

Thursday 9 June 2022 – Afternoon

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

J250/05 Paper 5 (Foundation Tier)

Time allowed: 1 hour 10 minutes

You must have:

- a ruler (cm/mm)
- the Data Sheet for GCSE (9–1) Combined Science (Physics) A (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

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Candidate number

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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.

2
SECTION A

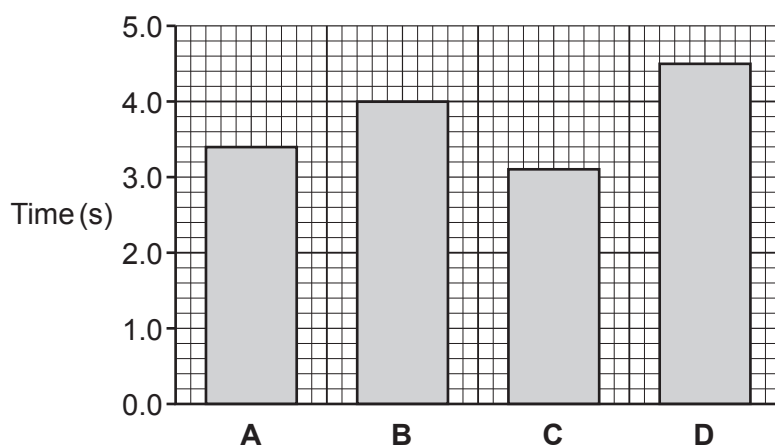
Answer **all** the questions.

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

Write your answer to each question in the box provided.

- 1** Four weightlifters **A**, **B**, **C** and **D**, each do 2000 J of work lifting a weight.

The time taken for each of them to do their lift is shown in the graph.



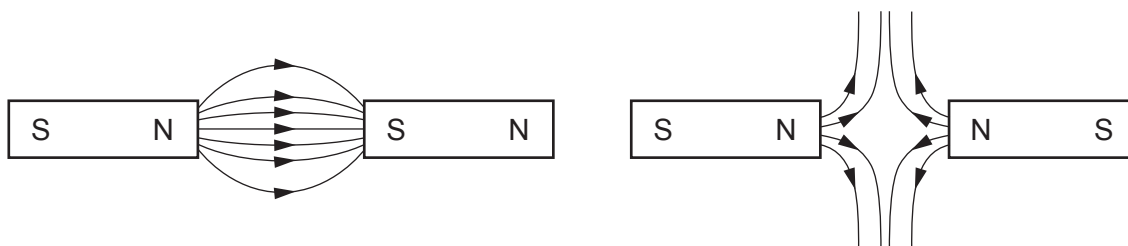
Which weightlifter has the **highest** power?

Use the Data Sheet.

Your answer

[1]

- 2** The diagrams show the magnetic field lines around the bar magnets.



Which answer is **correct**?

- A** N poles repel S poles.
- B** The direction of the magnetic field lines is N to S.
- C** The magnetic field is stronger further from the bar magnet.
- D** The poles are at the centre of the bar magnet.

Your answer

[1]

- 3 A student records the time it takes to run three distances. The table shows their results.

Distance (m)	25.2	25.0	25.1
Time taken (s)	40.0	41.6	42.4

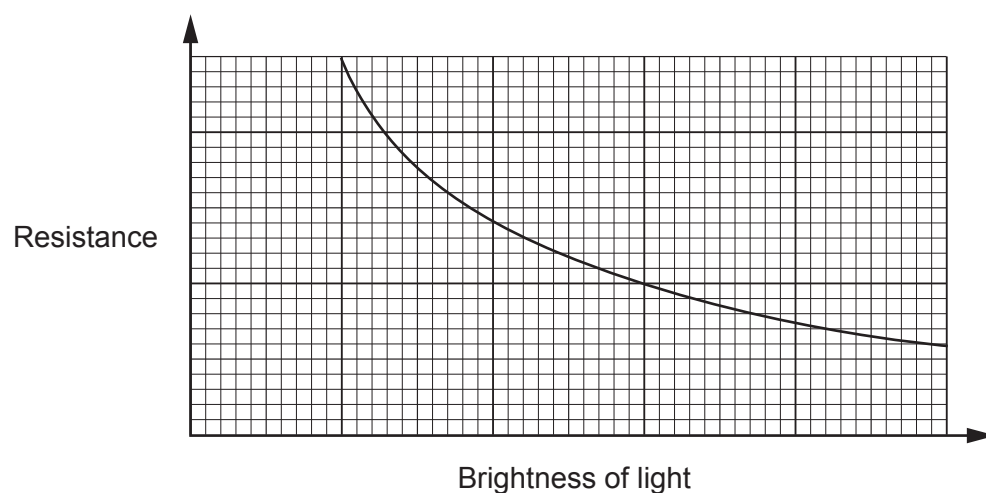
How many significant figures is the student using?

- A** 1
B 2
C 3
D 4

Your answer

[1]

- 4 The graph shows how the resistance of a circuit component changes with the brightness of light.



What is the name of the circuit component?

- A** Diode
B Filament lamp
C LDR
D Thermistor

Your answer

[1]

5 A cell transfers energy.

- The potential difference is 6 V.
- The charge flowing is 40 C.

What is the amount of energy transferred by the cell?

Use the equation: energy transferred = charge $\times$ potential difference

- A 0.15 J
- B 0.9 J
- C 6.7 J
- D 240 J

Your answer

[1]

6 Which force is a **contact** force?

- A Electrostatic
- B Friction
- C Gravity
- D Magnetic

Your answer

[1]

7 A child is riding a bicycle. They accelerate from 0 m/s to 4 m/s in 20 seconds.

Calculate the acceleration of the child.

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

- A 0.2 m/s^2
- B 4 m/s^2
- C 5 m/s^2
- D 8 m/s^2

Your answer

[1]

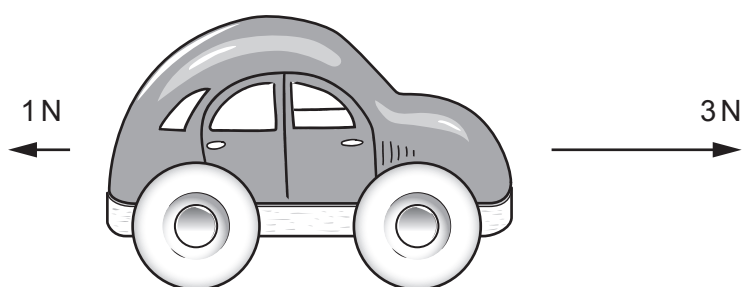
- 8 Which pair of forces are a Newton's third law pair?
- A Weight of magnet and magnetic force
 - B Weight of person and friction on person
 - C Weight of person and pull of person on the Earth
 - D Weight of skydiver and air resistance on skydiver

Your answer

☐

[1]

- 9 The diagram shows some forces acting on a toy car.



Which row in the table describes the motion of the toy car?

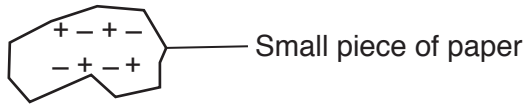
	Resultant force	Motion
A	2 N forwards	acceleration
B	2 N forwards	constant velocity
C	3 N forwards	acceleration
D	3 N forwards	constant velocity

Your answer

☐

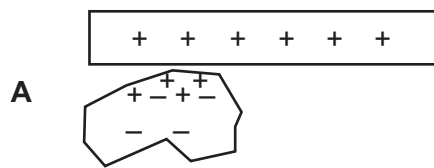
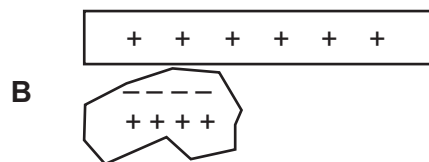
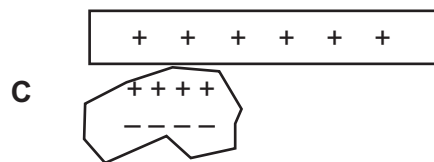
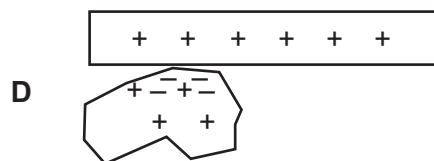
[1]

- 10 The diagram shows a positively charged rod near a small piece of paper.



The paper is attracted to the rod.

Which diagram shows the **correct** distribution of positive and negative charges in the piece of paper as the rod is brought closer?



Your answer

[1]

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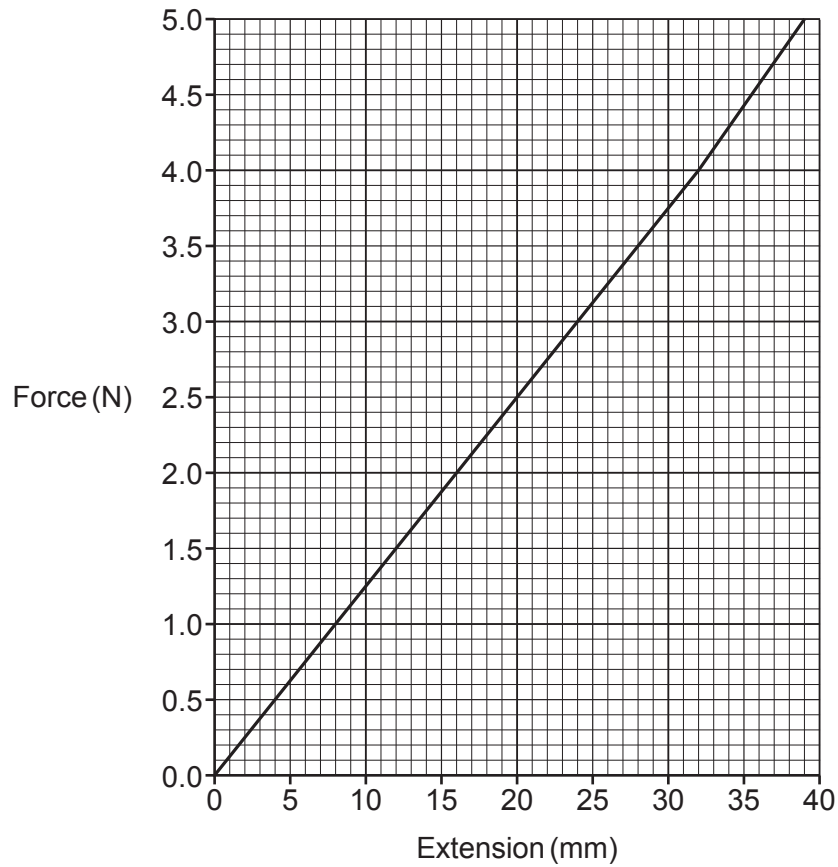
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SECTION B

Answer **all** the questions.

- 11 (a) A student stretches **one** spring by applying a force to it. **Fig. 11.1** shows the results.

Fig. 11.1

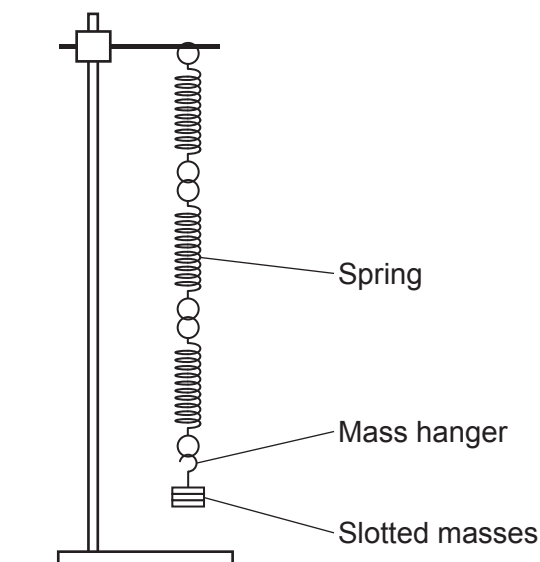


The student makes a prediction:

'The more springs I join together, the greater the total extension when the same force is applied.'

Fig. 11.2 shows a diagram of the springs.

Fig. 11.2



(i) Explain why the student makes this prediction.

.....

.....

..... [2]

(ii) The student has the equipment shown in **Fig. 11.2**.

What **other** piece of equipment do they need to test this prediction?

..... [1]

(iii) What do they change to test the prediction?

..... [1]

(iv) What do they measure to test the prediction?

..... [1]

(v) What do they keep the same to test the prediction?

..... [1]

- (b) Children often make models with clay. Clay and rubber bands behave differently.

Draw lines to connect each **property** to its correct **description**, and each **description** to the correct **example**.

Property	Description	Example
Elastic	Keeps its new shape when force removed	Rubber band
Plastic	Regains original shape when force removed	Clay

[2]

- (c) Some children are talking about squashing a lump of clay on a desk.

- Child **A** says, 'Forces are not required to squash the clay.'
- Child **B** says, 'There is only one force acting on the clay when I squash the clay.'
- Child **C** says, 'There are three forces acting on the clay when I squash the clay.'

Who is correct?

Tick (✓) **one** box.

Child A	☐
Child B	☐
Child C	☐

[1]

- (d) The mass of a lump of clay is 150 grams. 1 gram = 0.001 kg.

- (i) What is the mass of the lump of clay in kg?

Mass = kg [1]

- (ii) The mass of another lump of clay is 0.35 kg.

Calculate the weight of this lump of clay.

Use the equation: gravitational force = mass $\times$ gravitational field strength

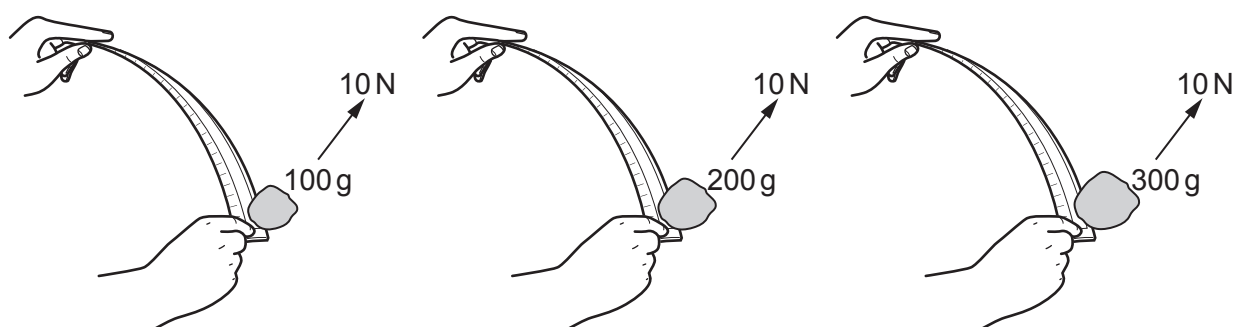
Gravitational field strength = 10 N/kg.

Weight = N [2]

- (e) One child uses a ruler to hit lumps of clay across the desk.

Fig. 11.3 shows the child hitting three different lumps of clay.

Fig. 11.3



- (i) Which lump of clay has the **greatest** acceleration?

Use the Data Sheet.

Tick (✓) **one** box.

100 g ☐

200 g ☐

300 g ☐

[1]

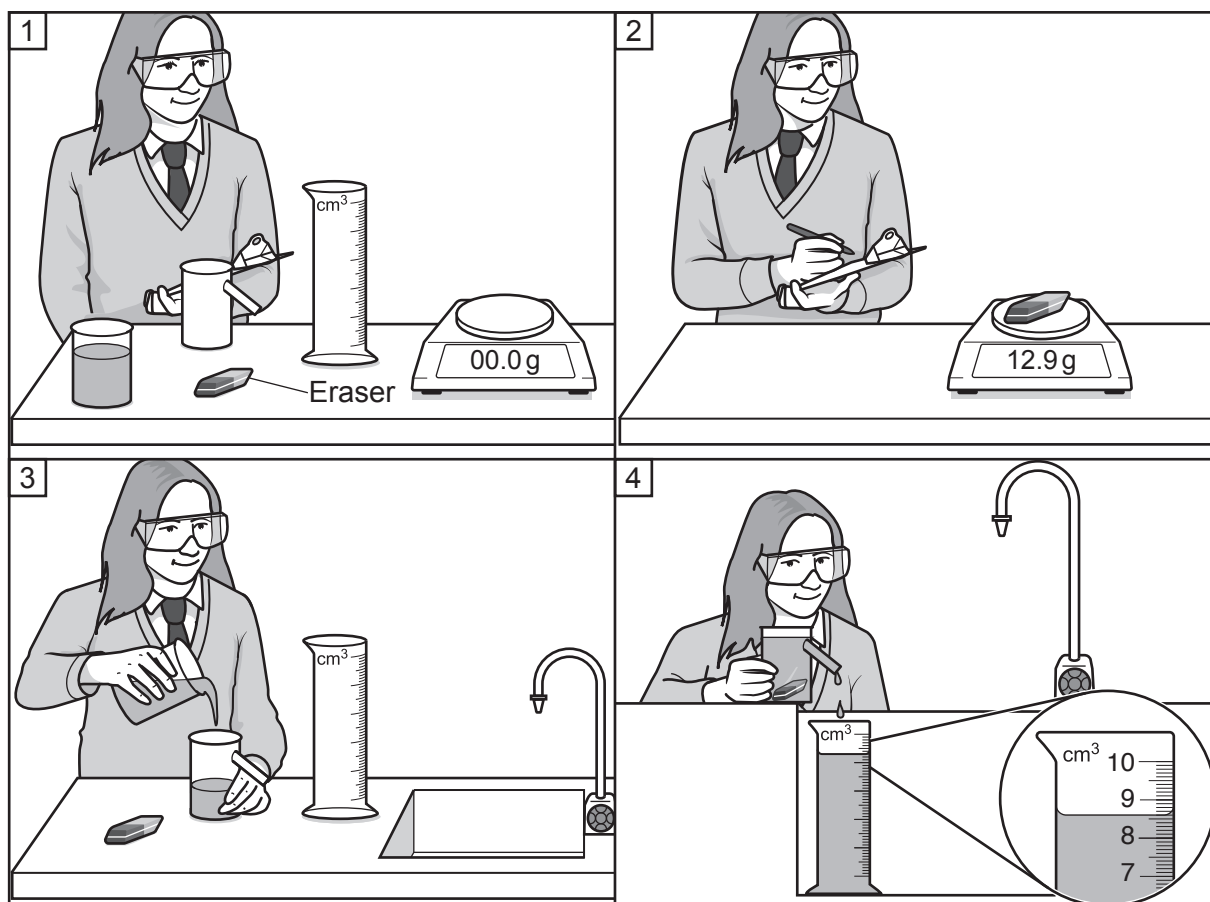
- (ii) Explain the reason for your answer to (e)(i).

.....

..... [1]

- 12* A student does an experiment to find out the density of an eraser. The eraser has an irregular shape.

The diagrams show the student's method:

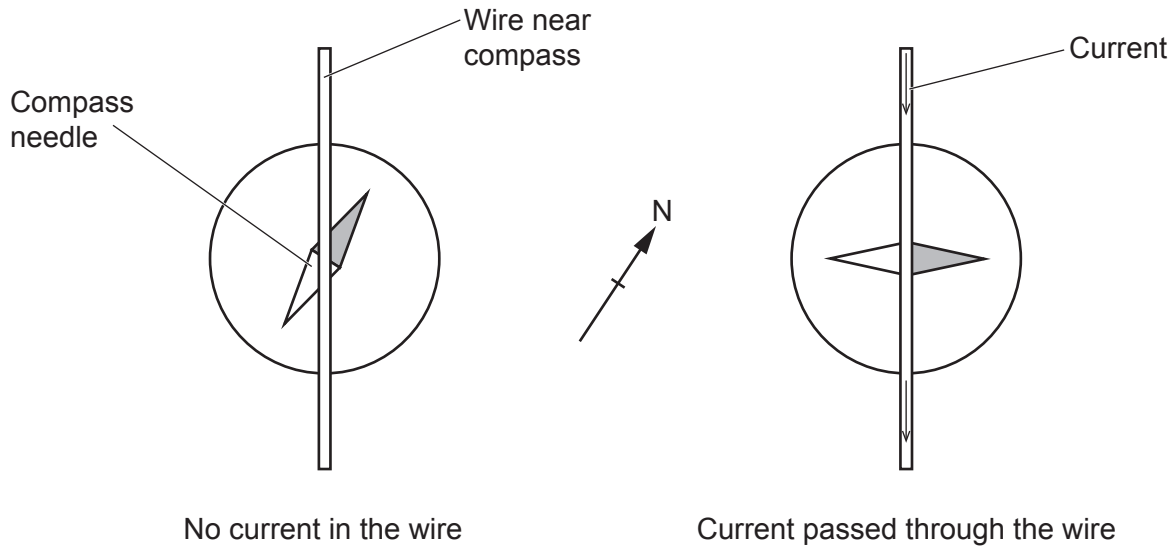


..... [6

13 In 1820, a scientist called Oersted did an experiment with a compass.

- He placed a wire near a compass.
- He passed a current through the wire.

The diagram shows his experiment. The direction of magnetic north is also shown.



(a) Magnetic fields are produced by currents in wires.

Describe how the diagram shows this.

.....
 [1]

(b) A teacher repeats the experiment.

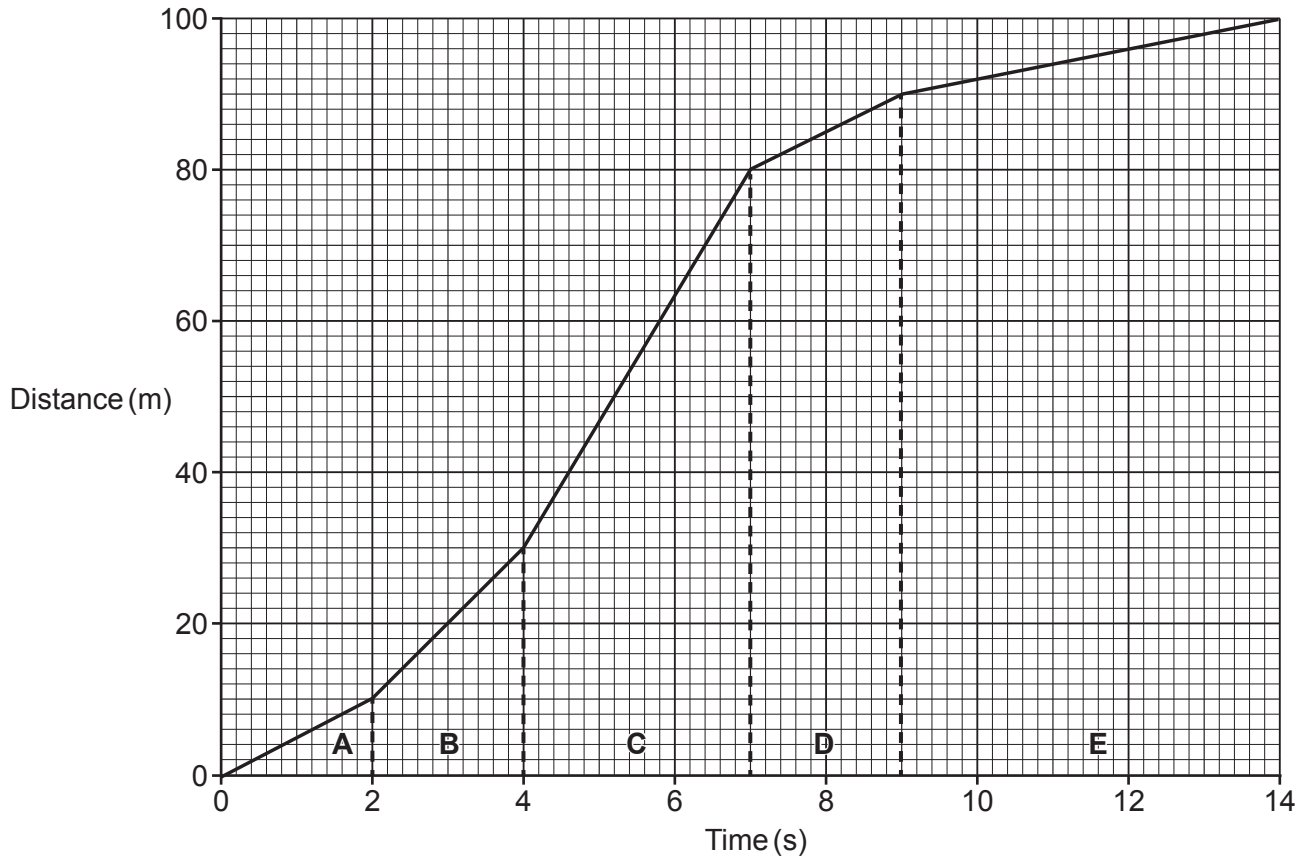
- The current in the wire is 5.0A.
- The current is in the wire for 30 seconds.

Calculate the charge flowing through the wire.

Use the equation: charge flow = current $\times$ time

Charge flow = C [2]

14 This is a distance-time graph for an athlete running a race.



(a) (i) What distance does the athlete run?

Distance = m [1]

(ii) In which **two** parts of the graph is the athlete moving at the **same** speed?

Tick (✓) **two** boxes.

A ☐ B ☐ C ☐ D ☐ E ☐

[1]

(iii) In each part of the graph the athlete moves at a **constant** speed.

How does the graph show this?

..... [1]

(iv) How long does it take the athlete to run part D?

Answer = s [1]

(b) Calculate the speed of the athlete in part A.

Use the equation: distance travelled = speed $\times$ time

Speed = m/s [3]

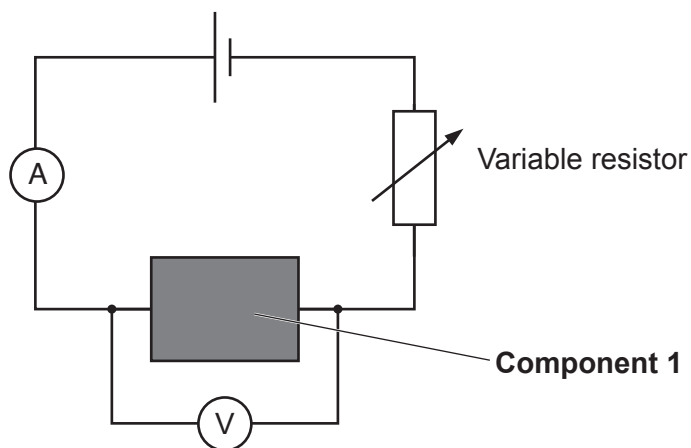
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- 15 A student uses the circuit in **Fig. 15.1** to test two different circuit components. They measure the current and potential difference for **Component 1**.

Fig. 15.1



- (a) (i) Explain why a variable resistor is used in the circuit.

.....
 [1]

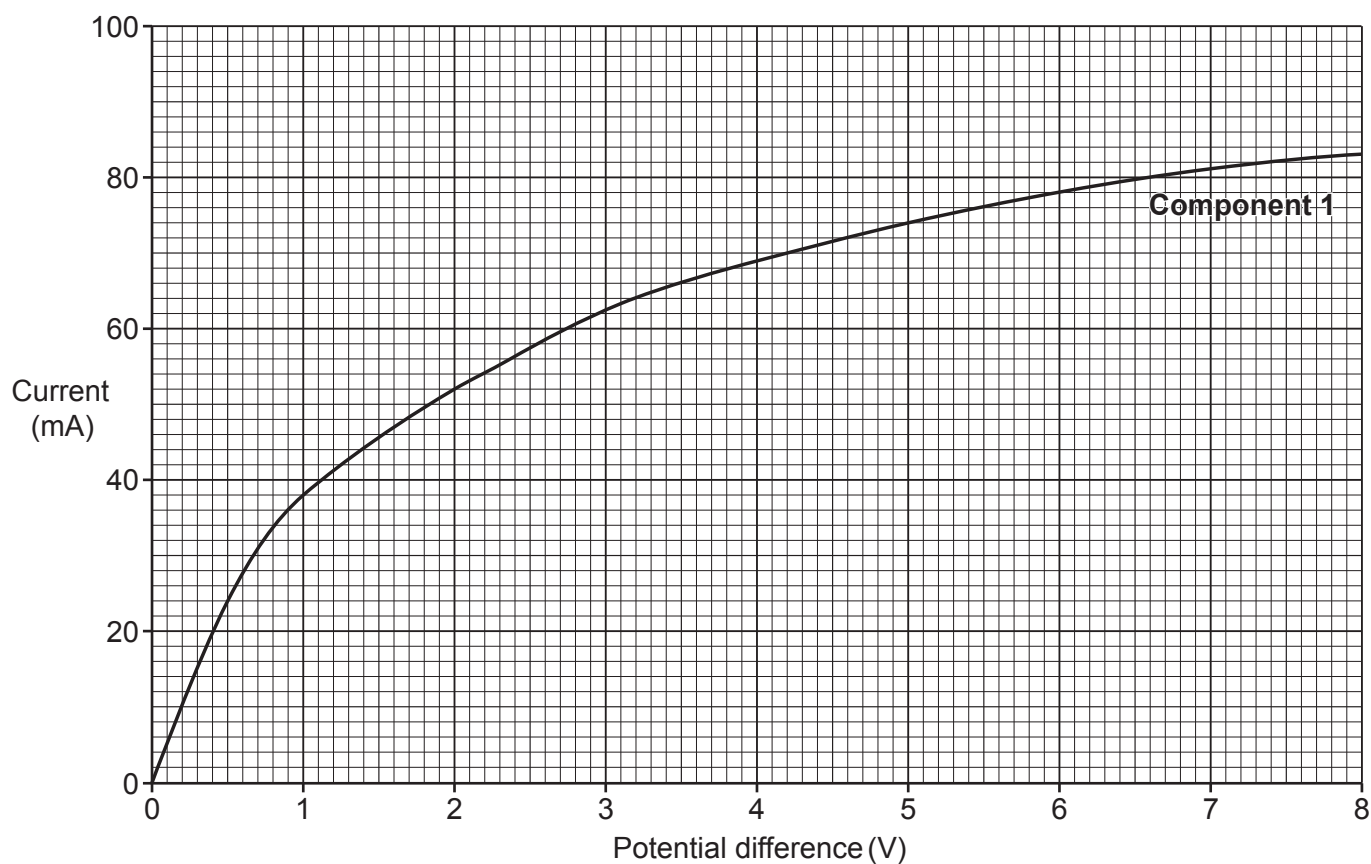
- (ii) The current in **Component 1** is 0.1 A.

What is the current in the variable resistor?

Current = A [1]

(b) Fig. 15.2 shows the results for **Component 1**.

Fig. 15.2



- The student replaces **Component 1** with **Component 2**.
- They repeat the experiment.

The table shows the results for **Component 2**:

Potential difference (V)	Current (mA)
0	0
1	20
2	40
3	60
4	80

Plot the results from the table on Fig. 15.2.
Draw a suitable line of best fit.

[2]

- (c) (i) What is the potential difference when the resistance of **Component 1** and **Component 2** are the same?

Use **Fig. 15.2**.

Potential difference = V [1]

- (ii) Explain why you chose your answer to (c)(i).

.....
 [1]

- (d) Draw lines to connect each **component** to its correct **name**.

Component

Name

Component 1

Resistor

Component 2

Filament lamp

Diode

[2]

- 16 (a) Describe the difference between specific heat capacity and specific latent heat.

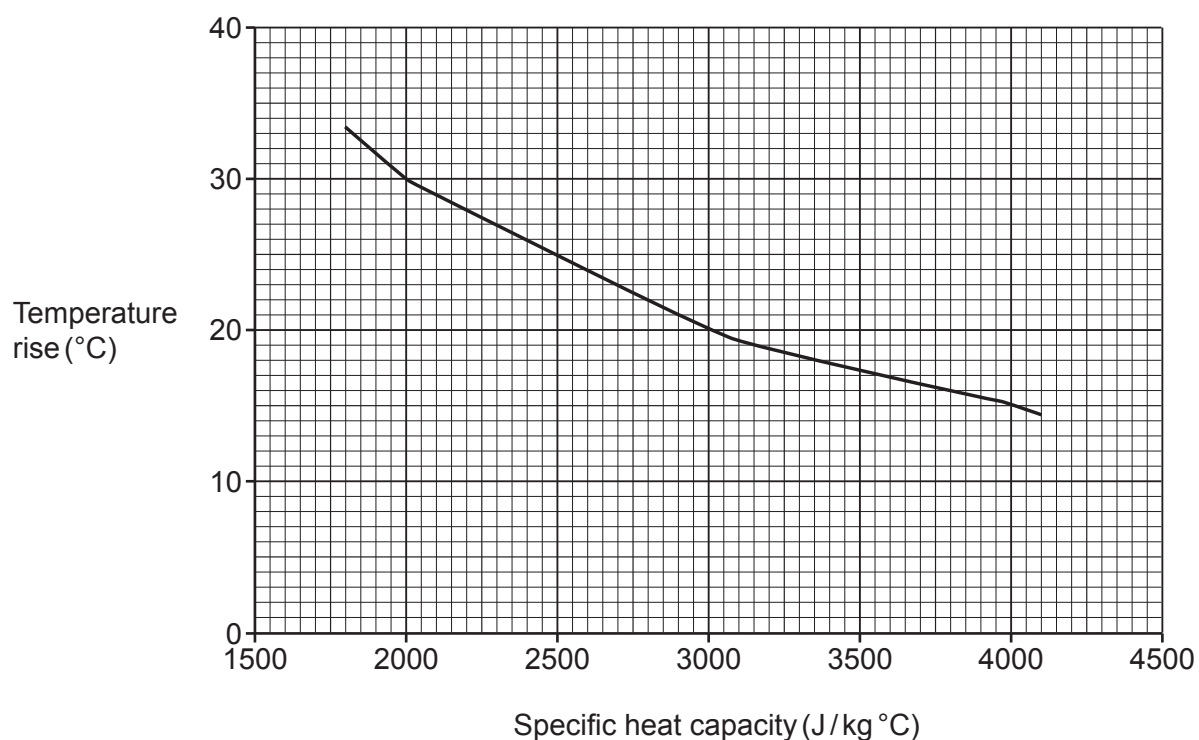
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.....

.....

..... [2]

- (b) A small heater is used to increase the temperature of different liquids. The graph shows how the temperature rise changes due to the varying specific heat capacities of these liquids.



- (i) Using the graph, describe the relationship between temperature rise and specific heat capacity.

.....

..... [1]

- (ii) A liquid has a specific heat capacity of $1600 \text{ J/kg } ^\circ\text{C}$.

Use the graph to estimate the temperature rise of the liquid.

Temperature rise = $^\circ\text{C}$ [2]

(iii) State **one** assumption you made when answering (b)(ii).

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

(c) A student calculates the specific heat capacity of water.
The student does **one** experiment and gets this result:

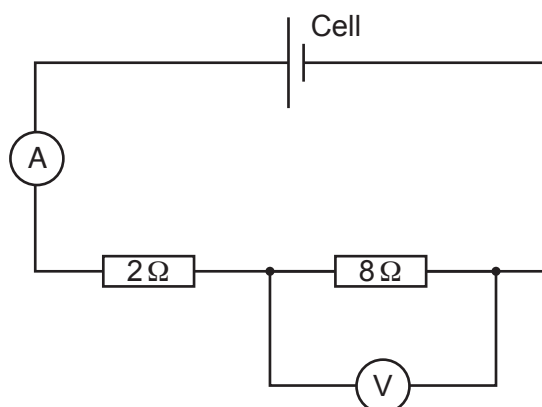
- Student's value = $4250 \text{ J/kg } ^\circ\text{C}$.
- Textbook value = $4200 \text{ J/kg } ^\circ\text{C}$.

Complete the sentence below.
Use one of the words.

Accurate	Precise	Reliable	Repeatable	Systematic
-----------------	----------------	-----------------	-------------------	-------------------

The student's value is [1]

17 A teacher builds the circuit shown in the diagram.



(a) Give the **total** resistance of the circuit.

Total resistance = Ω [1]

(b) The voltmeter reads 4 V.

Calculate the ammeter reading.
Use the Data Sheet.

Ammeter reading = A [3]

(c) Calculate the potential difference across the cell.

Potential difference = V [1]

END OF QUESTION PAPER

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