



General Certificate of Secondary Education

Centre Number

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Candidate Number

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# Physics

Unit 3 Practical Skills

Booklet B

Higher Tier

[GPY34]

Assessment



\*GPY34\*

### TIME

1 hour 15 minutes.

### Assessment Level of Control:

Tick the relevant box (✓)

Controlled Conditions	
Other	

### 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 only. **Do not write with a gel pen.**

Answer **all** questions.

### INFORMATION FOR CANDIDATES

The total mark for this paper is 70.

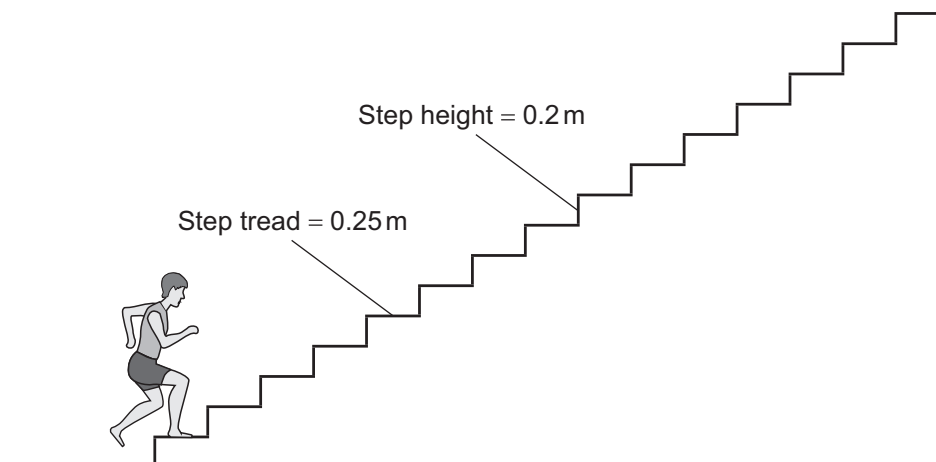
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question **2(a)**.

You should have a ruler and a protractor.



- 1 (a) A student measures his personal power by running up a flight of stairs. To obtain a more reliable result he repeats this three times. The diagram below shows a sketch of the staircase. There are **15 steps** in the staircase.



- (i) State **in words** the equation you would use to calculate the personal power of a student.

Personal power =

[2]

- (ii) The times recorded for running up the stairs are 4.5 s, 4.7 s and 4.6 s. The student has a mass of 60 kg. By first finding the average time to run up the stairs, calculate the average personal power of the student. **Include the unit for power with your answer. You should show clearly how you get your answer.**

Personal power = \_\_\_\_\_ [6]



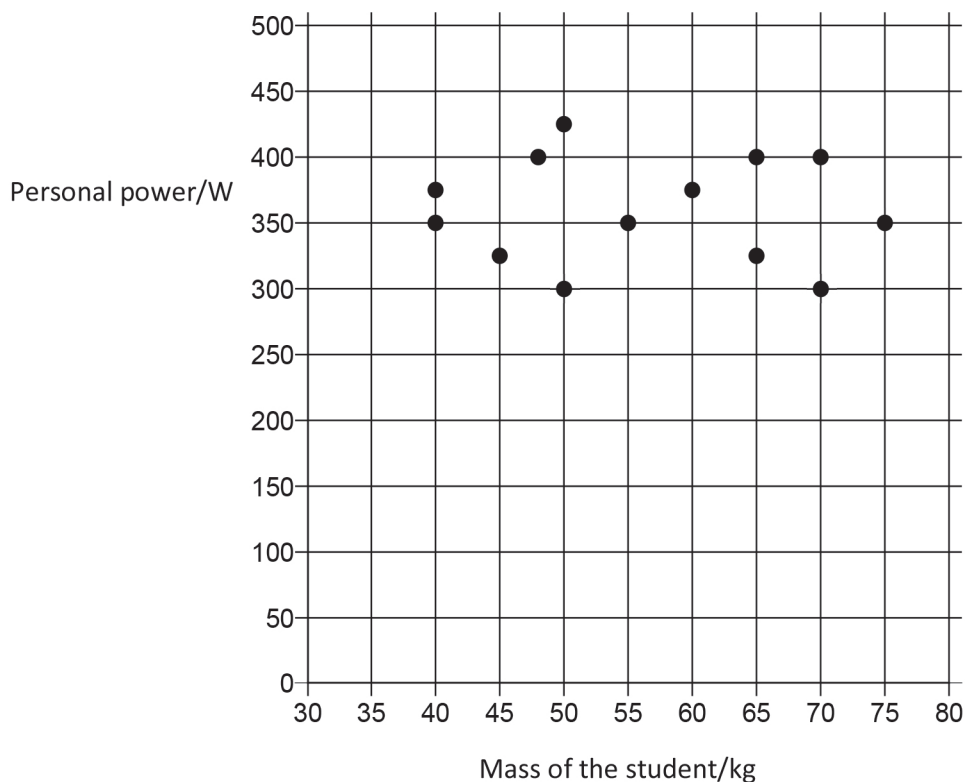
(iii) During the investigation, state one thing that a student might do to develop an increased level of power.

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[1]

(b) After the investigation, the teacher collected personal power values and masses of the students in the group and used the data to plot the graph shown below.



What do the results shown on the graph above suggest about the relationship between the personal power of a student and the mass of a student?

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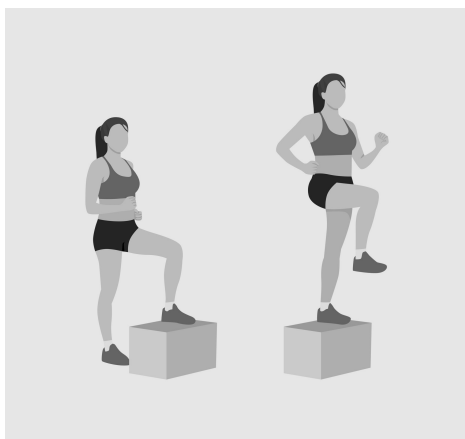
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[1]

[Turn over



(c) Another method of measuring personal power is to perform step-ups on a platform, as shown below.



Source: © Getty Images

The person shown does 45 step-ups in **1 minute**. In each steps she does 220 J of work.

Calculate her average power.

**Show clearly how you get your answer.**

Average power = \_\_\_\_\_ [3]





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**(Questions continue overleaf)**

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\*24GPY3405\*

2 (a) Describe **in detail** how you would use a **distant object** to measure the Focal Length of a converging lens. In your description you must:

- state the apparatus you use;
- describe fully what you would do;
- state what measurement you must make to find the Focal Length.

**In this question you will be assessed on your written communication skills including the use of specialist science terms.**

**Write your answers in the appropriate space provided.**

Apparatus \_\_\_\_\_

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What you would do \_\_\_\_\_

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Measurement \_\_\_\_\_

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[6]

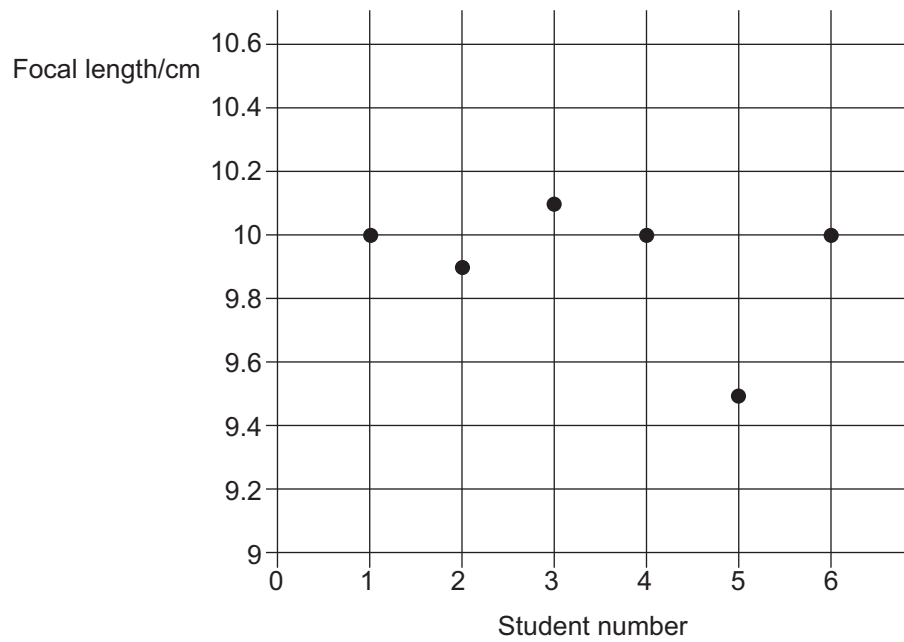
[Turn over

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\*24GPY3407\*

- (b) Several students carried out the measurement of the Focal Length of the same lens and plotted their results on the graph shown below. Each student is given a number from 1 to 6.



- (i) Circle the measurement which is clearly wrong. [1]
- (ii) What should the student have done when he noticed the value obtained for the Focal Length was wrong? [1]

\_\_\_\_\_ [1]



(iii) Using the graph, what is the best value for the Focal Length?  
Give your answer to one decimal place.

Focal Length = \_\_\_\_\_ cm [1]

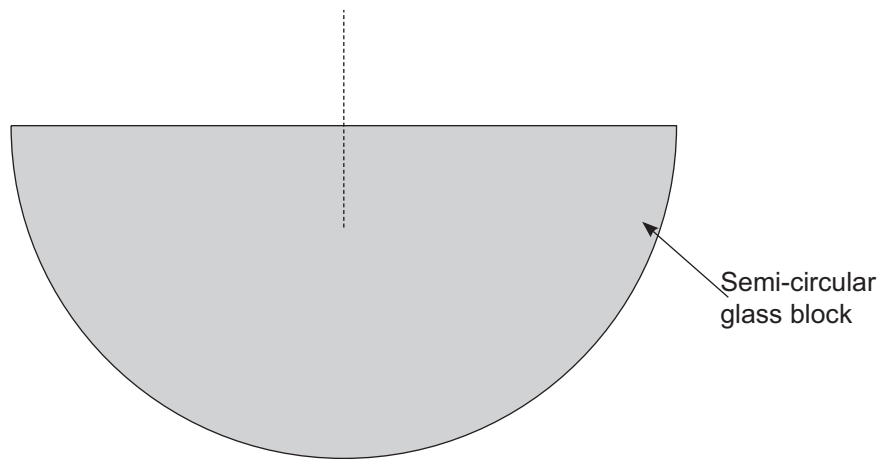
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\*24GPY3409\*

(c) To investigate the critical angle a student used a semi-circular glass block.



The student measured the angles of incidence in glass and refraction in air. Some of the student's results are shown in the table below.

Angle of incidence/ °	Angle of refraction/ °
0	0
30	50
35	65
40	90

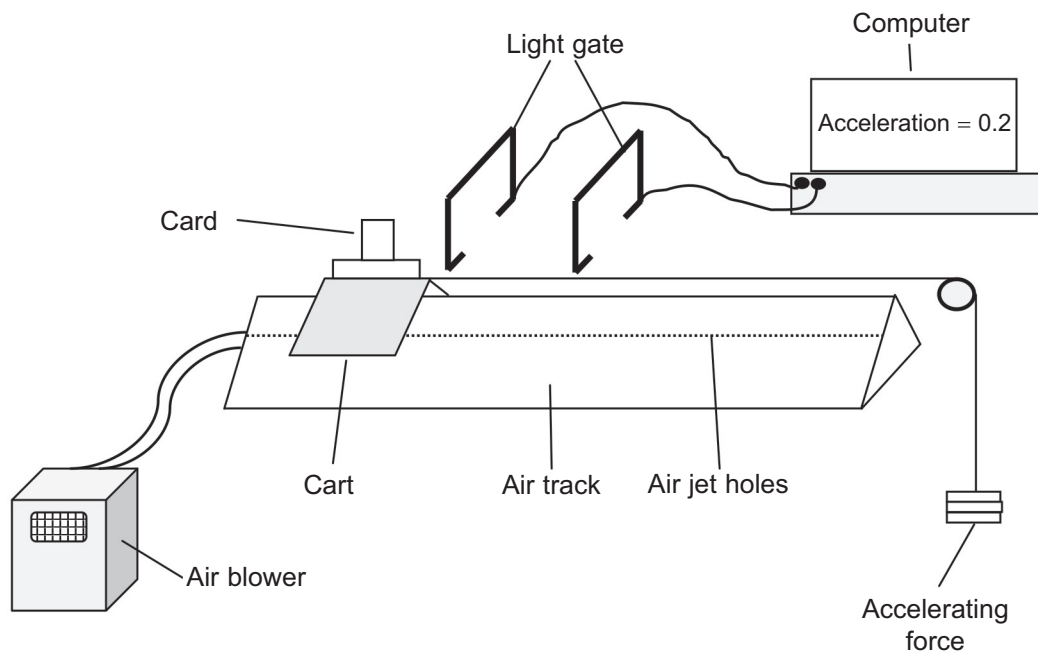
(i) On the diagram above, **using a protractor**, show the path of the ray when the angle of incidence is  $40^\circ$ . Clearly mark the angle of incidence and the angle of refraction. Clearly label the **three** rays that would be observed. [5]

(ii) State what would be observed when the angle of incidence is increased to  $50^\circ$ . [1]

(iii) Explain your answer. [2]



- 3 (a) The apparatus shown below can be used to investigate Newton's Laws of Motion.



Source: Principal Examiner

The air track has air blown into it and forced out through the air jet holes. This allows the cart to ride along the track on a bed of air.

(i) What force does the air track reduce? \_\_\_\_\_ [1]

(ii) The card on the cart is pulled through the two light gates. The computer measures the velocity of the cart at each of the light gates. What quantity relating to the card attached to the cart must be known if the computer is to measure velocity?

\_\_\_\_\_ [1]

[Turn over



(iii) What other quantity must be measured between the gates to allow the acceleration of the cart to be determined by the computer?

[1]

The table below shows the results from the investigation as recorded by the student. The total mass of the cart was kept constant during the investigation.

Accelerating force/ N	Acceleration/ $\text{m/s}^2$			
	Run 1	Run 2	Run 3	Average
0	0	0	0	0
0.2	0.12	0.14	0.13	0.13
0.4	0.24	0.26	0.25	
0.6	0.37	0.39	0.39	
0.8	0.47	0.49	0.46	0.47
1.0	0.65	0.62	0.64	

(iv) Complete the table by calculating the average acceleration produced by each accelerating force. Insert your answers to **two decimal places** in the last column of the table.

[2]

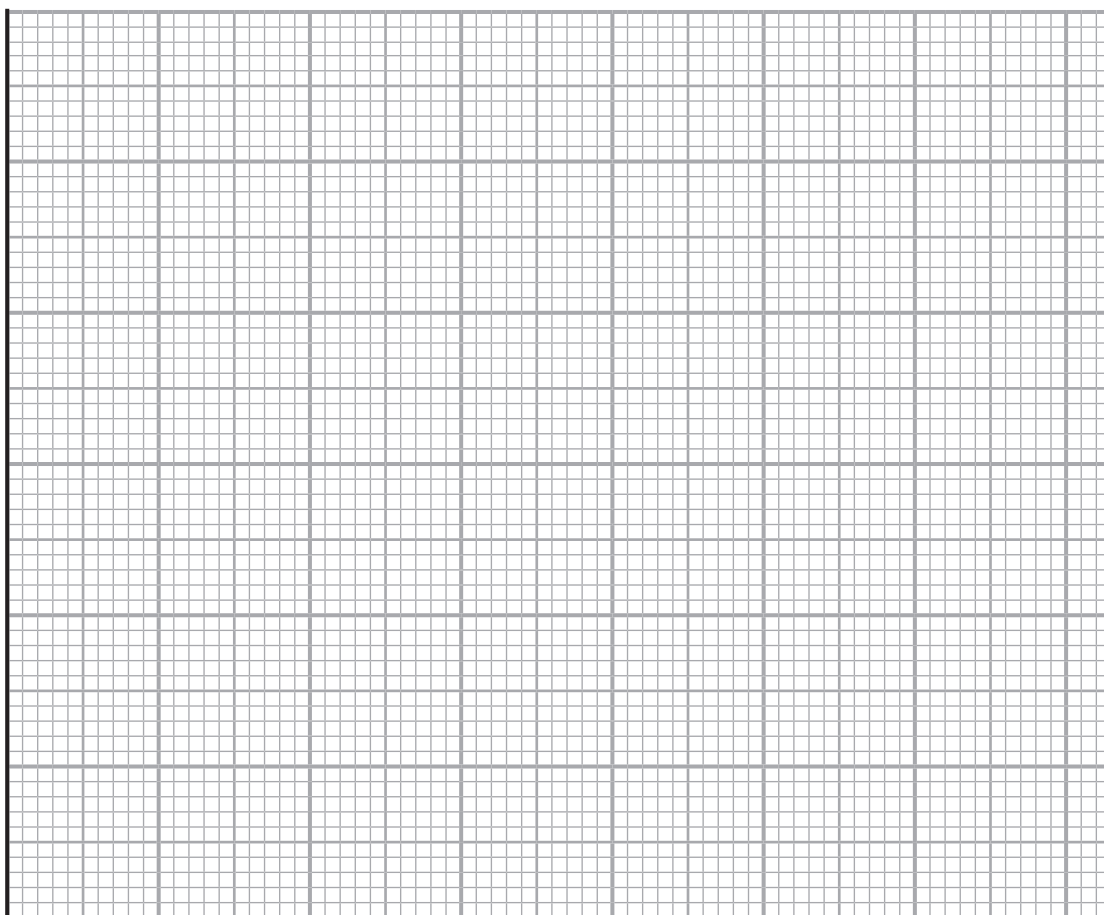


- (v) To show that, for a constant mass, the acceleration of the cart is directly proportional to the accelerating force, a graph can be plotted. Use the recorded data and the grid below to plot a graph to confirm a direct proportion relationship.

You should carefully label the axes and choose a suitable scale for each axis.

Draw the line of best fit through the points.

[6]



(vi) What two features of the graph are both needed to confirm the relationship as one of direct proportion?

1. \_\_\_\_\_

2. \_\_\_\_\_ [2]

(vii) Calculate the gradient of the graph.  
Give your answer to **one decimal place**.  
**Show clearly how you get your answer.**

Gradient = \_\_\_\_\_ [1]

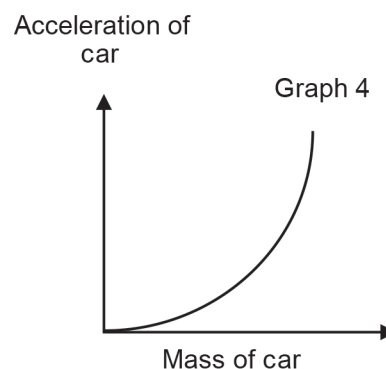
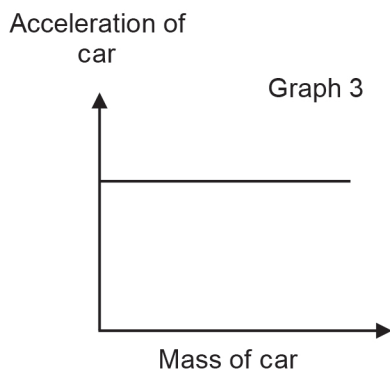
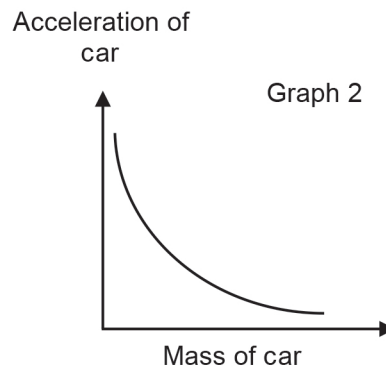
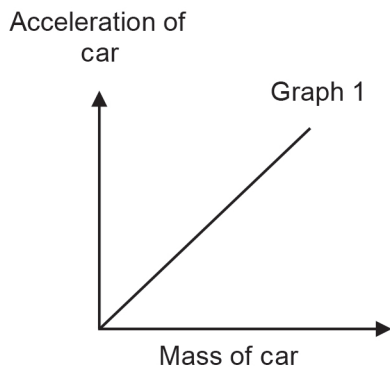
(viii) **State the unit** for the gradient.

Unit = \_\_\_\_\_ [1]



(b) In a different investigation, the relationship between the acceleration of a car and its mass was studied when a **constant resultant force** was acting on the car.

(i) Which of the graphs below would be obtained for this second investigation?



Graph number \_\_\_\_\_ [1]

(ii) What is the name given to the mathematical relationship between the mass and the acceleration of the car?

\_\_\_\_\_ [1]

[Turn over



4 (a) A student is asked to investigate experimentally how the resistance of a metallic conductor depends on its length.

(i) What is the independent variable in this investigation?

\_\_\_\_\_ [1]

(ii) What is the dependent variable in this investigation?

\_\_\_\_\_ [1]

Two quantities which must be controlled in the investigation are the material from which the wire is made and its cross-sectional area.

(iii) What other quantity must be kept constant in this investigation?

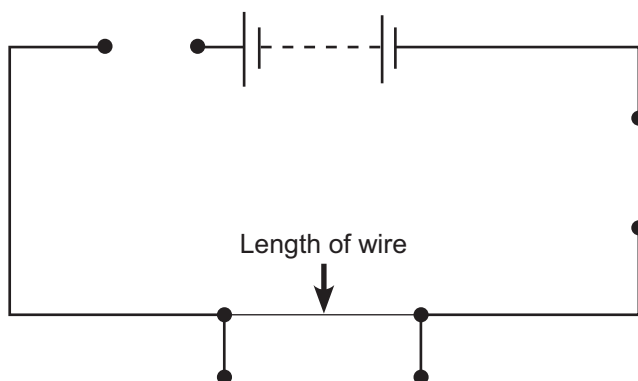
\_\_\_\_\_ [1]

(iv) What circuit component is needed to ensure that the temperature is kept constant? Describe how it is used to achieve this.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]



- (v) Complete the circuit diagram below to show how the components needed to carry out the investigation are connected.  
Credit will only be given if the correct electrical symbols are used.



[3]



- (vi) During the investigation the following experimental results were obtained. The resistance  $R$  of the wire is calculated using the equation shown below.

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

where  $V$  is the voltage and  $I$  is the current.

Length / cm	0	10	20	30	40	50
Voltage/ V	0	3.0	3.0	3.0	3.0	3.0
Current / A	0	2.0	1.0	0.7	0.5	0.4
Resistance / $\Omega$	0			4.3		

Using the values in the table calculate the resistance of the wire for each length of wire.

Record your values for resistance to **one decimal place** in the table above.

One value has already been calculated for you.

Use the space below for your calculations.

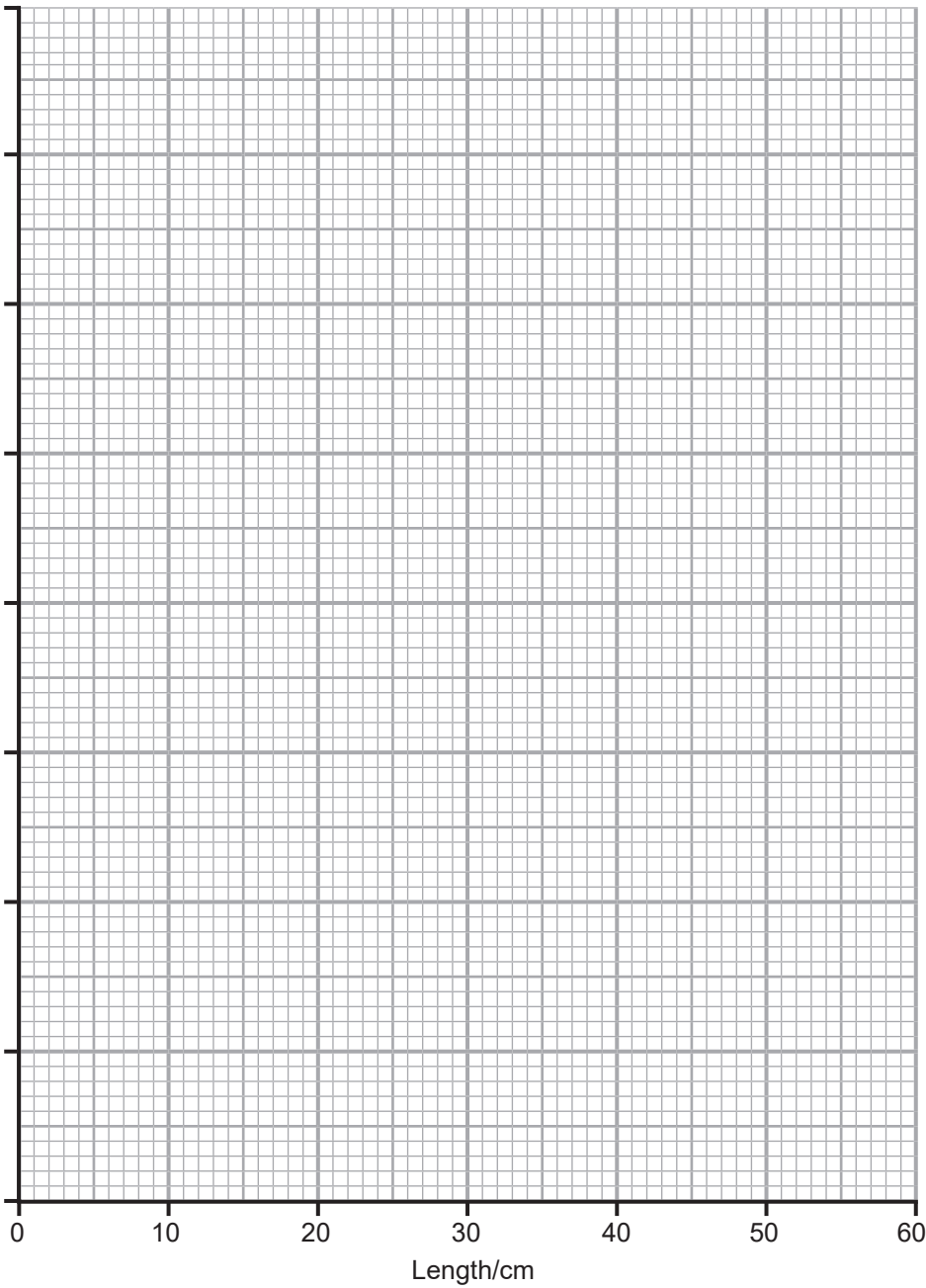
[2]

- (vii) The student decides to plot a graph of resistance against length. Using values from the table, plot the graph on the grid opposite. You must:

- label the y-axis and give the appropriate unit
- select an appropriate scale
- plot the five points
- draw the line of best fit

[6]





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[Turn over



\*24GPY3419\*

(viii) The resistance  $R$  and length of wire  $L$  are related by the equation

$$R = KL$$

Using your graph, find the best value of the constant  $K$ .

$K =$  \_\_\_\_\_ [2]



- (b) In another investigation, a student measured the resistance of three wires of same length and same material but different cross-sectional area. The results are shown in the table below.

Cross-sectional area / mm <sup>2</sup>	Resistance of the wire / $\Omega$
1.10	1.05
0.25	4.60
0.08	14.40

- (i) Using the data from the table show that the resistance R is inversely proportional to the cross-sectional area A. Support your answer with **three** calculations.

[2]

- (ii) Write down an equation to show how the resistance R and the cross-sectional area A are related.

[2]

- (iii) State the units of any constant in your equation.

Units of constant = \_\_\_\_\_ [1]



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Question Number	Marks
1	
2	
3	
4	

<b>Total Marks</b>	
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Examiner Number

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