Oxford Cambridge and RSA

Thursday 22 May 2025 – Morning

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

J249/01 (Foundation Tier)

Time allowed: 1 hour 45 minutes

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

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

F

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 **90**.
- 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 **28** pages.

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

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Section A

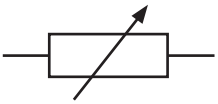
You should spend a **maximum** of **30 minutes** on this section.

Write your answer to each question in the box provided.

1 Which component gives out light?

A

B



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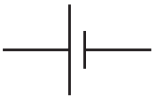

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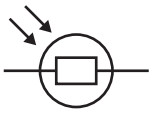

Your answer ☐

[1]

2 Which force is a **non-contact** force?

A Drag

B Friction

C Magnetic

D Tension

Your answer ☐

[1]

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3 Which row shows the minimum number of forces needed to stretch an object and the minimum number of forces needed to bend an object?

	Minimum number of forces needed to stretch an object	**Minimum number of forces needed to bend an object**
A	1	1
B	1	2
C	2	1
D	2	2

Your answer ☐

[1]

4 Which statement describes the gravitational field between two planets?

A It can be attractive or repulsive and depends on the mass of the planets.

B It can be attractive or repulsive and does not depend on the mass of the planets.

C It is always attractive and depends on the mass of the planets.

D It is always attractive and does not depend on the mass of the planets.

Your answer ☐

[1]

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5 A student draws a free body force diagram of an object falling through water.

What is the correct label for the **downwards** force?

A Air resistance

B Upthrust

C Water resistance

D Weight

Your answer ☐

[1]

6 There is a current of 50 mA in a wire for 250 s.

What is the charge flow?

Use the equation: charge flow = current × time

A 5.0 C

B 12.5 C

C 5000 C

D 12 500 C

Your answer ☐

[1]

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7 What is a correct unit for **pressure**?

A $kg\,m/s^2$

B N m

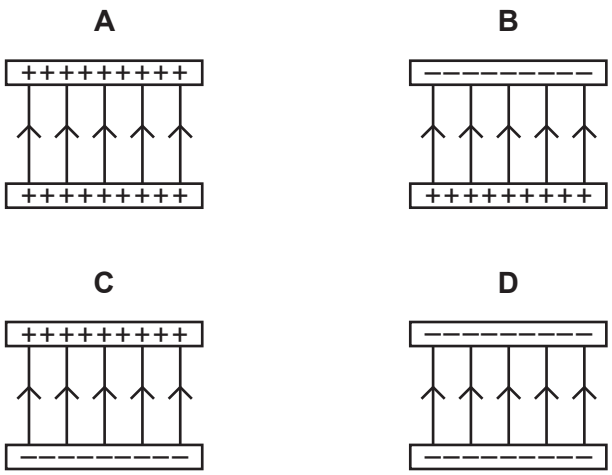
C N/m

D Pa

Your answer ☐

[1]

8 Which diagram shows the electric field pattern between two parallel metal plates?



Your answer ☐

[1]

9 Which statement can explain the effects of **static electricity**?

A Atoms are transferred between objects.

B Electrons are transferred between objects.

C Neutrons are transferred between objects.

D Protons are transferred between objects.

Your answer ☐

[1]

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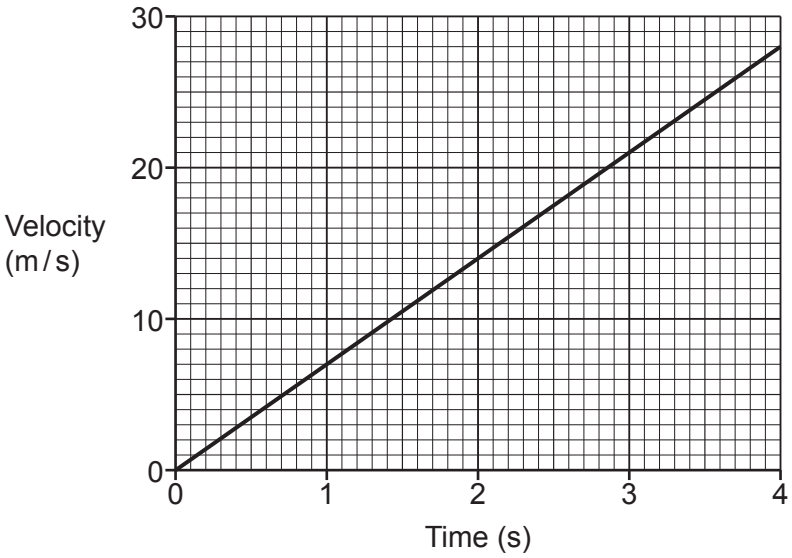
10 A teacher draws a velocity–time graph for a moving object.



What is the **acceleration** of the object?

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

A $7.0\,m/s^2$

B $7.5\,m/s^2$

C $56\,m/s^2$

D $112\,m/s^2$

Your answer ☐

[1]

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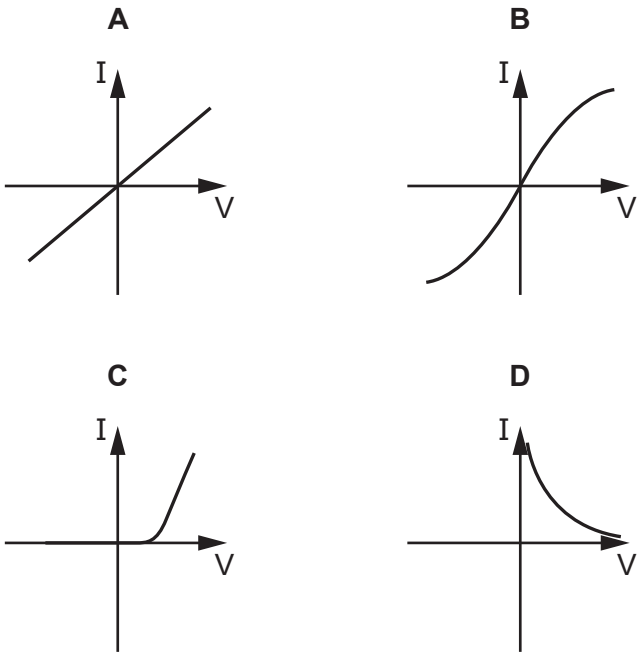
11 Which is the current–potential difference (I–V) characteristic graph for a **diode**?



Your answer ☐

[1]

12 Four objects **A**, **B**, **C** and **D** are accelerating.

Which object has the greatest resultant **force**?

Use the equation: force = mass × acceleration

	Mass (kg)	**Acceleration (m / s^2)**
A	5	2
B	5	4
C	10	0.5
D	20	0.25

Your answer ☐

[1]

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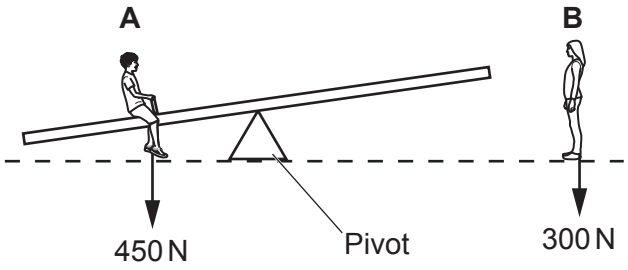
13 Two children want to play on a seesaw.



Child **A** sits 3.0 m from the pivot.

What distance from the pivot will child **B** need to sit to balance the seesaw?

Use the equation: moment of a force = force × distance (normal to direction of the force)

A 1.5 m

B 2.0 m

C 3.0 m

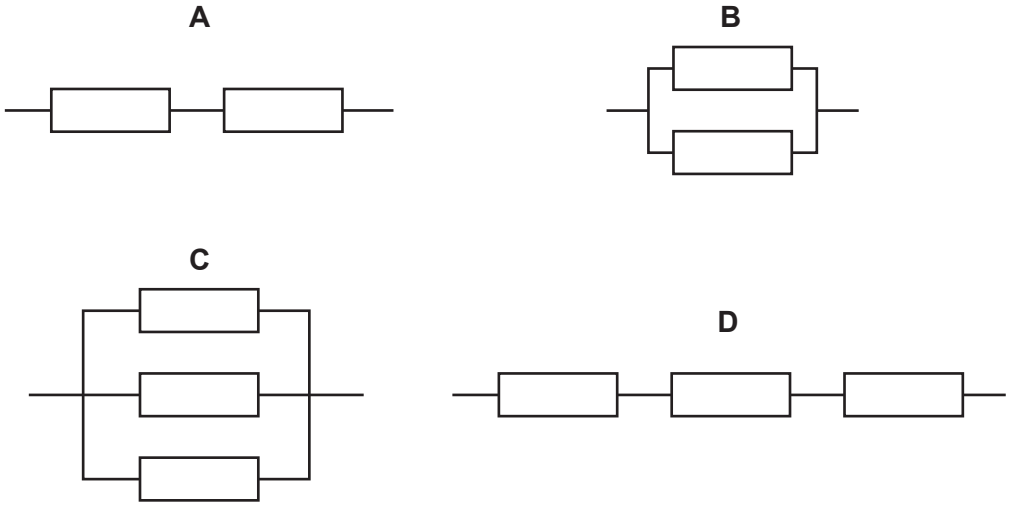
D 4.5 m

Your answer ☐

[1]

14 A student connects identical resistors together.

Which combination of resistors has the **lowest** resistance?



Your answer ☐

[1]

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15 A large freezer contains 10.0 kg of ice at 0 °C.

How much energy is needed to change the ice into water?

Use the equation: thermal energy for a change in state = mass × specific latent heat

Specific latent heat of water = 334 000 J / kg

A 3.34 kJ

B 33.4 kJ

C 3.34 MJ

D 33.4 MJ

Your answer ☐

[1]

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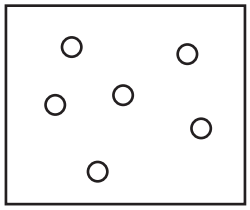
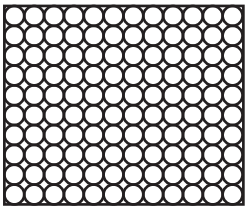
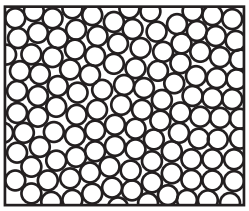
Section B

16 A student draws particle models of a solid, a liquid and a gas.

(a) Draw lines to connect each **state of matter** with its correct **particle model**.

State of matter	Particle model
solid	
liquid	
gas	

[2]

(b) Which state of matter is the easiest to compress?

Tick (✓) **one** box.

Solid ☐

Liquid ☐

Gas ☐

[1]

(c) Which state of matter is the **least** dense?

Tick (✓) **one** box.

Solid ☐

Liquid ☐

Gas ☐

[1]

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(d) Which state of matter has the **least** kinetic energy per particle?

Tick (✓) **one** box.

Solid ☐

Liquid ☐

Gas ☐

[1]

(e) A sealed plastic bottle containing warm air is placed into icy water.

(i) Complete the sentences to describe what happens to the air in the bottle.

Use words from the list.

decreases	**increases**	**stays the same**

The mass of the air ..... .

The speed of the air molecules ..... .

The force exerted by the air molecules on the walls of the bottle

..... .

The pressure exerted by the air ..... .

[4]

(ii) Suggest what might happen to the shape of the sealed plastic bottle if it is kept in the icy water for a long time.

.....

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

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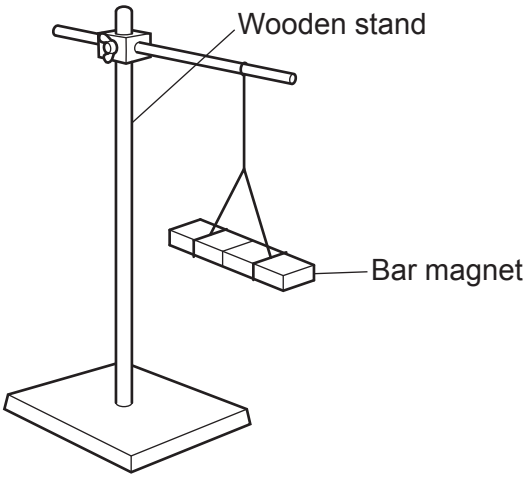
17 A student investigates magnetic fields using a bar magnet.

(a) Draw the magnetic field around the bar magnet.

[3]

(b) The student freely suspends the bar magnet from a wooden stand.



(i) Why did the student choose a wooden stand instead of an iron stand?

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

(ii) The bar magnet is able to move freely.

In which direction does the bar magnet face when it **stops** moving?

Tick (✓) **one** box.

East-west ☐

North-south ☐

Up-down ☐

[1]

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(iii) Why does the bar magnet face in this direction?

Tick (✓) **one** box.

It lines up with the wooden stand. ☐

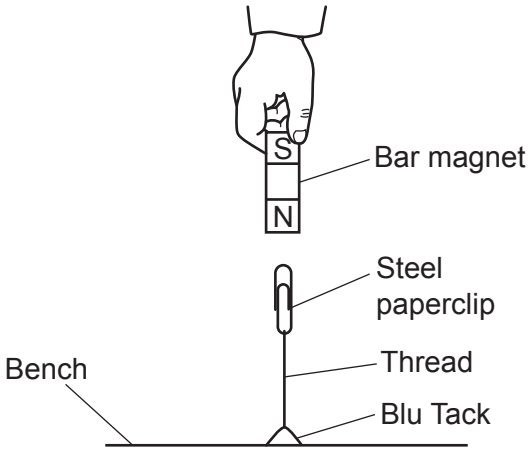
It lines up with the Earth's gravitational field. ☐

It lines up with the Earth's magnetic field. ☐

[1]

(c) An unmagnetised steel paperclip is attached to Blu Tack using thread. The Blu Tack is stuck to a bench.

The student uses the bar magnet to lift the paperclip until the paperclip is suspended in the air.



(i) Which type of magnet is the steel paperclip?

Tick (✓) **one** box.

Induced ☐

Permanent ☐

Solenoid ☐

[1]

(ii) Explain your answer to **(c)(i)**.

.....

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

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18 The model of the atom has changed over time.

(a) Three scientists worked on models of the atom.

Draw lines to connect each **scientist** with the correct description of the **scientist's work**.

Scientist	**Scientist's work**
Bohr	developed the plum pudding model of the atom
Rutherford	discovered electrons can only move in fixed orbits called shells
Thomson	fired alpha particles at gold foil

[2]

(b) Suggest **one** reason why models change over time.

.....

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

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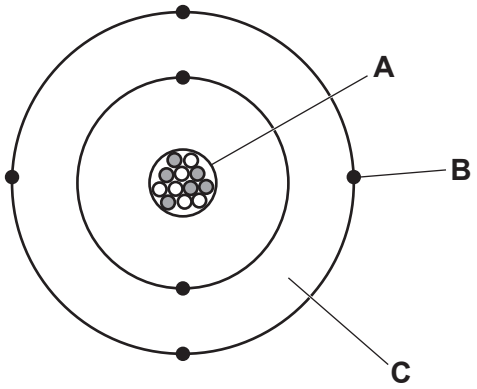
(c) The diagram shows a model of an atom.



Write down which letter, **A**, **B** or **C**, represents the following in the diagram.

The nucleus: .....

An electron: .....

[2]

(d) Complete the sentences.

Put a ring around the correct statement in each box.

The nucleus is

negatively charged
neutral
positively charged

.

Electrons are

negatively charged
neutral
positively charged

.

[2]

(e) One atom has a diameter of 1×10^{-10} m.

A molecule has 50 atoms in a line.

Calculate the length of this molecule.

Write your answer in **standard form**.

Length = ... m **[2]**

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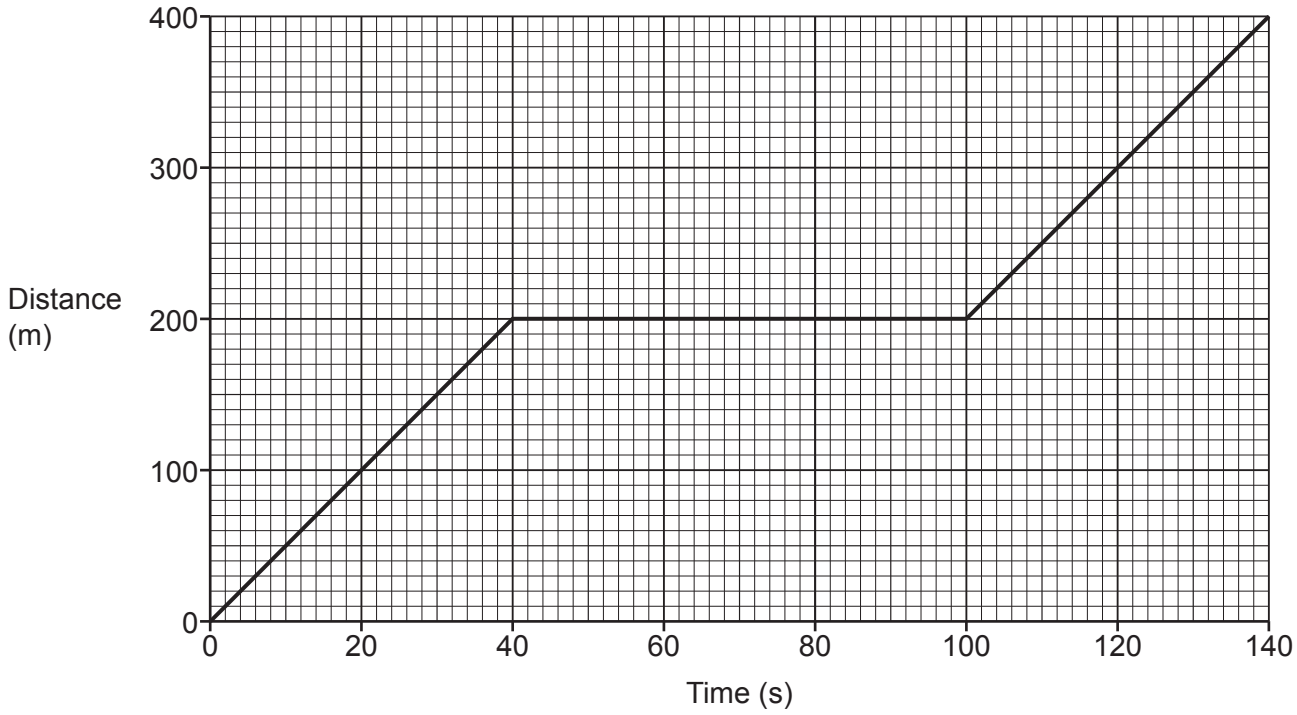
19* A student draws a distance–time graph of their bicycle journey to school.



Describe and explain the motion of the student at each stage of their journey.

Include calculations in your answer.

Use the Equation Sheet.

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

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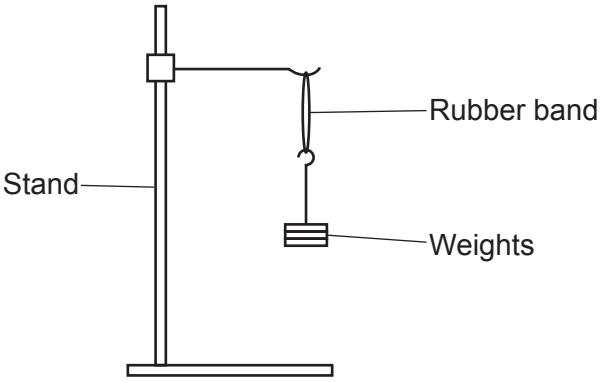
20 A student investigates how a rubber band stretches.



This is their method:

- Measure the original length of the rubber band using a ruler.
- Add 1.0 N weights, one at a time.
- Measure the new length of the rubber band after each weight is added.

(a) Suggest **one** risk for this investigation and how the risk can be reduced.

Risk: .....

How the risk can be reduced: .....

.....

[2]

(b) The student records this data when adding a weight:

Original length of the rubber band = 5.0 cm

New length of the rubber band after the weight is added = 14.0 cm

What is the extension of the rubber band?

Extension = ... cm **[1]**

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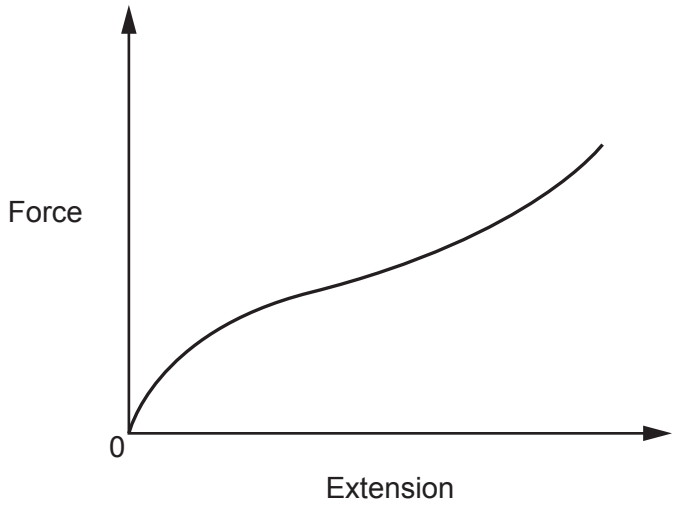
(c) The student sketches a graph of the results of the investigation.



The student removes the weights from the rubber band. The rubber band returns to its original length.

Which statements about this investigation are **true**, and which are **false**?

Tick (✓) **one** box in each row.

Conclusion	**True**	**False**
The relationship between force and extension is linear.		
The rubber band obeys Hooke's Law.		
The deformation is **only** elastic.		

[2]

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(d) The student also stretches two springs.

(i) The first spring has a spring constant of 50 N / m.

Calculate the energy transferred in stretching when this spring is extended by 0.18 m.

Use the equation: energy transferred in stretching = $\frac{1}{2}$ × spring constant × (extension)^2

Energy transferred = ... J **[2]**

(ii) The second spring has a spring constant of 48 N / m.

Calculate the force needed to stretch this spring by 0.18 m.

Use the Equation Sheet.

Write your answer to **2** significant figures.

Force = ... N **[4]**

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21

(a) In a shop, a lift moves customers a vertical distance of 12 m from the ground floor to the top floor.

The maximum weight of passengers allowed in the lift is 4500 N.

(i) Calculate the maximum mass of passengers allowed in the lift.

Use the equation: gravitational force = mass × gravitational field strength

Mass = ... kg **[4]**

(ii) Calculate the work done in moving the maximum weight of passengers between the ground floor and the top floor.

Use the equation: work done = force × distance

Work done = ... J **[2]**

(iii) The lift takes 1.2 minutes to move the passengers from the ground floor to the top floor.

Calculate the power needed to move the maximum weight of passengers in the lift.

Use your answer from part **(a)(ii)** and the equation: power = $\frac{\text{work done}}{\text{time}}$

Power = ... W **[3]**

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(b) The power of the motor of another lift is 920 W.

The potential difference across the motor of this lift is 230 V.

Calculate the current in the motor.

Use the Equation Sheet.

Current = ... A **[4]**

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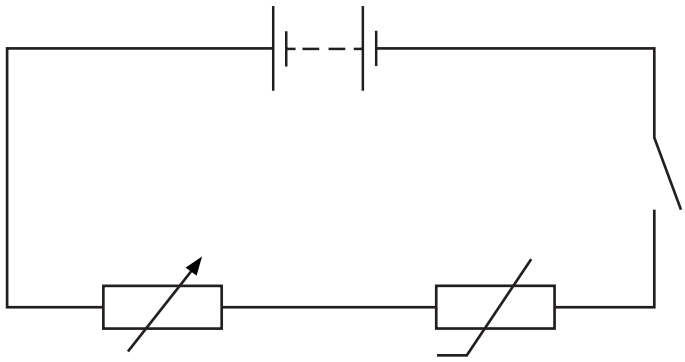
22 A student investigates the current–potential difference (I–V) characteristic graph for a thermistor.

The diagram shows the circuit that the student builds.



(a)

(i) The student connects an ammeter and a voltmeter into the circuit to take the measurements needed for their investigation.

Draw **one** ammeter and **one** voltmeter in the correct positions in this circuit.

[3]

(ii) Why does the student use a variable resistor in the circuit?

Tick (✓) **one** box.

To change the current in the circuit ☐

To change the potential difference of the battery ☐

To change the temperature of the circuit ☐

[1]

(iii) Explain why the student switches the circuit off between taking the readings of current and potential difference.

.....

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

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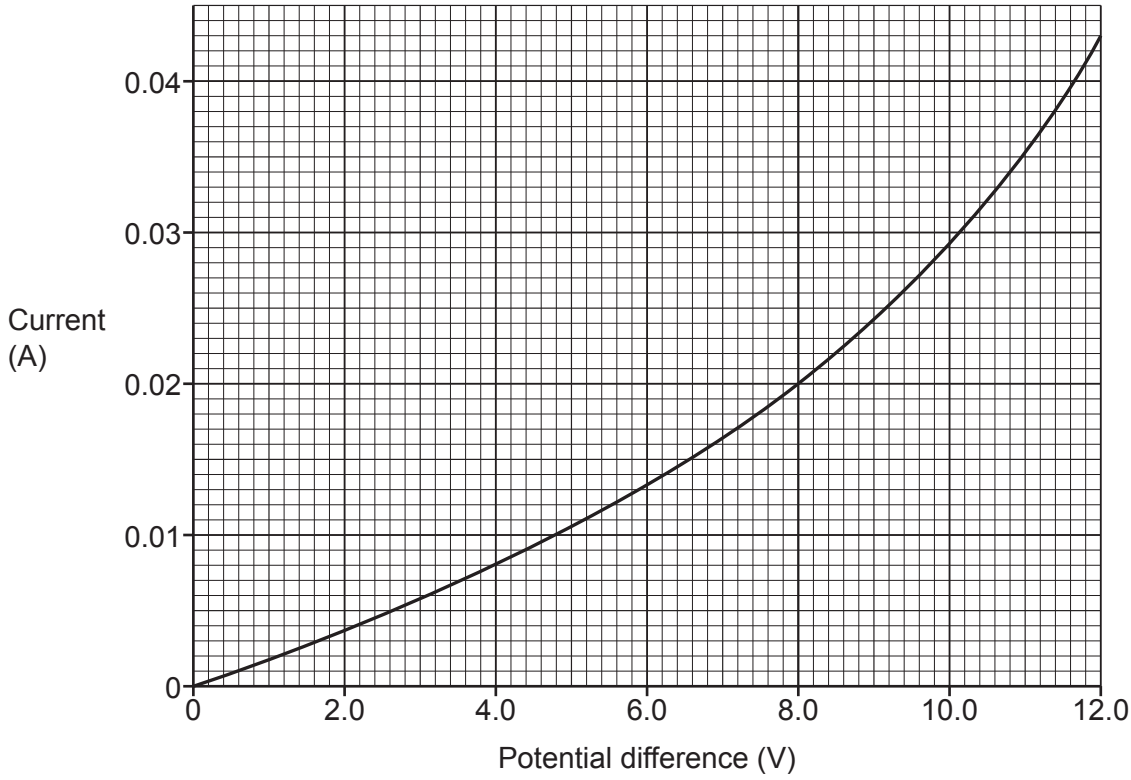
(b) The student takes readings of current and potential difference and plots them on a graph.



(i) Describe the trend shown by the graph.

.....

.....

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

(ii) How does the resistance of the thermistor change as the potential difference increases?

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

(iii) State the current in the thermistor when the potential difference across the thermistor is 8.0 V.

Use the graph.

Current = ... A **[1]**

(iv) Calculate the resistance of the thermistor when the potential difference across the thermistor is 8.0 V.

Use the equation: potential difference = current × resistance

Resistance = ... Ω **[3]**

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23 An engineer is investigating the density of polystyrene.

(a) Describe how to determine the mass and volume of a rectangular polystyrene block.

.....

.....

.....

.....

.....

.....

..... **[3]**

(b) One polystyrene block has a density of 50 kg / m^3.

The mass of the block is 0.60 kg.

Calculate the volume of the block.

Use the Equation Sheet.

Volume = ... m^3 **[3]**

END OF QUESTION PAPER

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EXTRA ANSWER SPACE

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

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