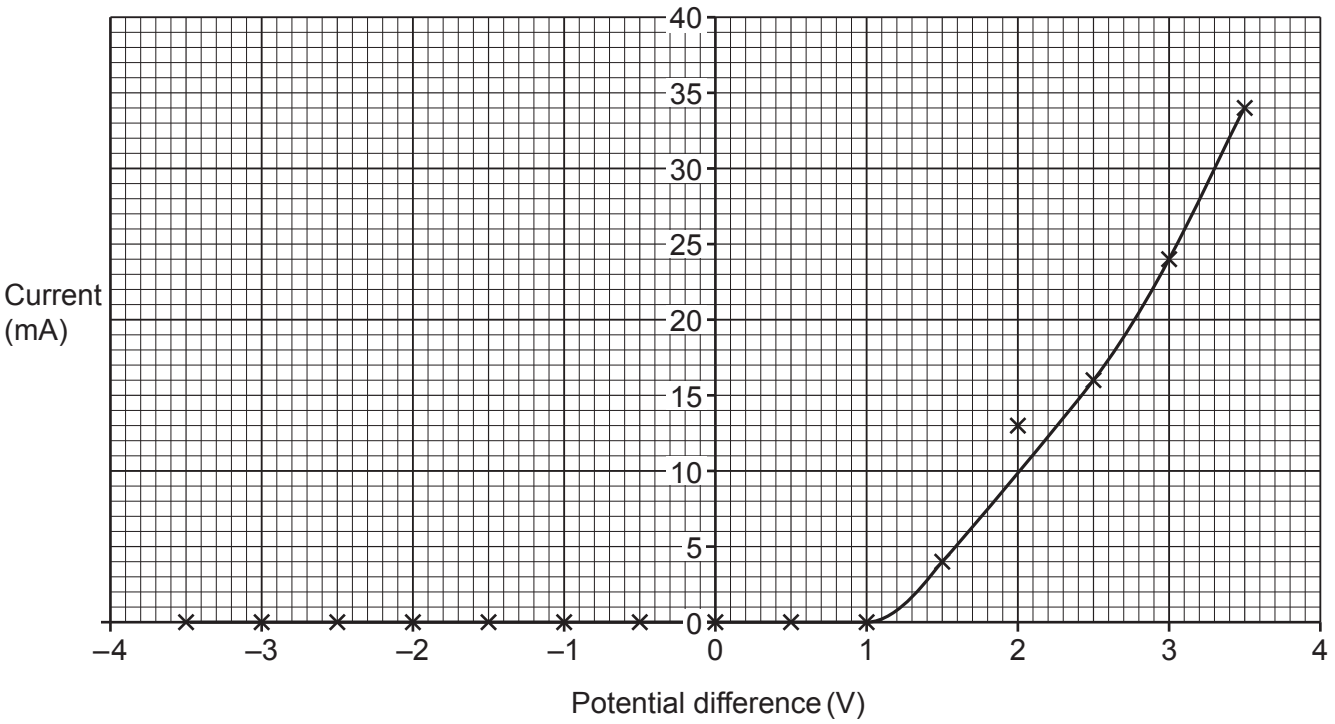
Current = ... mA **[1]**

(iii) State the **maximum** potential difference before the diode conducts.

Use the graph.

Maximum potential difference = ... V **[1]**

(e) Student **B** improves the investigation and obtains the results shown in this graph.



Describe what Student **B** did to get the additional results.

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..... **[1]**

16 An iron bar can be magnetised by placing it inside a magnetic field.

(a) What **type** of magnet is the iron bar?

..... **[1]**

(b) Complete this sentence about magnetic fields.

Use words from the list.

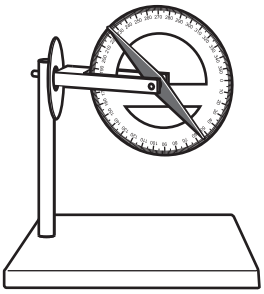
aluminium powder	**gold leaf**	**iron filings**	**plotting compasses**

The shape of the magnetic field around a bar magnet can be investigated using

..... or ..... .

[2]

(c) The diagram shows a **dipping compass**.



Describe how dipping compasses are used to find the shape of the Earth's magnetic field.

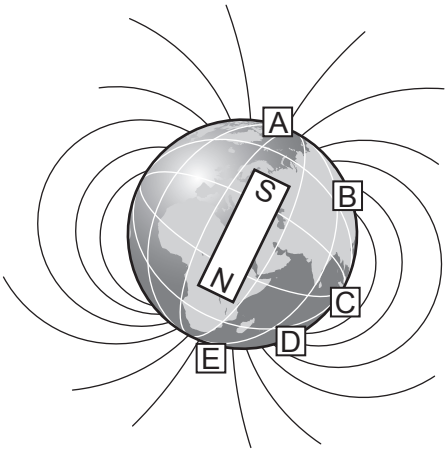
.....

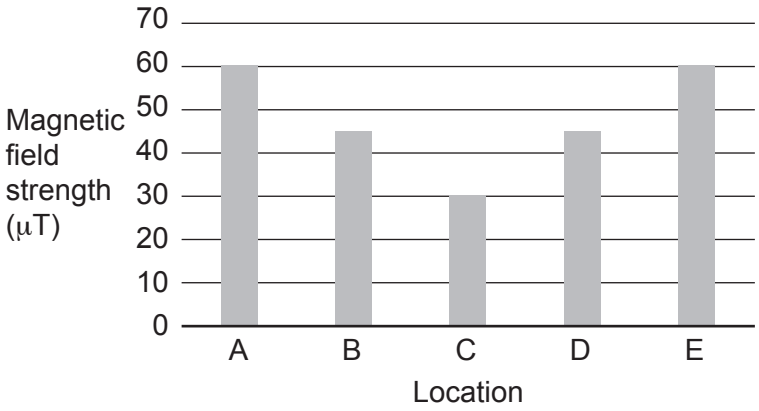
..... **[1]**

(d) Scientists think that the Earth is surrounded by a magnetic field.

They measured the magnetic field strength at different locations around the Earth, **A**, **B**, **C**, **D** and **E**.

The graph shows the magnetic field strength at these different locations.





Describe the pattern in the results shown on the graph.

What does this pattern in results show about the magnetic field strength around the Earth?

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..... **[2]**

17 In the early part of the twentieth century, several scientists developed new ideas about what atoms look like.

(a) Thomson proposed the plum pudding model in 1904.

(i) What are the two main ideas about **electric charge** in this model?

1 .....

.....

2 .....

.....

[2]

(ii) Give **one** reason this model was not developed until 1904.

.....

..... **[1]**

(b) Rutherford fired alpha particles at gold foil. He published his results in a scientific journal.

(i) Suggest **two** reasons why he published his results in a scientific journal.

1 .....

.....

2 .....

.....

[2]

(ii) Draw **one** line from one of the physicists to show which **change** they made to Rutherford's model.

Physicist	**Change**
	neutrons
Bohr	
	electron orbits
Marsden	
	nucleus

[1]

END OF QUESTION PAPER

EXTRA ANSWER SPACE

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.