OCR
Oxford Cambridge and RSA

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Wednesday 22 May 2019 – Afternoon

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

J250/11 Paper 11 (Higher Tier)

Time allowed: 1 hour 10 minutes

7794361176

You must have:
- a ruler (cm/mm)
- the Data Sheet (for GCSE Physics A (inserted))

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

J250011

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

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

First name(s) _____

Last name _____

INSTRUCTIONS
- The Data Sheet will be found inside this document.
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Answer **all** the questions.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

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

SECTION A

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

Answer **all** the questions.

Write your answer to each question in the box provided.

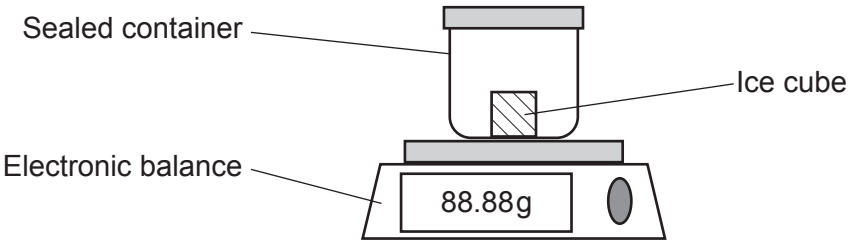
1 Some quantities are vectors and some are scalars.

Which row of the table is correct?

	Vector	**Scalar**
A	Speed	Displacement
B	Speed	Distance
C	Velocity	Displacement
D	Velocity	Distance

Your answer ☐ **[1]**

2 An ice cube and container are placed on an electronic balance on a hot day. The container is sealed.



Which row of the table correctly describes what happens?

	Reading on balance	**Type of change**	**Name of change**
A	Decreases	Chemical	Evaporating
B	Decreases	Physical	Evaporating
C	Stays the same	Chemical	Melting
D	Stays the same	Physical	Melting

Your answer ☐ **[1]**

3 Which statement about gravitational fields is correct?

A A spacecraft has a gravitational field that causes attraction.

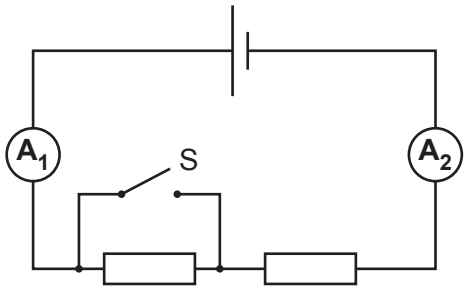
B Gravitational fields are attractive and repulsive.

C Gravitational field strength is measured in newtons.

D The larger the mass the smaller the gravitational field.

Your answer ☐ **[1]**

4 A student connects this electrical circuit. The resistors are identical.



Ammeter $\mathbf{A_1}$ reads 1.6A when the switch S is open.

What does ammeter $\mathbf{A_2}$ read when switch S is closed?

A 0.0A

B 0.8A

C 1.6A

D 3.2A

Your answer ☐ **[1]**

5 On the Moon, a 10 kg mass has a weight of 16 N.

What is the gravitational field strength on the Moon?

A 1.6 N / kg

B 6.0 N / kg

C 26 N / kg

D 160 N / kg

Your answer ☐ **[1]**

6 Which statement describes Newton's **third** law?

A Action and reaction are equal, opposite and act on the same object.

B Action and reaction are equal, opposite and act on separate objects.

C The rate of change of momentum is equal and opposite to resultant force.

D The rate of change of momentum is proportional to resultant force.

Your answer ☐ **[1]**

7 A student thinks about atoms placed side by side in a row.

Approximately, how many atoms would fit in a length of 1 m?

A 1×10^{8}

B 1×10^{10}

C 1×10^{12}

D 1×10^{14}

Your answer ☐ **[1]**

8 An electron is accelerated through a potential difference of 12 000 V. The charge on an electron is 1.60×10^{-19} C.

Calculate the energy transferred to the electron.

Use the equation: energy transferred = charge × potential difference

A 1.33×10^{-23} J

B 1.92×10^{-15} J

C 1.20×10^{4} J

D 7.50×10^{22} J

Your answer ☐ **[1]**

9 A current of 2.5 A flows for 1 minute through a circuit.

Calculate the charge flowing.

Use the equation: charge flow = current × time

A 0.04 C

B 2.5 C

C 24 C

D 150 C

Your answer ☐ **[1]**

10 The diagrams show a collision between two trolleys.

Before collision **After collision**

Calculate the combined speed of the trolleys **after** the collision.

Use the information in the diagram and the equation: momentum = mass × velocity

A 1 m/s

B 2 m/s

C 6 m/s

D 9 m/s

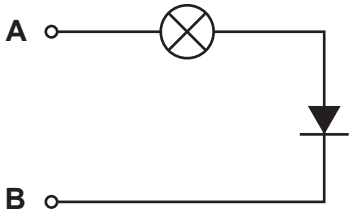
Your answer ☐ **[1]**

SECTION B

Answer **all** the questions.

11 A student makes a 'component tester'. He connects a diode to a small filament lamp.

This is a diagram of the component tester.



(a) Describe how the student could use the component tester to find the positive (+) terminal of a cell.

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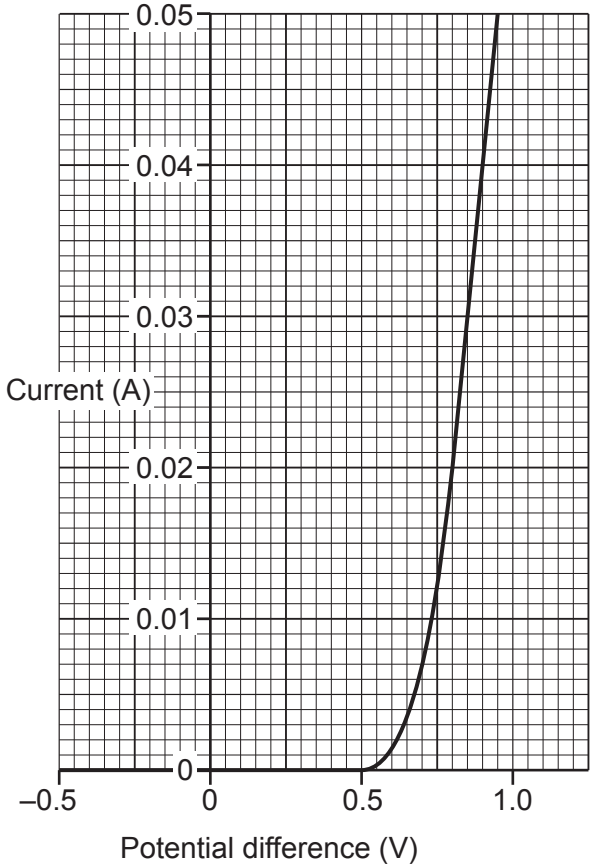
..... **[3]**

(b) Here is a graph of current against potential difference for a diode.



(i) The diode is **not** a fixed resistor.

Describe **two** ways the graph shows this.

1 .....

.....

2 .....

.....

[2]

(ii) Calculate the resistance of the diode at + 0.8 V.

Use the graph **and** the equation: potential difference = current × resistance

Resistance = ... Ω **[4]**

(c) The manufacturer of the diode gives the following warning:

> The supply voltage must not exceed 1 V.

Use the graph in **11(b)** to explain why.

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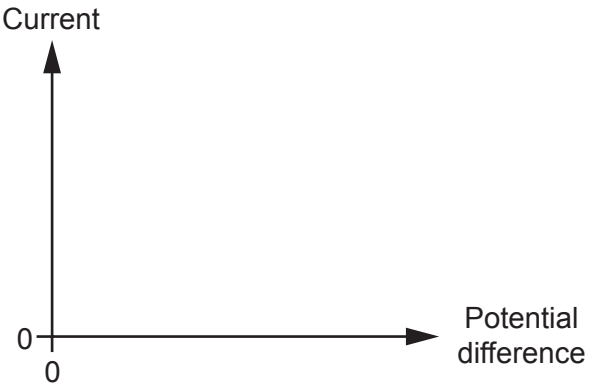
..... **[2]**

(d) Sketch a graph of current against potential difference for a filament lamp.
Use the axes below.



[1]

12 (a) A student has two metal cubes, **A** and **B**, as shown in **Fig. 12.1**.

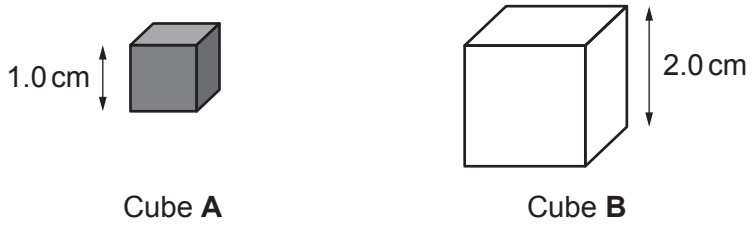


Fig. 12.1

Each side of metal cube **A** is 1.0 cm. Each side of metal cube **B** is 2.0 cm.

Both metal cubes have the same mass. The density of metal cube **A** is 16 g / cm^3.

(i) Calculate the density of metal cube **B**.

Use the equation: density = mass ÷ volume

Density = ... g / cm^3 **[3]**

(ii) Metal cube **A** sinks when placed in water.

Explain why.

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

(b) The student hangs cube **A** from the end of a vertical spring and waits for the spring to become stationary, as shown in **Fig. 12.2**.

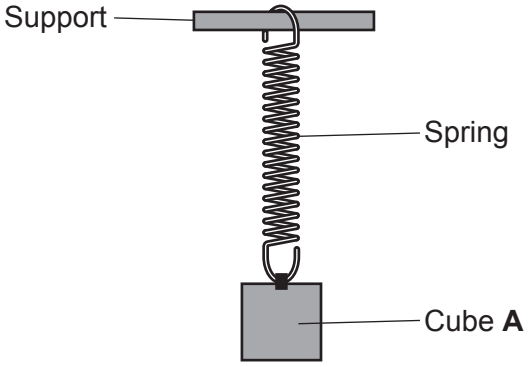

Fig. 12.2

(i) Draw a labelled free body force diagram **for the spring**.

The spring is attached to the support at the top and has cube **A** attached at the bottom.

[2]

(ii) The resultant force on the spring is zero.

Explain why.

Use your answer to **12(b)(i)** to help you.

.....

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

(iii) More than one force is required to stretch the spring.

Describe what happens if only one force is applied.

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

(iv) The student removes cube **A** and places another cube, cube **C**, on the spring.

The extension of the spring due to cube **C** is 0.04 m.

The spring constant of the spring is 30 N / m.

Calculate the weight of cube **C**.

Weight = ... N **[3]**

13 (a) A student wraps a coil of insulated wire around a soft iron rod to make an electromagnet. He places some steel pins on a wooden mat under the iron rod. **Fig. 13.1** shows the set-up of the apparatus.

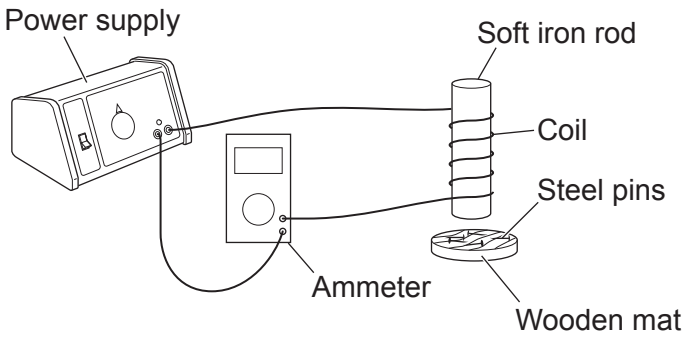

Fig. 13.1

He changes the number of turns in the coil. He records how many pins are picked up by the iron rod. The table shows his results.

Number of turns in coil	Current (A)	Number of pins
10	0.50	1
20	0.50	2
30	0.25	2
40	0.25	2
50	0.50	4

(i) The student concludes 'The more turns, the stronger the magnetic field'.

Do the results in the table support his conclusion?

Explain your answer.

.....

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

(ii) The electromagnets with 20 and 40 turns pick up the same number of pins.

Suggest why the electromagnet with 40 turns is more useful.

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

(b) **Fig. 13.2** shows the inside of a simple d.c. motor. The direction of the current in the coil is shown.

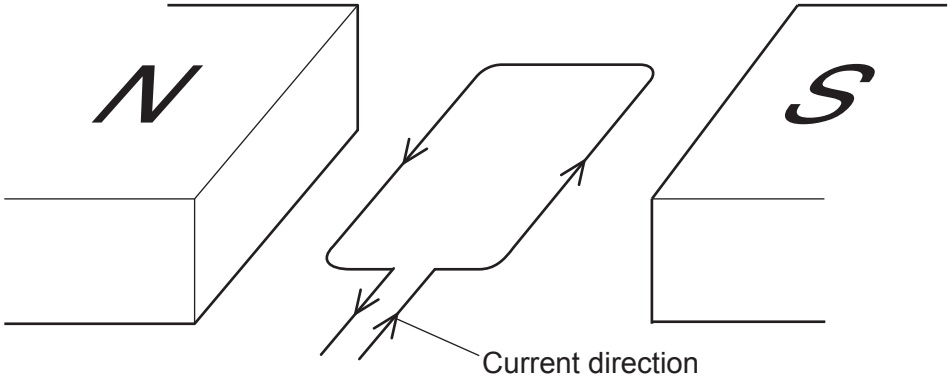


Fig. 13.2

(i) Which direction will the coil rotate in **Fig. 13.2**?

State the name of the rule you used to work out your answer.

Direction .....

Name of rule ..... **[1]**

(ii) **Fig. 13.3** shows the simple d.c. motor from above.

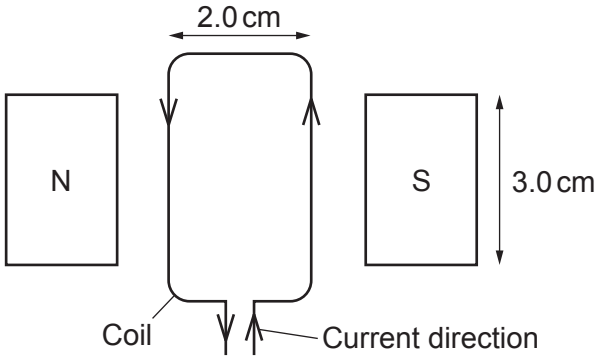


Fig. 13.3

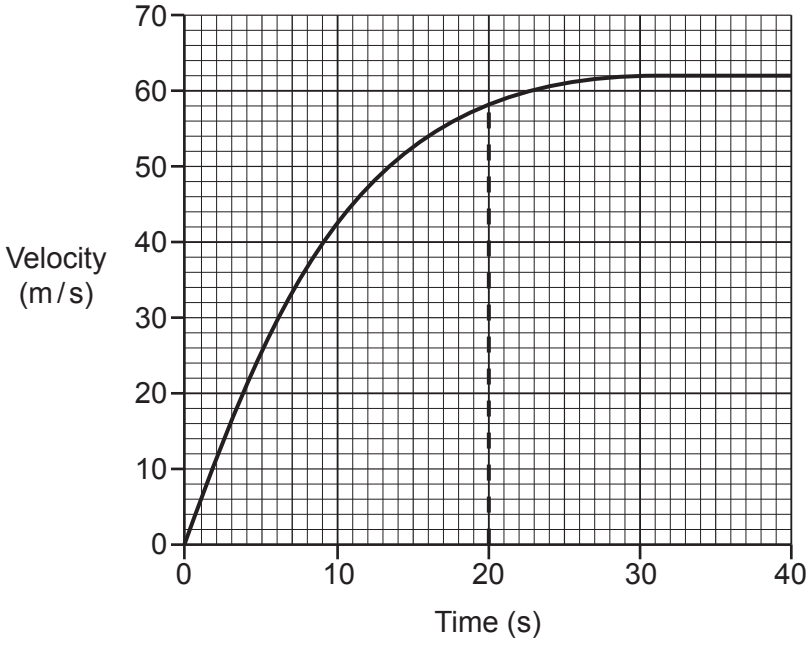
In **Fig. 13.3** the magnetic field between the poles is uniform. The magnetic flux density between the poles is 0.08 T. The current in the coil is 0.50 A.

Calculate the maximum magnetic force on **one** side of the coil.

Use the values in the diagram to help you.

Maximum magnetic force = ... N **[4]**

14 A car accelerates from rest. This is a graph of the motion of the car on a straight road.



(a) In the first 20 seconds, the car travels 750 m.

Show that the **total** distance travelled in 40 seconds is approximately 2000 m.

Use the graph to help you.

[2]

(b) Calculate the **average speed** for the total journey shown in the graph.

Average speed = ... m/s **[3]**

15 Student **A** does an experiment to find out if force is related to acceleration.

Fig. 15.1 is a diagram of her experiment.

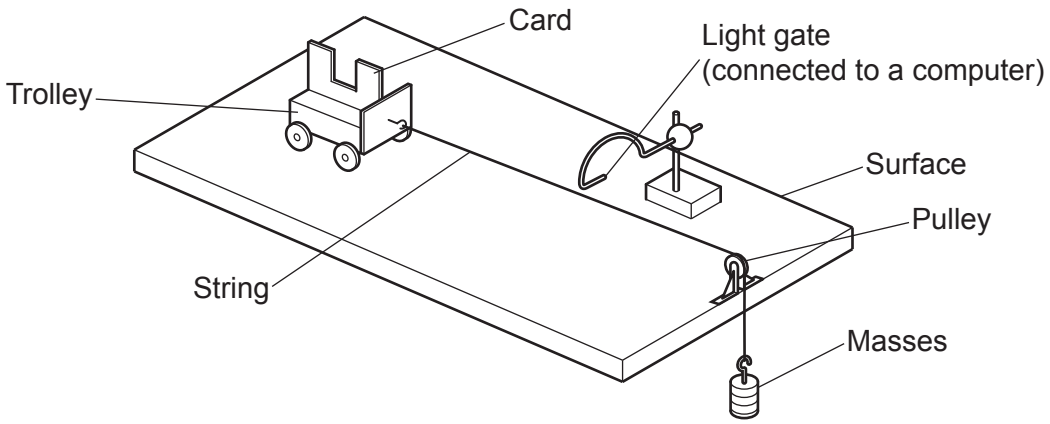


Fig. 15.1

(a) She hangs a 400 g mass over the pulley.

How can she work out the accelerating force on the trolley?

Use an equation to help explain your answer.

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

(b) The tall parts of the card on the trolley labelled **X** and **Y** pass through the light gate, as shown in **Fig. 15.2**.

The light gate can measure:
- the time it takes for **Y** to go through
- the time it takes for **X** to go through
- the time between **Y** and **X** going through.

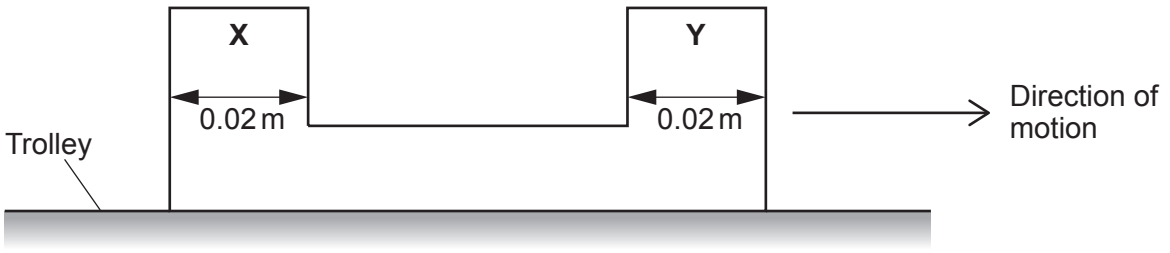

Fig. 15.2

How can student **A** use the **light gate** and **card** to measure the acceleration of the trolley?

Use an equation to help explain your answer.

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

(c) Describe **one** way this experiment could be improved.

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

(d)* Student **A** records some measurements. She plots the data points and draws a line of best fit on the graph in **Fig. 15.3**.

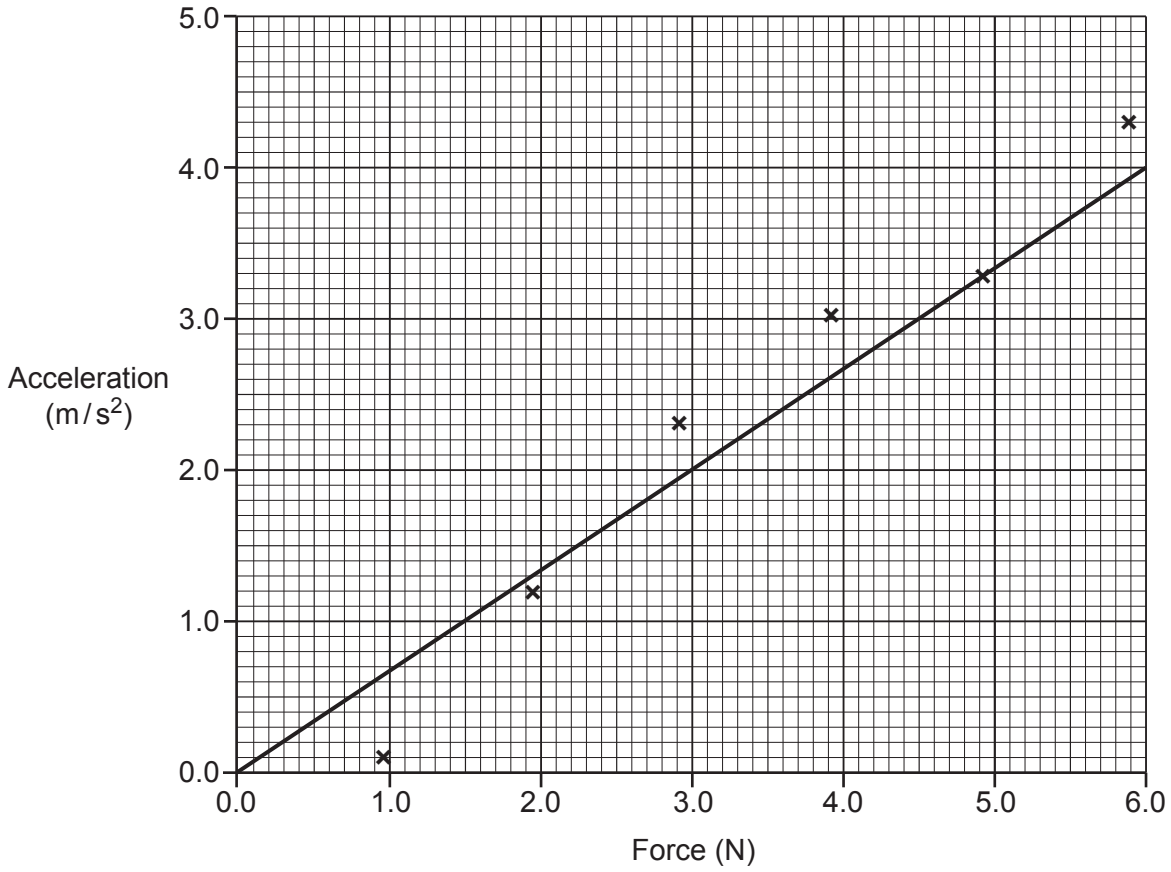

Fig. 15.3

Describe and explain what the results in **Fig. 15.3** show. Comment on the validity of student **A**'s results shown on the graph in **Fig. 15.3**.

You are **not** expected to include a calculation.

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

(e) Student **B** does the same experiment.

Fig. 15.4 is a graph of her results.

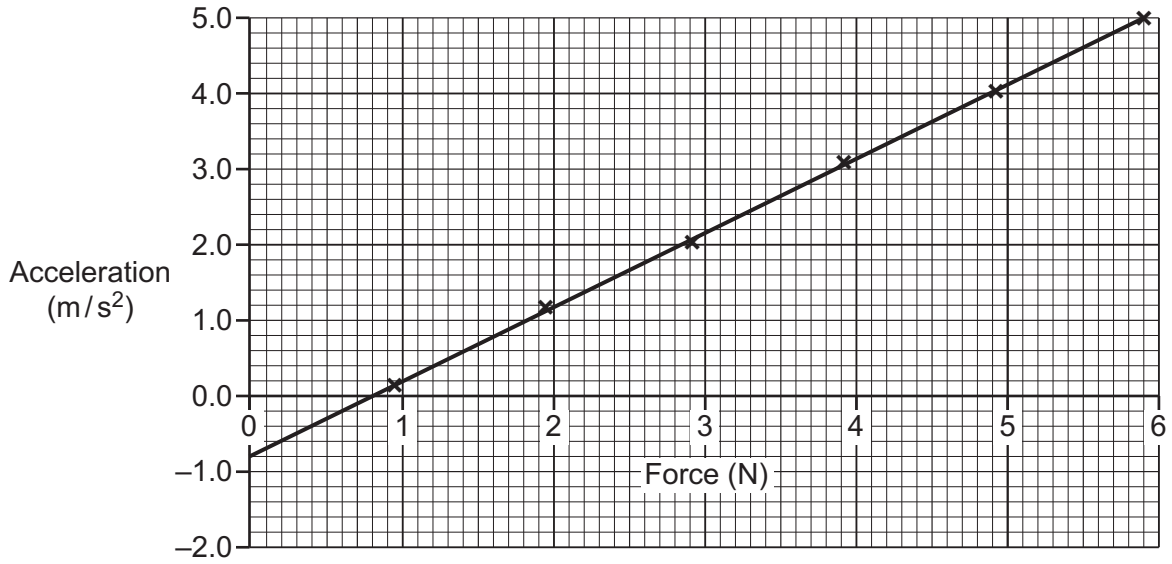

Fig. 15.4

(i) Calculate the gradient of the graph in **Fig. 15.4**.

Gradient = ... per kg **[2]**

(ii) Student **B**'s graph in **Fig. 15.4** can be described by an equation.

Write this equation in the form: $y = mx + c$

Use your answer to **15(e)(i)** and student **B**'s graph in **Fig. 15.4** to help you.

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

END OF QUESTION PAPER

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).