Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2025

Physics

Unit 3 Practical Skills

Booklet B

Foundation Tier

[GPY32]

GPY32

MONDAY 23 JUNE, MORNING

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

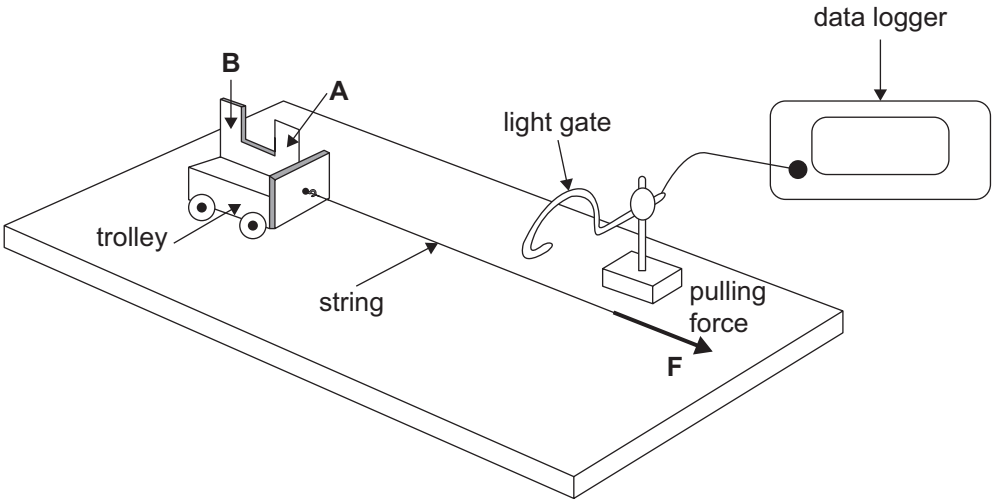
Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink and use a dark HB pencil for drawings and graphs.
Do not write with a gel pen.
Answer **all** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You may use a scientific calculator.

14718.05**R**

1 (a) A light gate connected to a data logger can be used to measure the speed of an object. A card placed on a moving trolley is used. When parts A and B pass through a light gate a laser beam is blocked and a time is measured.



Source: "Reproduced from spark.iop.org with permission of the Institute of Physics."

The time between A and B passing through the light gate is also measured and recorded by the data logger. The widths of parts A and B are measured using a ruler.
The table below shows the results of one use of this apparatus.

Width of part A	3 cm
Width of part B	3 cm
Time for A to pass through the light gate	0.3 s
Time for B to pass through the light gate	0.2 s
Time between A and B passing through the light gate	0.25 s

(i) Using the values shown in the table, calculate the speed of part A.
Show your working out.

Speed of part A = _____ cm/s [1]

(ii) Using the values shown in the table, calculate the speed of part B.
Show your working out.

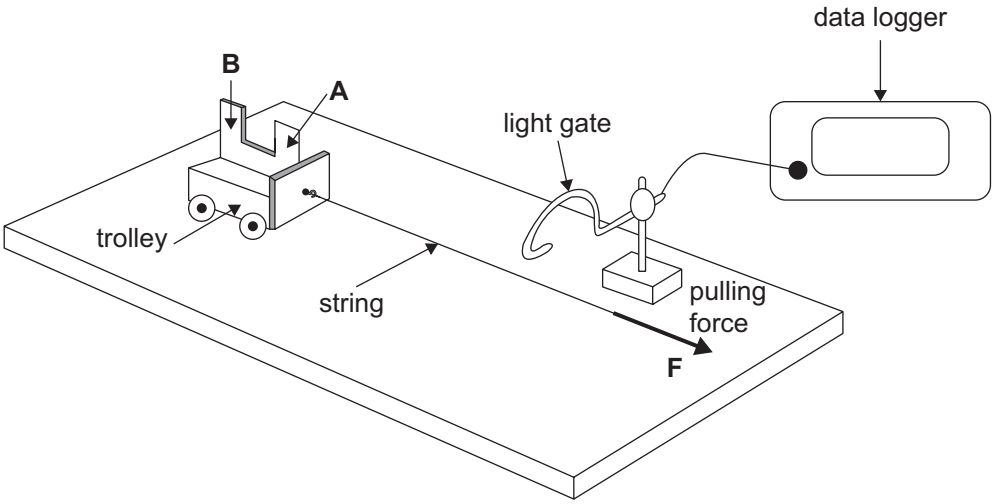
Speed of part B = _____ cm/s [1]

(iii) Using your answers to parts (i) and (ii), calculate the rate of change of speed of the trolley.
Show your working out.

Rate of change of speed = _____ cm/s^2 [2]

[Turn over

A student investigates force and acceleration using the apparatus shown below.
The trolley is pulled along by force F.



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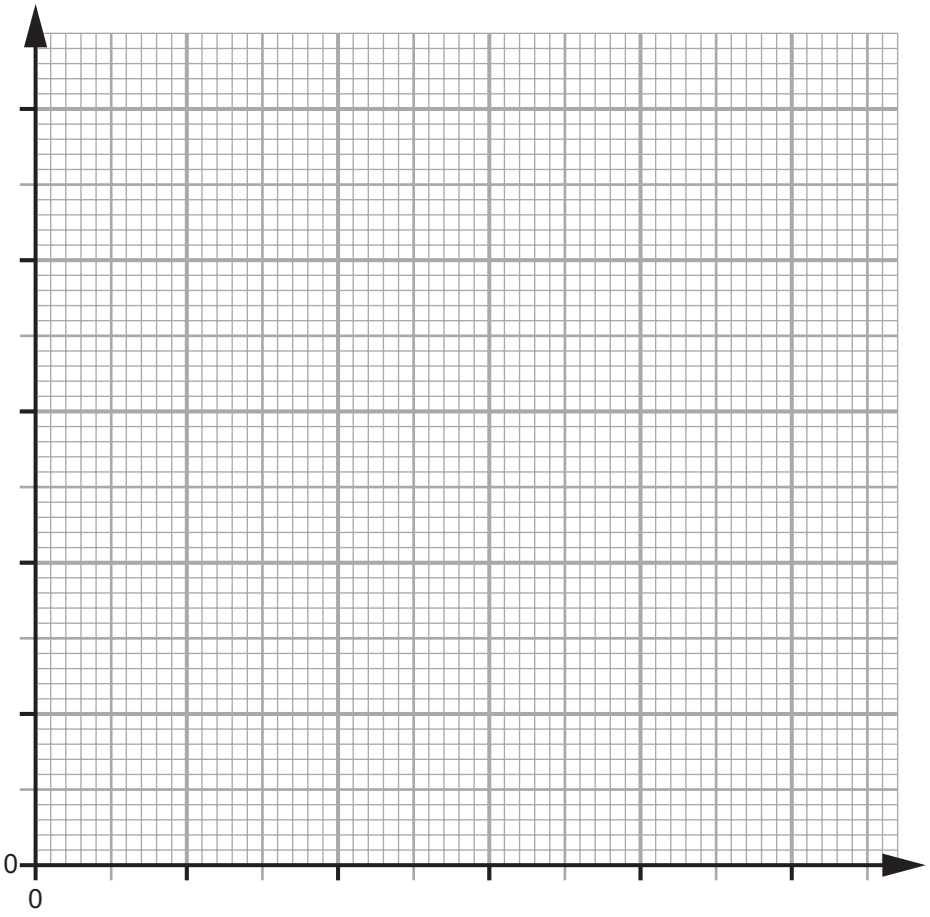
The experiment was carried out using different forces to pull the trolley.
For each force used to pull the trolley the acceleration produced was measured.
The results are shown in the table below.

Force/N	Acceleration/ m/s^2
0.5	0.1
1.0	0.2
1.5	0.3
2.0	0.4
2.5	0.5

(iv) On the grid opposite, plot a graph of force on the y-axis against acceleration on the x-axis.
Choose a scale for each axis.
Label each axis with the quantity and unit.
Plot the points on the grid, using × or ⊙ to clearly show the plotted points.
Draw the best fit line through the points. [7]



(v) Newton's second law states that the relationship between the force and the acceleration is given by the equation below.

$$\mathbf{F = ka}$$

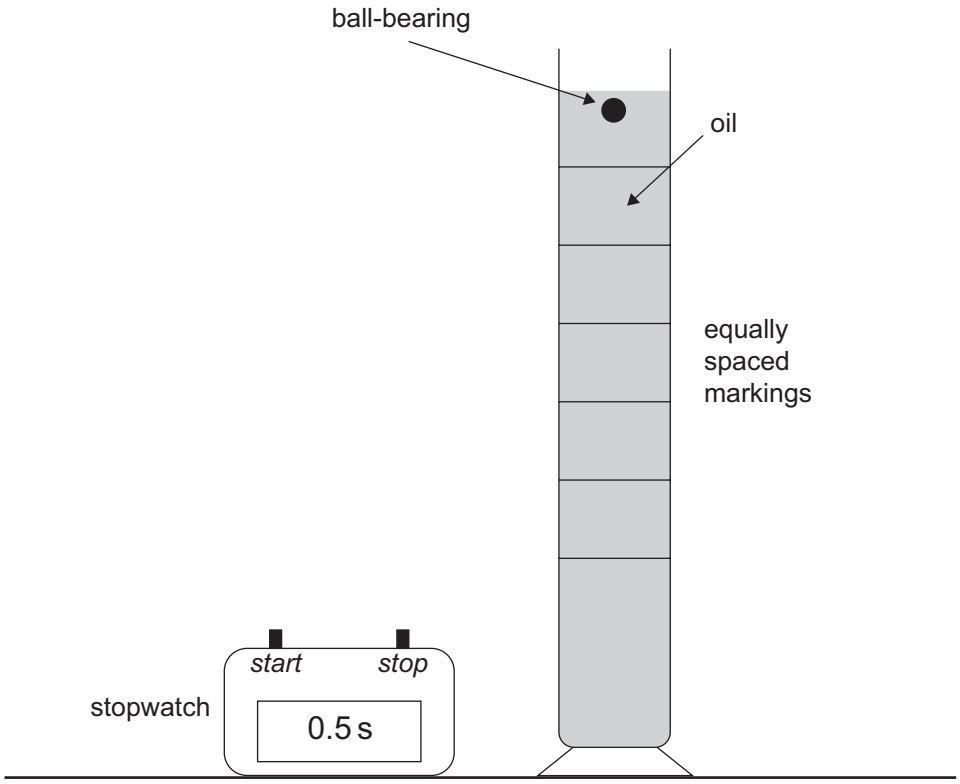
Using the graph, calculate the value of the constant k.
State the unit for k.
Show your working out.

k = _____

Unit = _____ [3]

[Turn over

(b) Another student investigates the motion of a ball-bearing as it falls through a cylinder of oil, as shown in the diagram below.
The markings on the side of the cylinder are equally spaced.
The student is provided with a stopwatch.
The oil exerts a frictional force on the ball-bearing.



(i) The ball-bearing is released from rest and eventually travels down through the oil with a **constant speed**.
Describe how you would use the markings on the cylinder and the stopwatch to show that the ball-bearing is moving with a constant speed.

_____

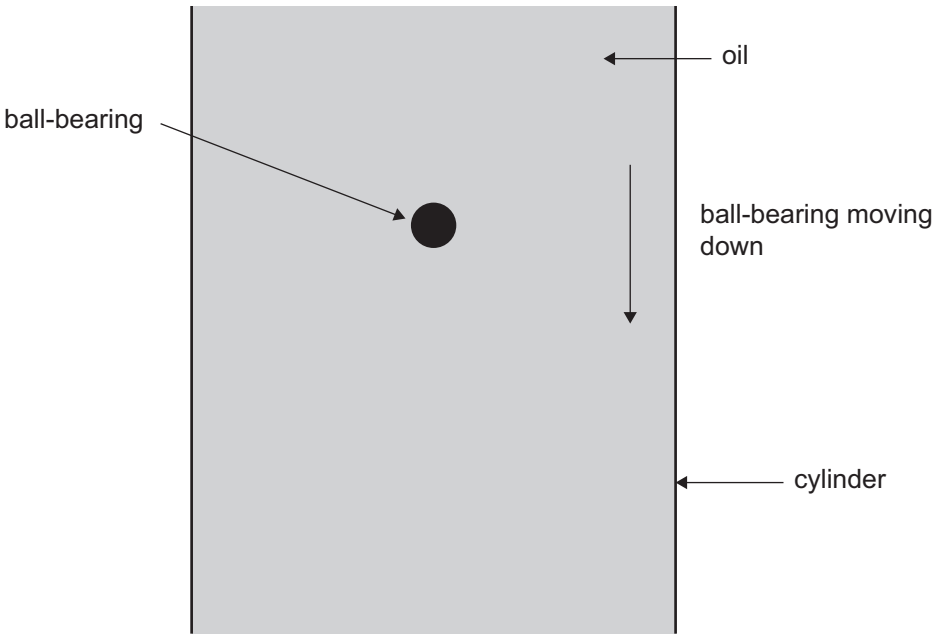
_____

_____

_____

_____ [2]

(ii) On the diagram below, mark and name the forces acting on the ball-bearing.



[1]

(iii) When the ball-bearing is moving with constant speed, what does this tell the student about these two forces?

_____

_____ [1]

[Turn over

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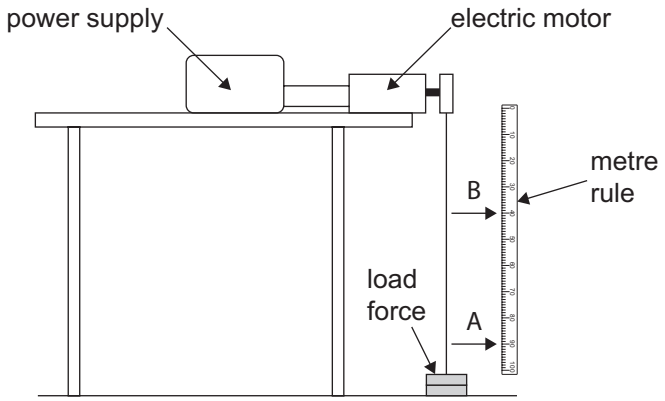
2 **(a)** To measure the output power of a small electric motor, the experimental arrangement in the diagram below was used. The distance between the two markers A and B was measured using a metre rule.



Source: Principal Examiner

(i) A risk assessment was performed before starting the task.
Suggest **one** precaution that was needed.

_____

_____ [1]

(ii) The load is comprised of a 0.2 kg mass.
Explain how the load force would be calculated.

_____ [1]

(iii) What additional piece of equipment is required to measure the time to lift the load?

_____ [1]

[Turn over

(b) The results of the experiment are shown in the table below.

(i) In the table below, add the units for the load force in column 1, the height the load is lifted in column 2 and the time taken to lift the load in column 4.

[3]

Column 1	Column 2	Column 3	Column 4	Column 5
Load force/	**Height load lifted/**		**Time taken/**	
2	0.5		0.4	
2	0.6		0.5	
2	0.8		0.6	
2	1.1		0.9	
2	1.3		1.2	

(ii) Use the equation below to calculate the work done for each set of readings and insert your answers in column 3.

work done = load force × height

Give your answers to **1 decimal place**.
Insert a heading with unit at the top of column 3.
You can use the space below for calculations.

[4]

(iii) Use the equation below to calculate the output power for each set of readings and insert your answers in column 5.

$$\textbf{power} = \frac{\textbf{work done}}{\textbf{time taken}}$$

Give your answers to **1 decimal place**.
Insert a heading with unit at the top of the column 5.
You can use the space below for calculations.

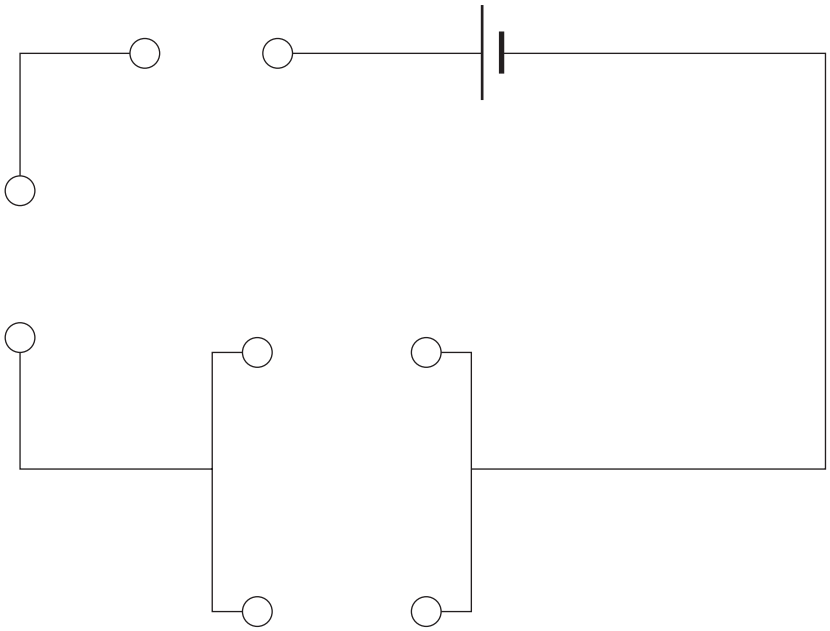
[4]

(iv) Use your calculated data to find the most reliable value of the output power of the motor.
Show your working out.

Most reliable value of output power = _____ [3]

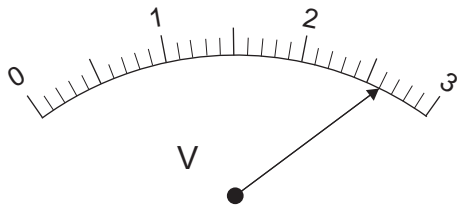
[Turn over

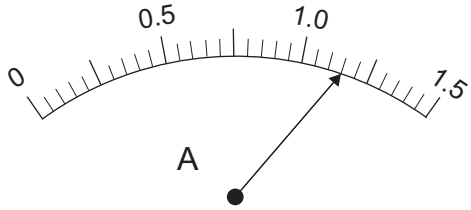
3 (a) (i) Complete the circuit below to show how the current passing through a bulb and the voltage across the bulb can be measured.
Include a switch so that the bulb can be turned on and off.
Use the correct symbol for each component.



[4]

The readings on the two meters in the completed circuit when the switch is closed are shown below.





(ii) What is the voltage reading? _____ V

What is the current reading? _____ A [2]

(iii) Using the equation below and these voltage and current values, calculate the power of the bulb.

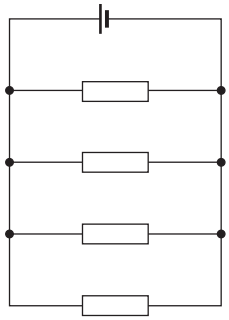
power = current × voltage

Give your answer to **1 decimal place**.

Power = _____ [2]

[Turn over

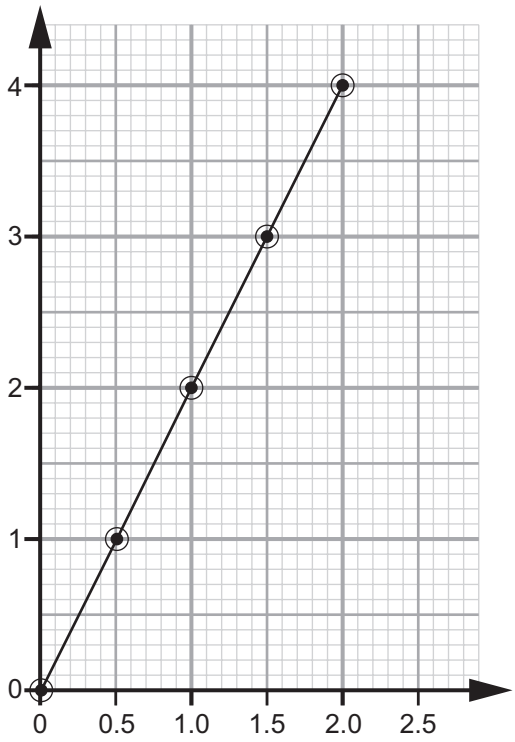
(b) Four **equal** resistors are connected in parallel as shown below.



Source: Chief Examiner

The current in the circuit is measured as the number of resistors is increased from one to four.

The graph below shows how the current changed as the number of resistors is increased. **The voltage does not change.**



(i) Label the y-axis with the quantity.

Label the x-axis with the quantity and unit. [3]

(ii) Explain why the current increases as the number of resistors in parallel increases.

_____

_____ [1]

(iii) Calculate the gradient of the graph.
Show your working out.

Gradient = _____ [3]

(iv) The relationship between the number of resistors N and the current I is given by the equation below.

$$\mathbf{N = kI}$$

How are the gradient and the constant k related?

_____ [1]

(v) The voltage across the four resistors is 2.0 V.
Use the graph and the equation below to find the value of one of the resistors.

$$\mathbf{R = \frac{V}{I}}$$

Show your working out.

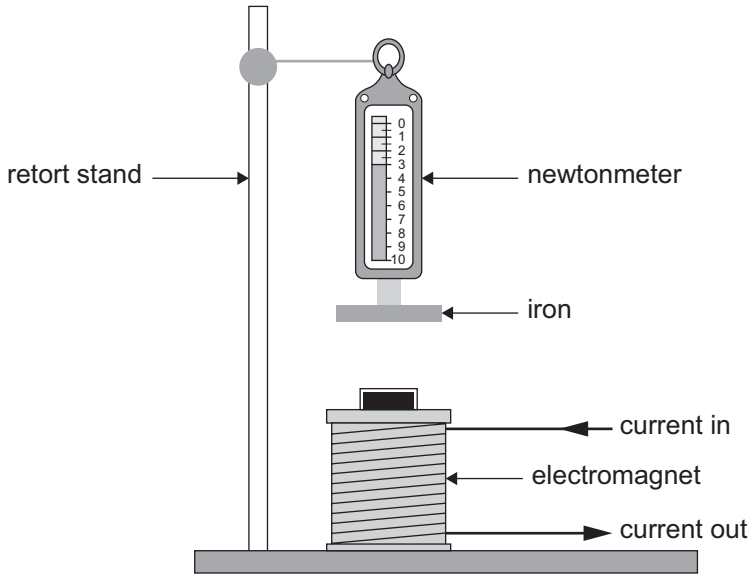
Resistance = _____ Ω [2]

[Turn over

4 **(a)** To investigate the strength of an electromagnet, a student set up the apparatus shown below.

A piece of iron is attached to a newtonmeter.

An electromagnet is placed under the iron.



The electromagnet exerts a downward attractive force on the iron when a current flows through the electromagnet.

The student varied the current through the electromagnet and recorded the reading on the newtonmeter for each value of current.

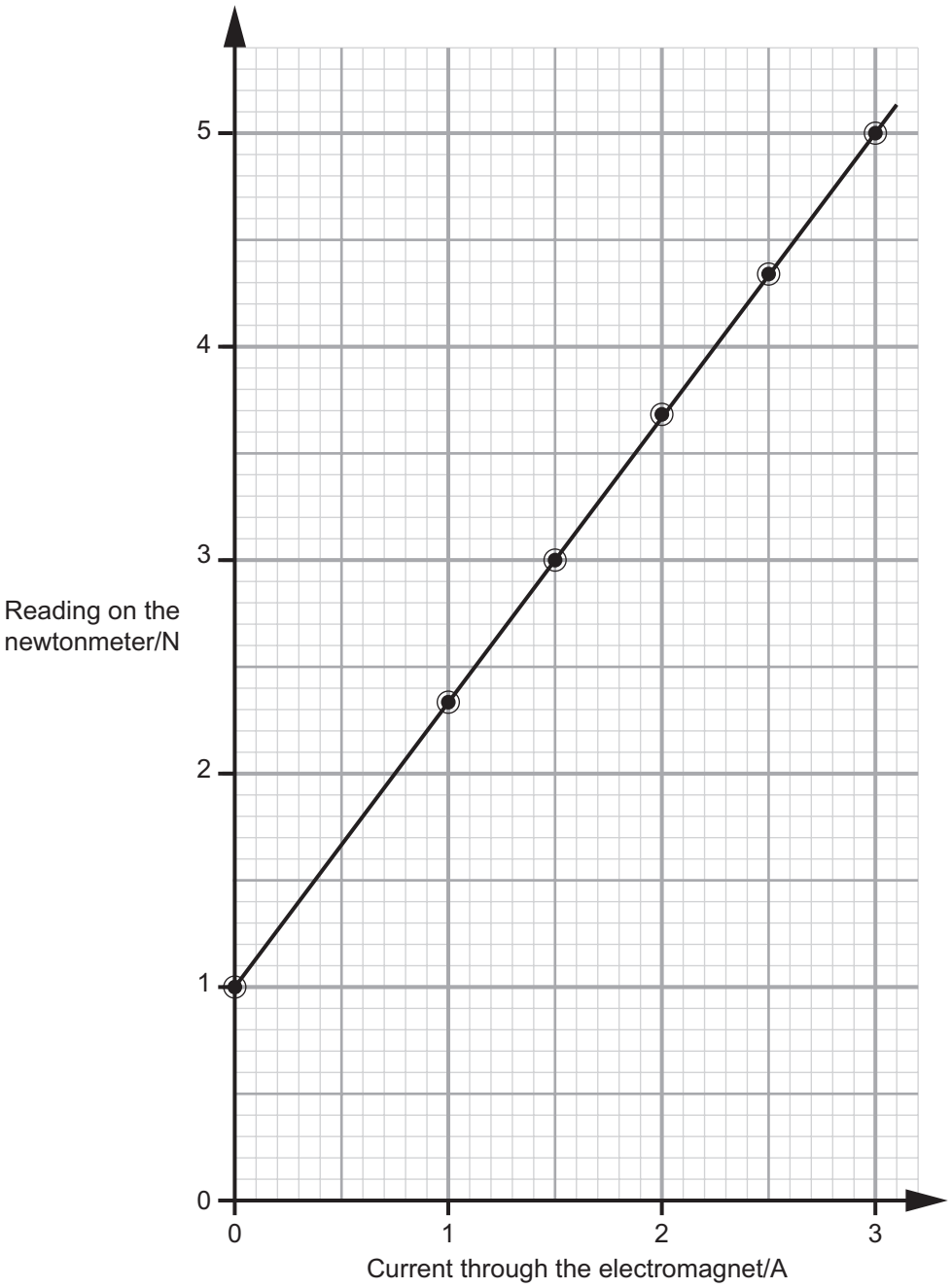
The results of this investigation are shown in the graph opposite.

(i) How does the graph show that the reading on the newtonmeter and the current through the electromagnet are not proportional?

_____ [1]

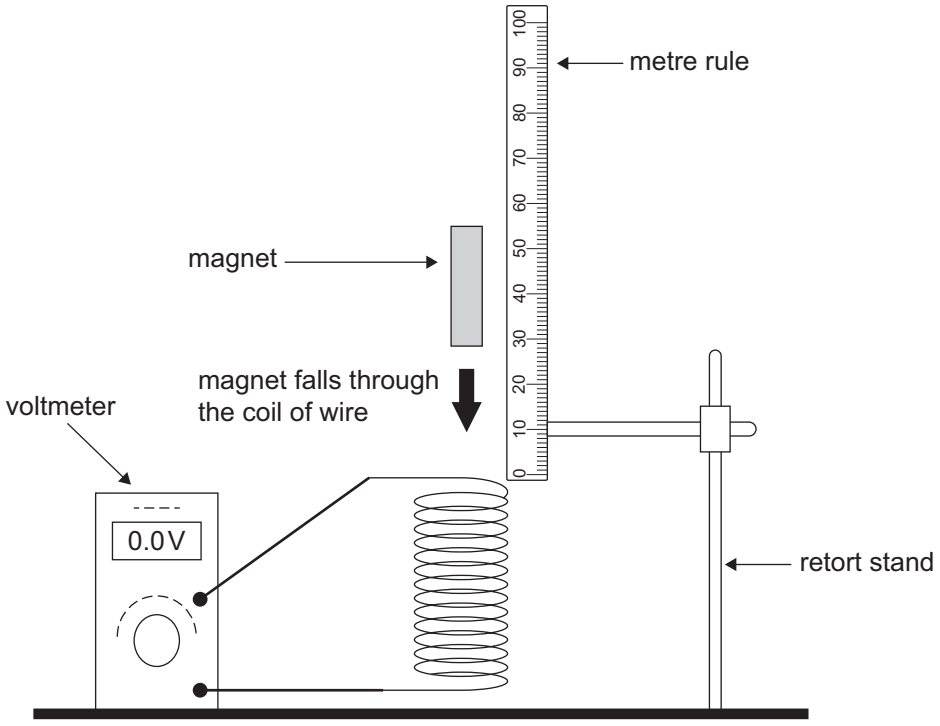
(ii) Explain why the newtonmeter reading is 1 N when there is no current passing through the electromagnet.

_____ [1]


Reading on the newtonmeter/N
0
1
2
3
4
5
0
1
2
3
Current through the electromagnet/A

[Turn over

(b) When a magnet is dropped into a coil of wire a voltage is induced in the coil. This is known as electromagnetic induction.
To investigate how the induced voltage depends on the height from which the magnet is dropped, a student set up the apparatus below.



The coil is connected to a voltmeter.

The student records the voltage induced as the magnet enters the coil of wire.

(i) What should the student do to improve the reliability of their measurements?

_____ [1]

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(Question 4(b) continues overleaf)

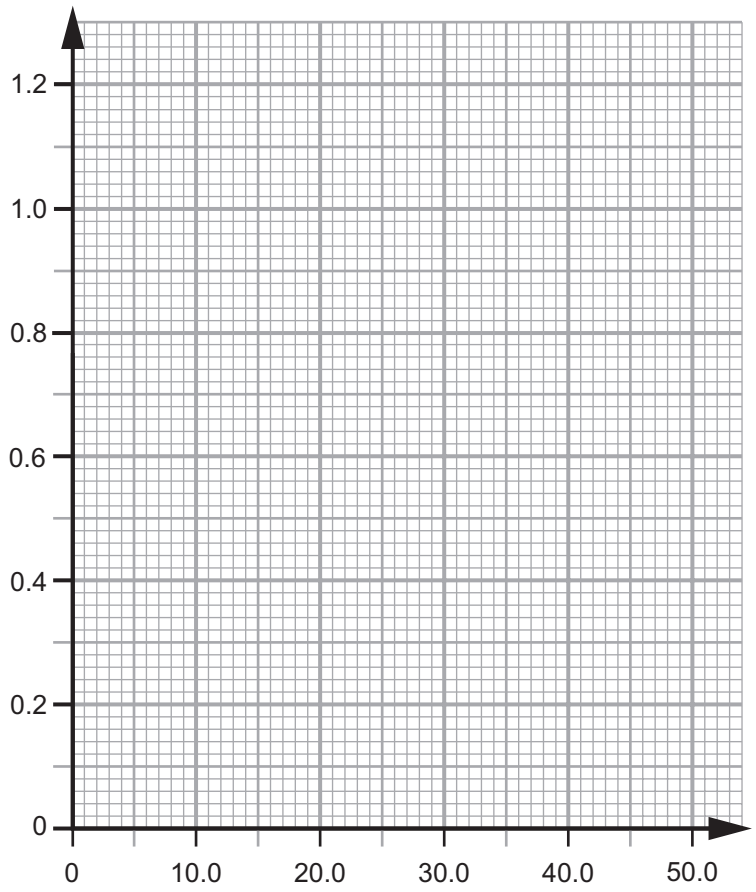
[Turn over

The table below shows the measurements obtained.

Height/cm	Induced voltage/V
0	0
10.0	0.40
20.0	0.70
30.0	0.90
40.0	1.0
50.0	1.1

(ii) On the grid below, plot the graph of the height dropped on the x-axis against induced voltage on the y-axis. Label each axis with the quantity and its unit. [2]

(iii) Mark the points using ⊙ or ×. [3]



(iv) Draw the best fit curve through the points. [2]

(v) The induced voltage and the height from which the magnet is dropped are **not** proportional.
Explain how the graph supports this.

_____

_____ [1]

(vi) In this investigation, name and explain the following:

The dependent variable _____

Explanation _____

_____

The independent variable _____

Explanation _____

_____

The control variable _____

Explanation _____

_____ [6]

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For Examiner's use only	
Question Number	**Marks**
1	
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