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H

Thursday 9 June 2022 – Afternoon

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

J250/11 Paper 11 (Higher 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 | | | | | | 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 **20** pages.

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

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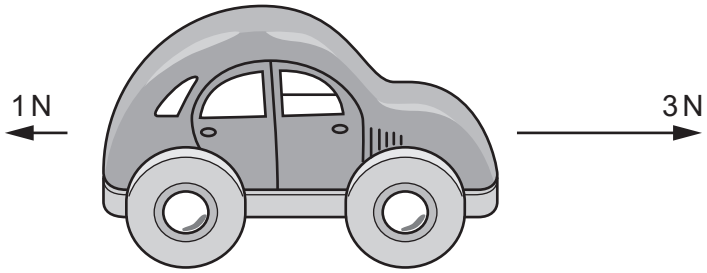
SECTION A

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 The diagram shows some forces acting on a toy car.



Which row of 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]**

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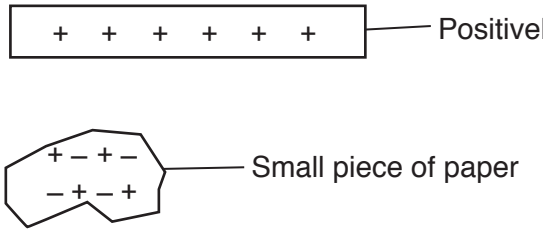
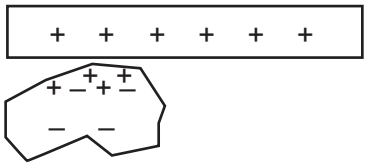
2 The diagram shows a positively charged rod near a small piece of paper.



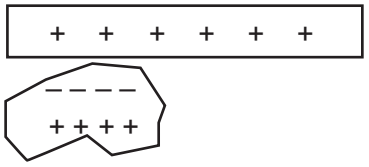
The paper is attracted to the rod.

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

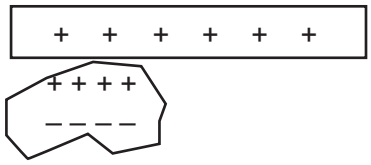
A



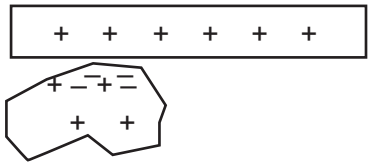
B



C



D



Your answer ☐ **[1]**

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3 A compass needle is made of a magnet containing a north pole and a south pole.
The N pole of the compass needle points north on Earth.

Which row in the table describes the magnetic field of the Earth?

	Type of magnetic pole near to the Earth's geographic north pole	Direction of magnetic field
A	N	N to S
B	N	S to N
C	S	N to S
D	S	S to N

Your answer ☐ **[1]**

4 A ball is inflated with air.

In which environment will the air inside the ball have the **highest** pressure?

A In a refrigerator (3 °C)

B In a house (18 °C)

C Outside on a cold day (5 °C)

D Outside on a warm day (21 °C)

Your answer ☐ **[1]**

5 A 1.5 V cell transfers 18 mC of charge in a circuit.

What is the amount of energy transferred by the cell?
Use the Data Sheet.

A 0.027 mJ

B 0.27 J

C 27 mJ

D 27 J

Your answer ☐ **[1]**

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6 A student does 20 “step ups” onto a wall.

- The total work done by the student is 3000 J.
- The time taken is 24 s.

Calculate the power of the student.

Use the equation: power = $\frac{\text{work done}}{\text{time}}$

A 6.25 W

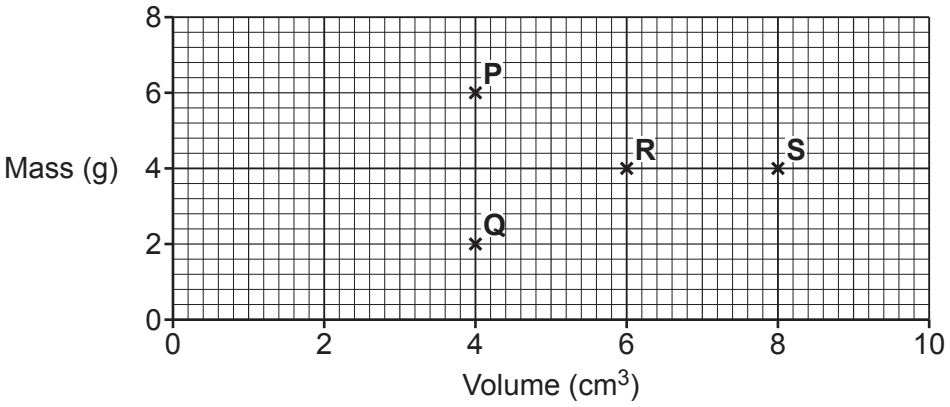
B 125 W

C 2500 W

D 3600 W

Your answer ☐ **[1]**

7 A student measures the mass and volume of four blocks.
The graph shows their results.



Which two blocks have the **same** density?

Use the equation: density = $\frac{\text{mass}}{\text{volume}}$

A **P** and **Q**

B **P** and **R**

C **Q** and **S**

D **R** and **S**

Your answer ☐ **[1]**

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8 Planets **X** and **Z** are the same size.

- The gravitational field strength on planet **X** is 12 N / kg.
- Planet **X** has a mass of 1×10^{25} kg.
- Planet **Z** has a mass of 4×10^{25} kg.

What is the gravitational field strength on planet **Z**?
Use the Data Sheet.

A 0.75 N / kg

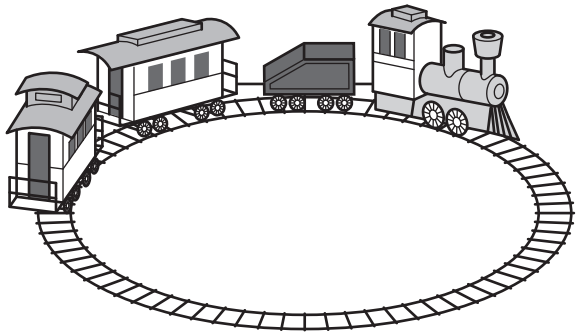
B 3 N / kg

C 12 N / kg

D 48 N / kg

Your answer ☐ **[1]**

9 A toy train moves around a circle of track.
The speed of the toy train is 2 cm / s.



Why is the velocity of the toy train changing?

A Air resistance is acting on the toy train.

B Force of track on toy train = force of toy train on track.

C Friction is acting between the track and the toy train.

D The toy train is changing direction.

Your answer ☐ **[1]**

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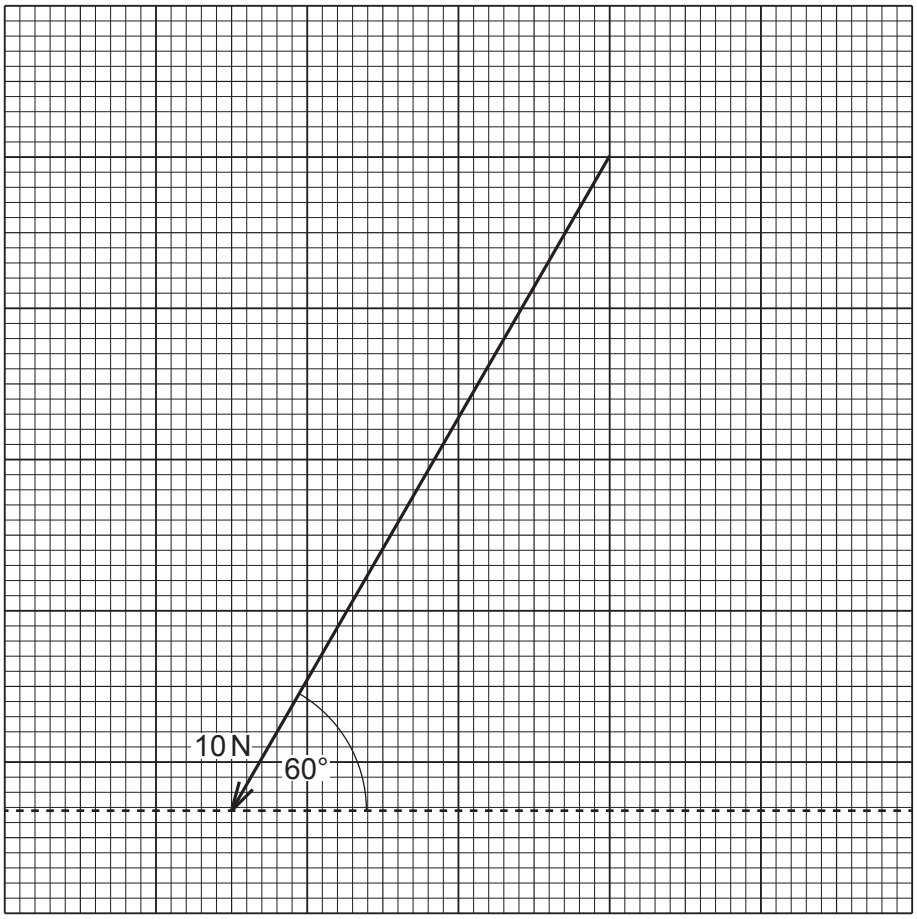
10 A child uses a force of 10 N at an angle of 60° to push a toy car.
This is a **scale diagram** of the force:

Scale:
1 cm = 1 N



What is the **horizontal** component of the force pushing the toy car?
Use the scale diagram.

A 3.2 N

B 5 N

C 8.7 N

D 10 N

Your answer ☐ **[1]**

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SECTION B

Answer **all** the questions.

11 **(a)** Describe the difference between specific heat capacity and specific latent heat.

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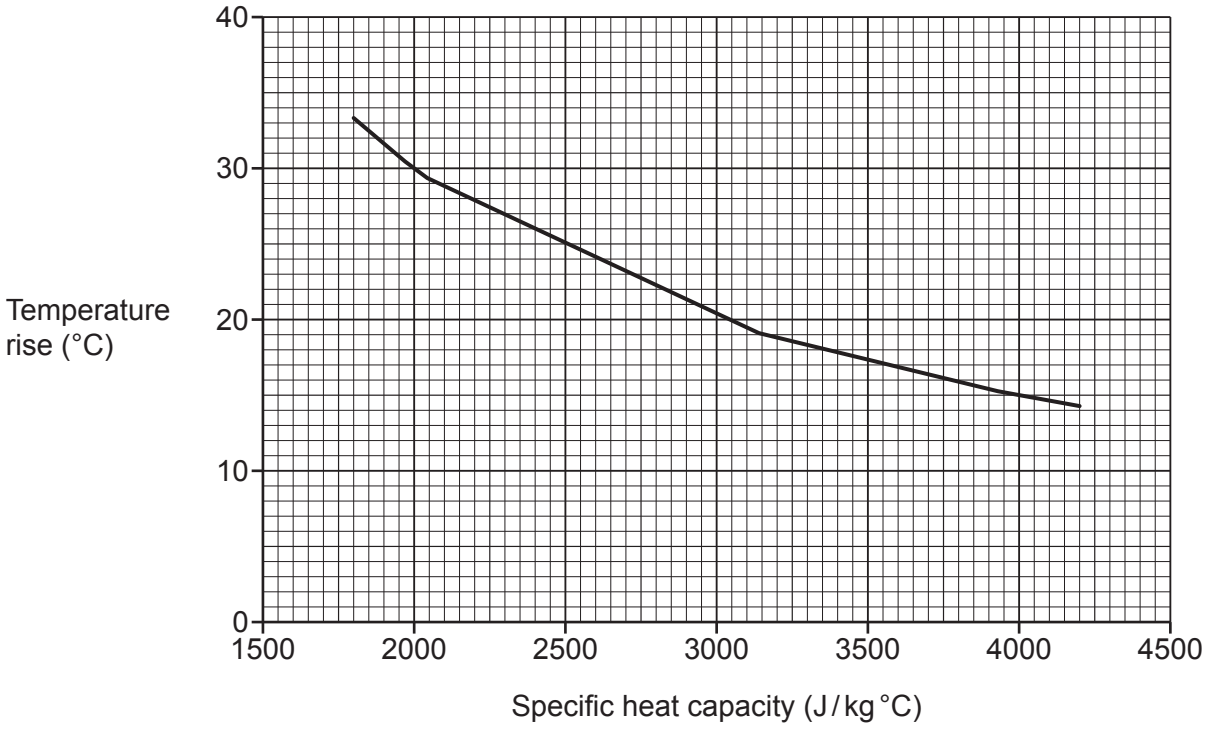
.....

..... **[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 J / kg °C.

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

Temperature rise = ... °C **[2]**

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(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 J / kg °C.
- Textbook value = 4200 J / kg °C.

Complete the sentence below.
Use one of the words.

Accurate	**Precise**	**Reliable**	**Repeatable**	**Systematic**

The student's value is …….. . **[1]**

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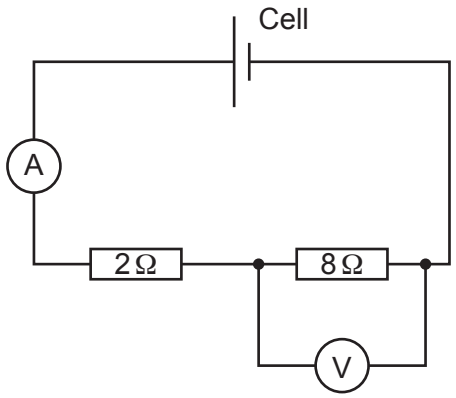
12 A teacher builds the circuit shown in the diagram.



(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]**

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13 Children often make models with clay.
Clay and springs behave differently.

(a) Draw **three** lines to match the **materials** to the **properties**.

Materials	Properties
	Elastic
Clay	
	Obeys Hooke's law
Spring	
	Plastic

[3]

(b) Two children are squashing clay on a desk.

Child **A** says, 'Only one force is needed to squash clay.'
Child **B** says, 'There are three forces acting on the clay when I squash the clay.'

Using ideas about forces, explain why child **B** is correct.

Use a free-body force diagram to help explain your answer.

.....

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..... **[4]**

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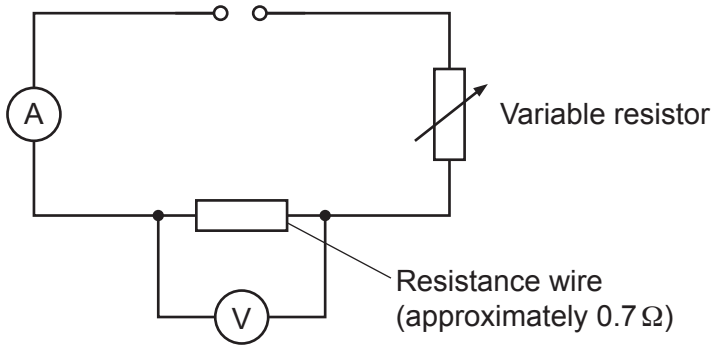
14* A student investigates if a length of resistance wire has linear or non-linear behaviour.

They use the circuit shown in **Fig. 14.1**.

Fig. 14.1

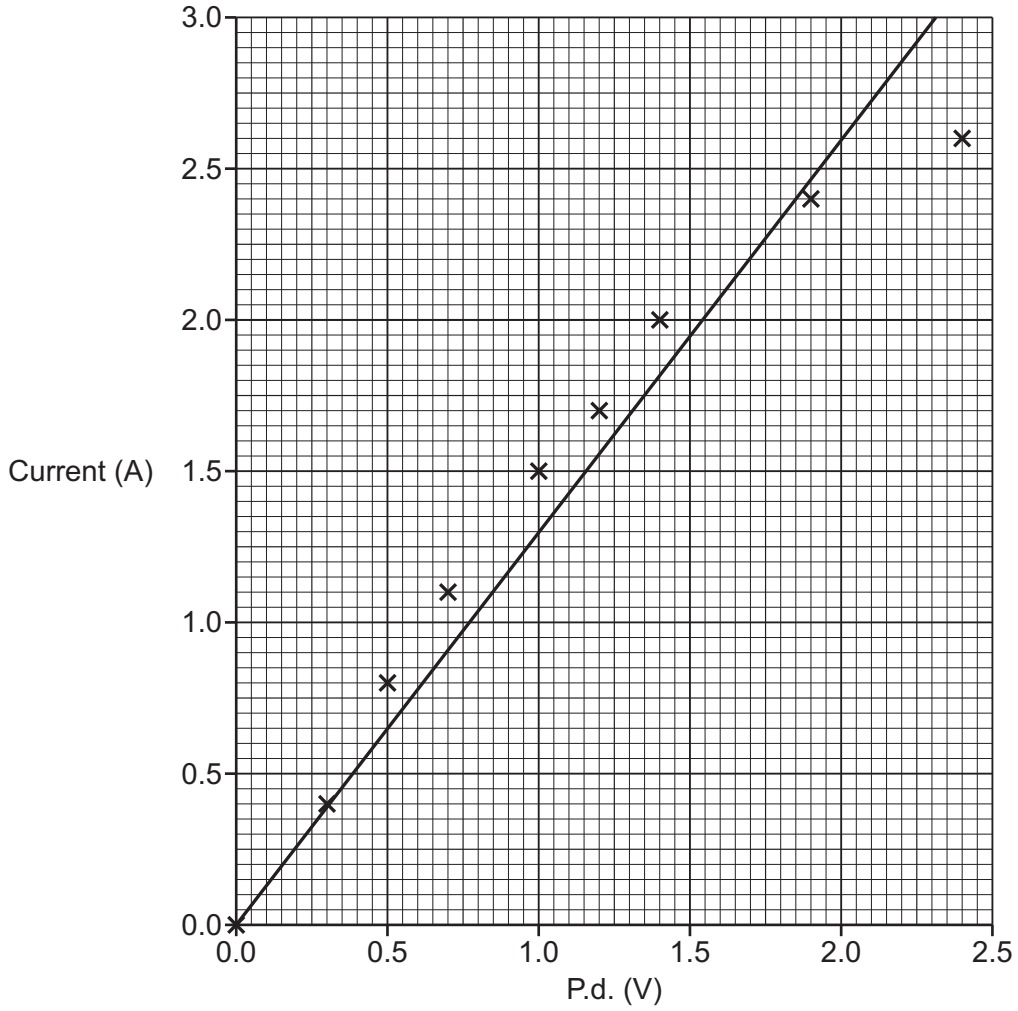


This is their method:

- Turn on the power supply.
- Measure the p.d. and current.
- Move slider on variable resistor.
- Take repeat measurements of p.d. and current.

Fig. 14.2 shows the student's results.

Fig. 14.2



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The student says, ‘I think my results are linear.’

Evaluate the student’s graph (**Fig. 14.2**) and conclusion.

Suggest how their method could be improved.

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

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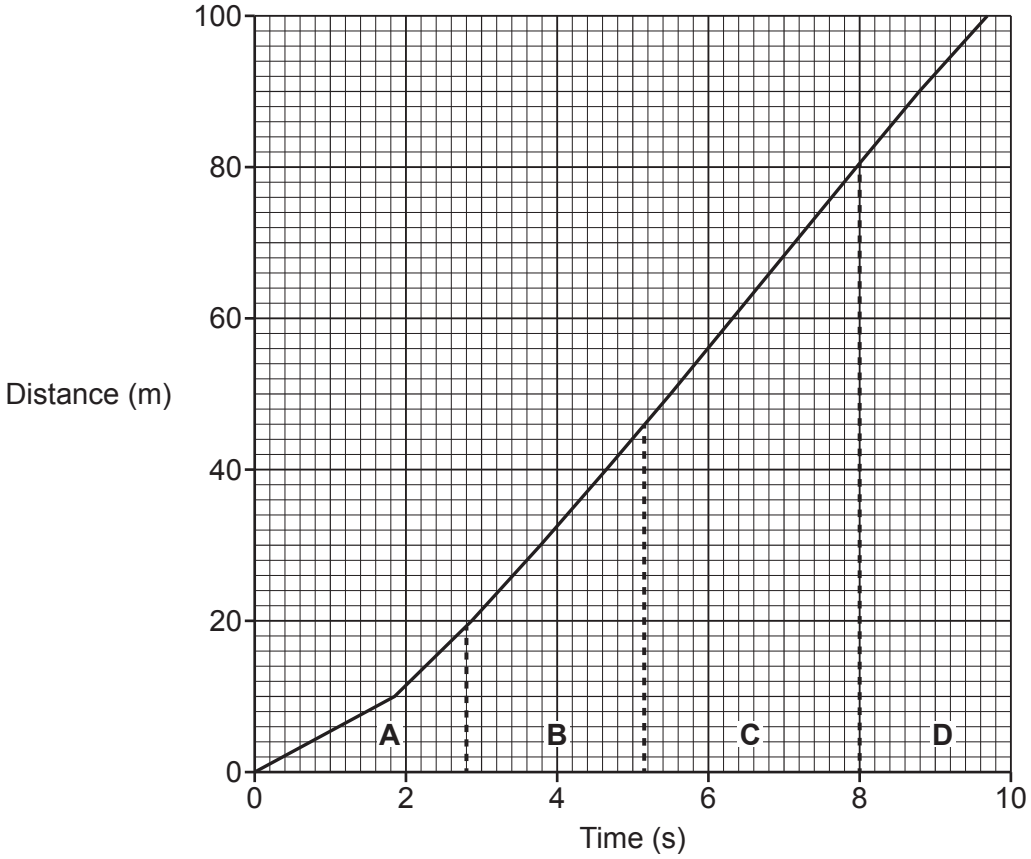
15 An athlete ran a 100 m sprint.
This is a distance-time graph of the sprint:



(a) Describe the athlete's motion in part **A** and part **C**.

A .....

C .....

[2]

(b) After the first 4 seconds, the athlete's speed is 11.5 m/s.
They travelled a distance of 32 m.

Calculate their acceleration during the first 4 seconds.

Use the Data Sheet.

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

Acceleration = ... m/s^2 **[4]**

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16 A teacher teaches their class about momentum.

(a) Define the term **momentum**.

.....

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

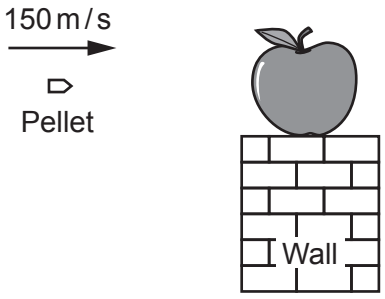
(b) Define the **principle of conservation of momentum**.

.....

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

(c) In an experiment, shown in **Fig. 16.1**, the teacher uses a pellet gun to shoot an apple.

Fig. 16.1



The mass of the pellet is 7 grams.

Calculate the momentum of the pellet before it hits the apple.
Use the Data Sheet.

Momentum of pellet = ... kg m / s **[3]**

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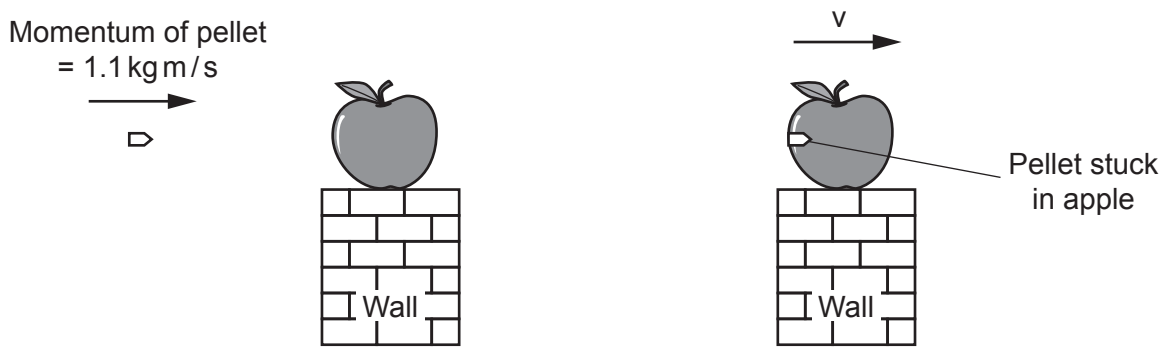
(d) The teacher repeats the experiment with a different pellet as shown in **Fig. 16.2**.

Fig. 16.2



Before collision **After collision**

- The pellet becomes stuck in the apple and they move off the wall together.
- The mass of the pellet is 0.011 kg.
- The mass of the apple is 0.089 kg.

Calculate the velocity of the pellet and apple after the collision.
Use the Data Sheet.

Velocity of pellet and apple = ... m / s **[3]**

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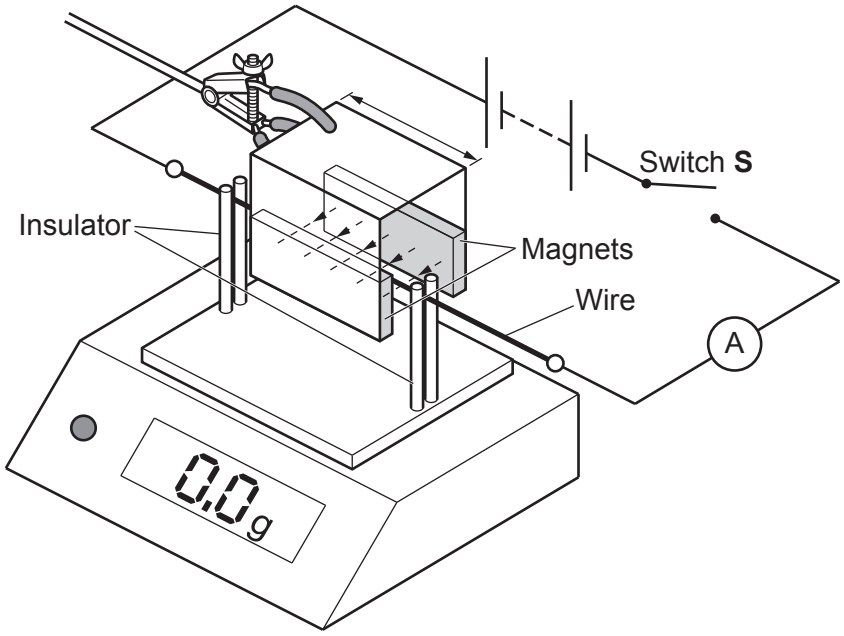
17 The diagram shows a wire placed in a magnetic field.



The electronic balance is used to work out the force acting on the wire.

(a) When Switch **S** is open, the electronic balance reading is 0.0 g.
Explain why.

.....

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

(b) When Switch **S** is closed, the electronic balance has a positive reading of 0.3 g.

(i) Explain why the balance shows a reading when Switch **S** is closed.

.....

.....

.....

.....

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

(ii) State the reading on the balance if the polarity of the battery is reversed.

Answer = ... g **[1]**

(iii) The polarity of the battery is unchanged from **(b)(i)**.
State the reading on the balance if the poles of the magnet are reversed.

Answer = ... g **[1]**

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(c) The experiment is repeated.

- When Switch **S** is closed the force on the wire is 0.004 N.
- The ammeter reads 0.8 A.
- The length of the wire in the magnetic field is 0.05 m.

Calculate the magnetic flux density around the wire.
Use the Data Sheet.

Magnetic flux density = ... T **[3]**

(d) A student investigates if the current in the wire changes the force on the wire.

Answer the questions to describe how the student can do this investigation.

(i) What does the student **vary**?

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

(ii) What does the student **control**?

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

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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