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Senior Physics Challenge Task 1
ANSWERS BOOKLET

Part 1 [20 marks]

Show that, for a ball bearing falling ... [2 marks]

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Using the data for the **large** ball bearing, **determine** ... [2 marks]

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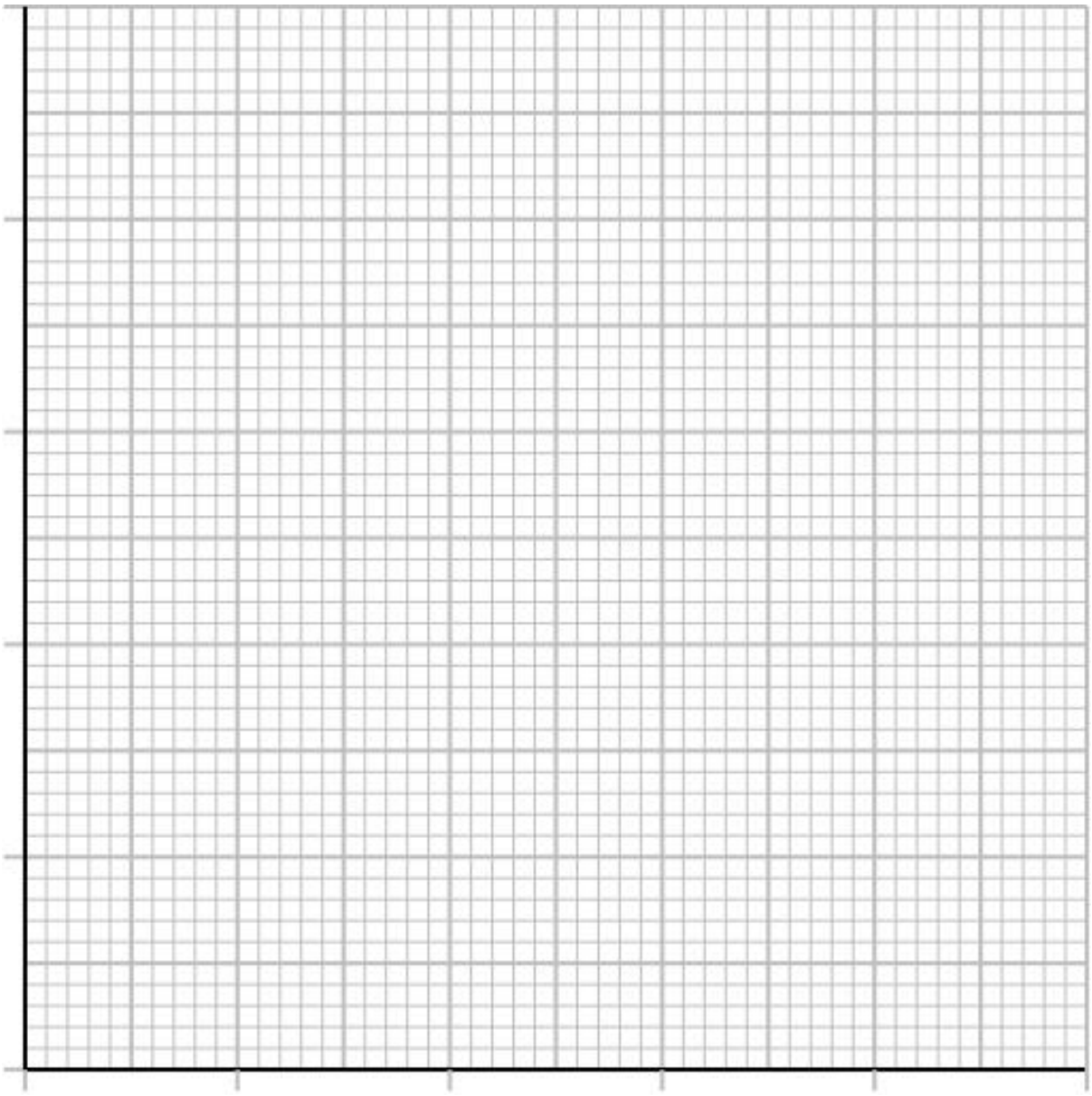
Calculate the average ... [1 mark]

Diameter of ball bearing	Distance (d) between elastic bands	1st time taken for ball bearing to fall	2nd time taken for ball bearing to fall	Average ……	
mm	cm	s	s	ms^{-1}	
1.00	25	80.1	83.4		
1.50	25	36.2	36.9		
2.00	25	20.0	21.2		
2.50	25	13.0	13.3		
3.00	25	9.3	9.0		
3.50	20	5.4	5.4		
4.00	20	4.4	4.5		
5.00	15	2.4	2.7		

Plot a suitable graph ... [6 marks]



State and explain the most likely sources ... [2 marks]

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Discuss to what extent ... [3 marks]

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Determine a value for the viscosity (η) of …… [2 marks]

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Suggest a reason why the large ball bearing ... [1 mark]

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Suggest a reason why one of the.... [1 mark]

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Part 2 [10 marks]

Show that the terminal velocity ... [1 mark]

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Explain, in terms of the ... [2 marks]

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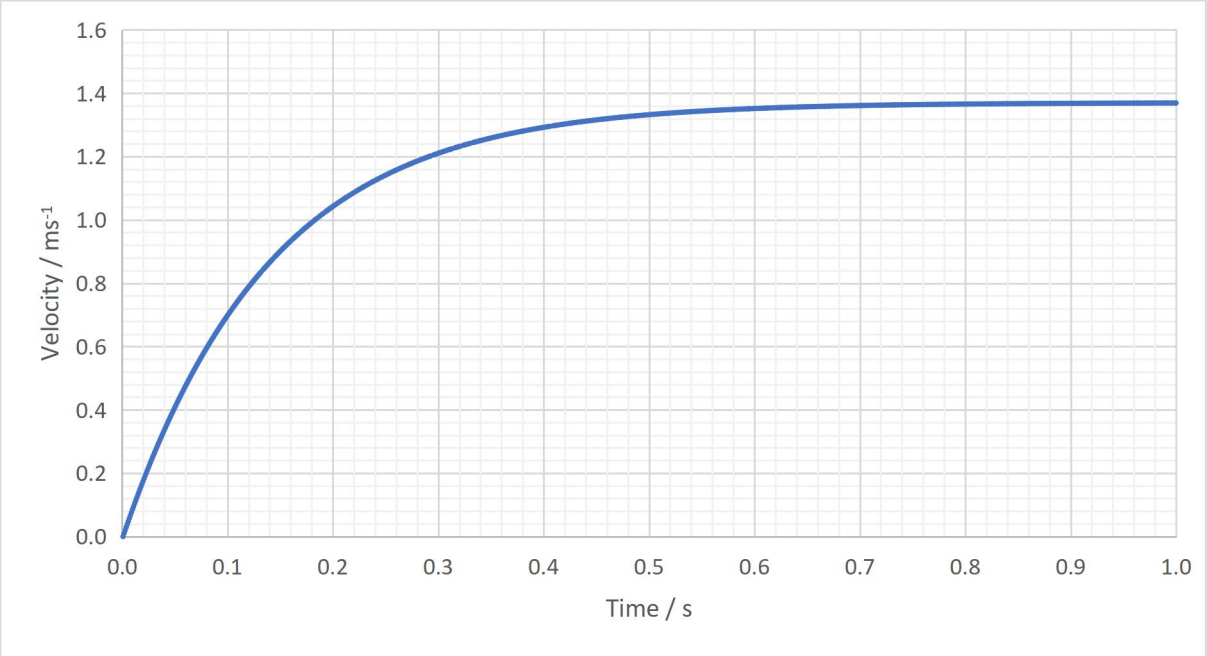

Using the graph, or otherwise, **...** [2 marks]

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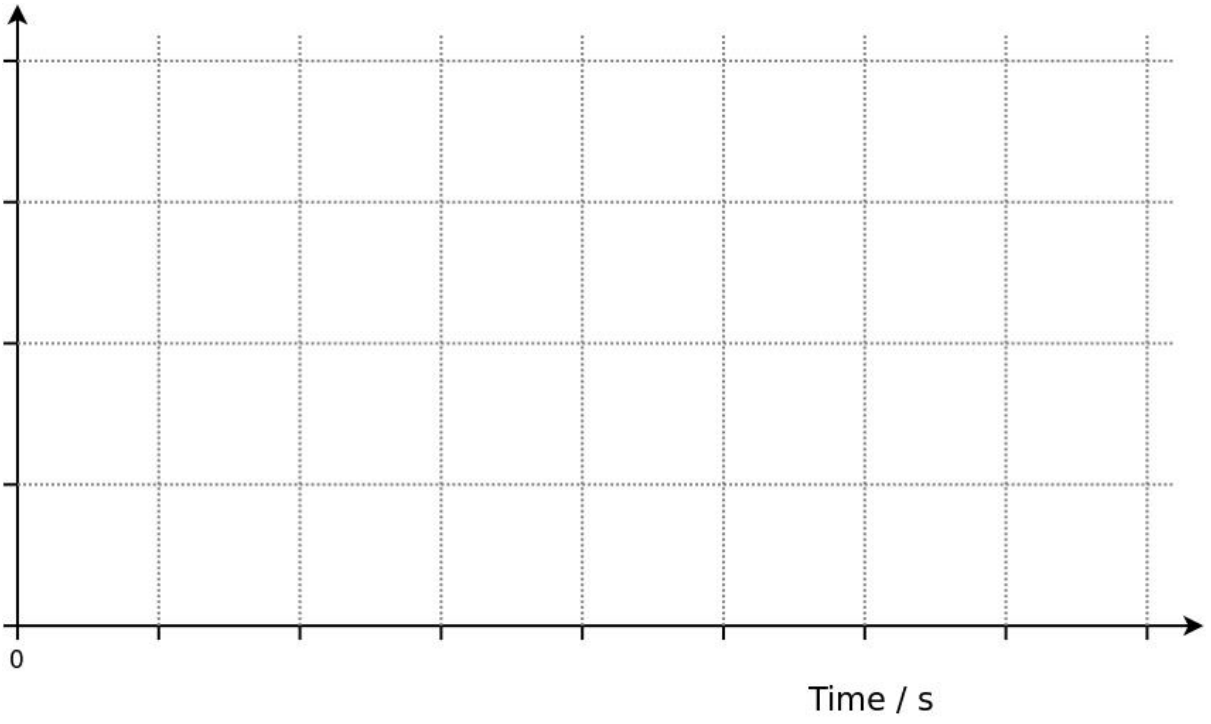
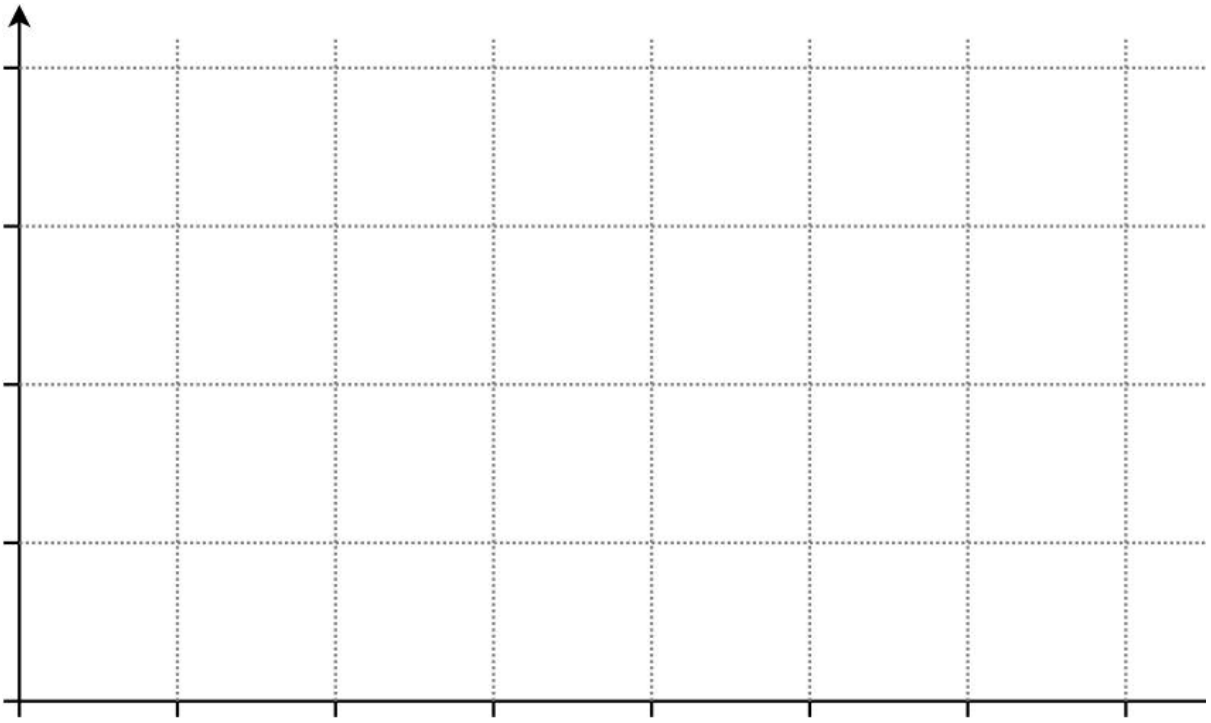
Sketch the corresponding distance – time graph ...

Include an appropriate scale for the distance axis [3 marks]



sketch a graph to show how ... [2 marks]



Part 3 [10 marks]

In this experiment you will determine ... [2 marks]

Height squash ball was dropped from

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Record your results

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Explain why the mass of the squash ball ... [1 mark]

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Explain why the Stoke's law ... [1 mark]

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Use your results to **determine** ... [2 marks]

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State the absolute uncertainty ... [1 mark]

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Using your results, **state** the ... [1 mark]

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Calculate the ... [1 mark]

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Calculate the percentage difference ... due to gravity. **Comment** on your result. [1 mark]

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Senior Physics Challenge Task 2
ANSWERS BOOKLET

Part 1 [6 marks]

Record the position of the pivot when the ruler is balanced

Position of pivot ……

Record the distance (D) ... and the centre of mass of the ... when the ruler is ...

Record the distance (d) ... and the centre of ...

Record the volume of ....

Record the dimensions of the card used each time

Calculate the mass of the... [4 marks]

Distance (D) between pivot and beaker / mm	Distance (d) between card and pivot / mm	Volume of water added / ml	Mass of card used / g	Dimensions of the card used

Knowing the dimensions of the thin card, **calculate** ... [2 marks]

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Part 2 [6 marks]

Drop height = ……[1 mark]

Calculate the mass and weight of.... [1 mark]

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Mass of ... ……

Weight of ... ……

Measure the time taken for ...

Repeat the measurement two more times

Calculate the average time ....

Add extra mass to.... knowing the dimensions of the..., calculate the.... [4 marks]

Extra mass added / g	Time taken (Trial 1) / s	Time taken (Trial 2) / s	Time taken (Trial 3) / s	Average time taken / s

Part 3 [12 marks]

Calculate the combined mass of the cone ...

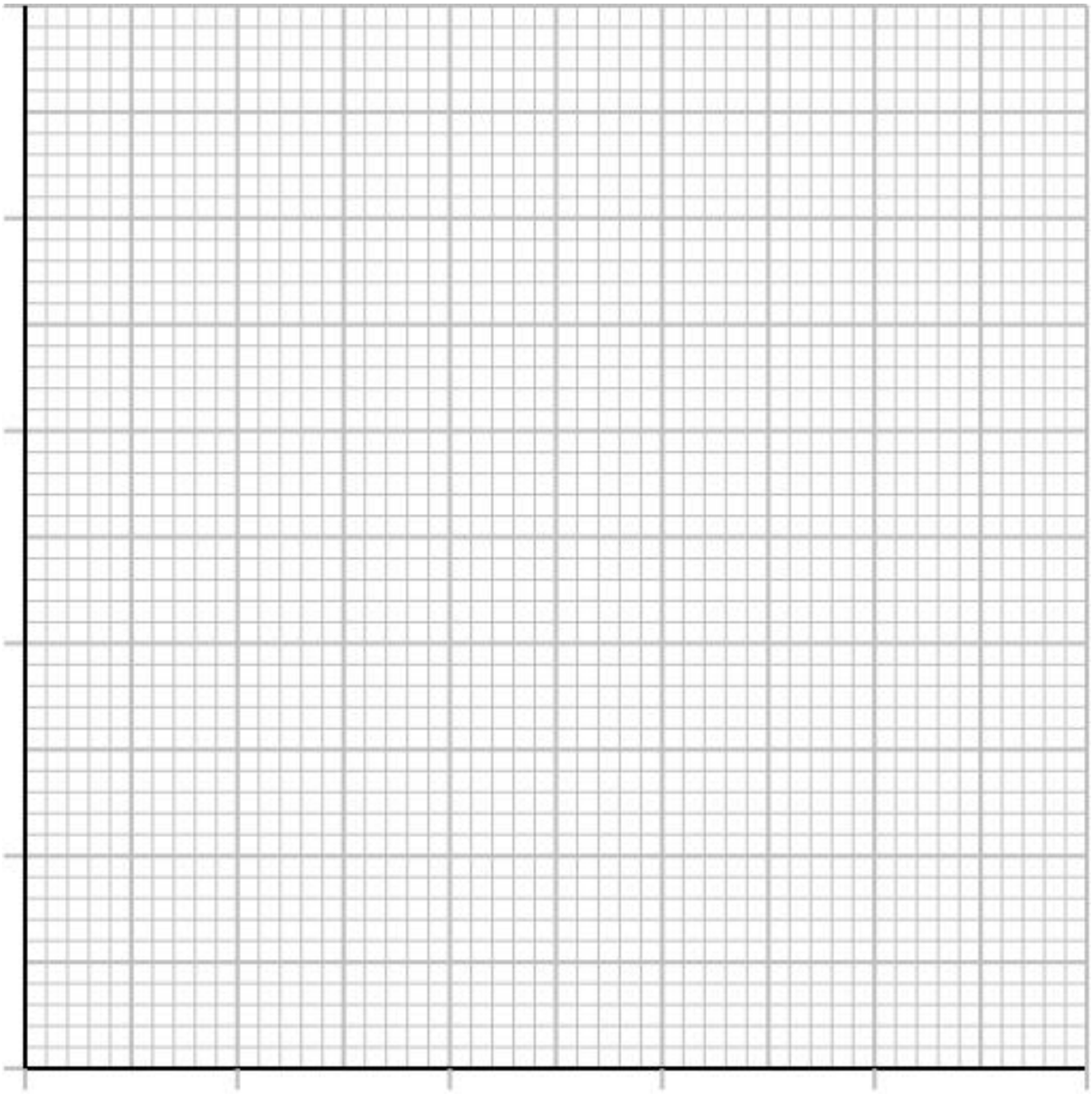
Calculate the weight of the cone and...

Calculate the average speed at which the cone ... [3 marks]

Combined mass of cone and additional card / g	Weight of cone and additional card / N	Average speed of falling cone / ms^{-1}		

Calculate values of $\log(F_D)$ and $\log(v)$ ... [1 mark]

Plot a graph of ... [5 marks]



Discuss to what extent the ... [1 mark]

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Determine a value for ... [1 mark]

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State the range of results for which this value of n is valid. [1 mark]

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Part 4: [6 marks]

State the: [2 marks]

Independent variable(s) ……

Dependent variable(s) ……

Control variable(s) ……

State how you controlled the necessary variables [1 mark]

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Take measurements to investigate whether the hypothesis is valid

Record your results [2 marks]

Discuss whether your results support the hypothesis [1 mark]

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Senior Physics Challenge Task 3
ANSWERS BOOKLET

Part 1 [12 marks]

Record the position of the bottom ... [1 mark]

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Hang the 500 ml beaker with the string handle and **record** t... [1 mark]

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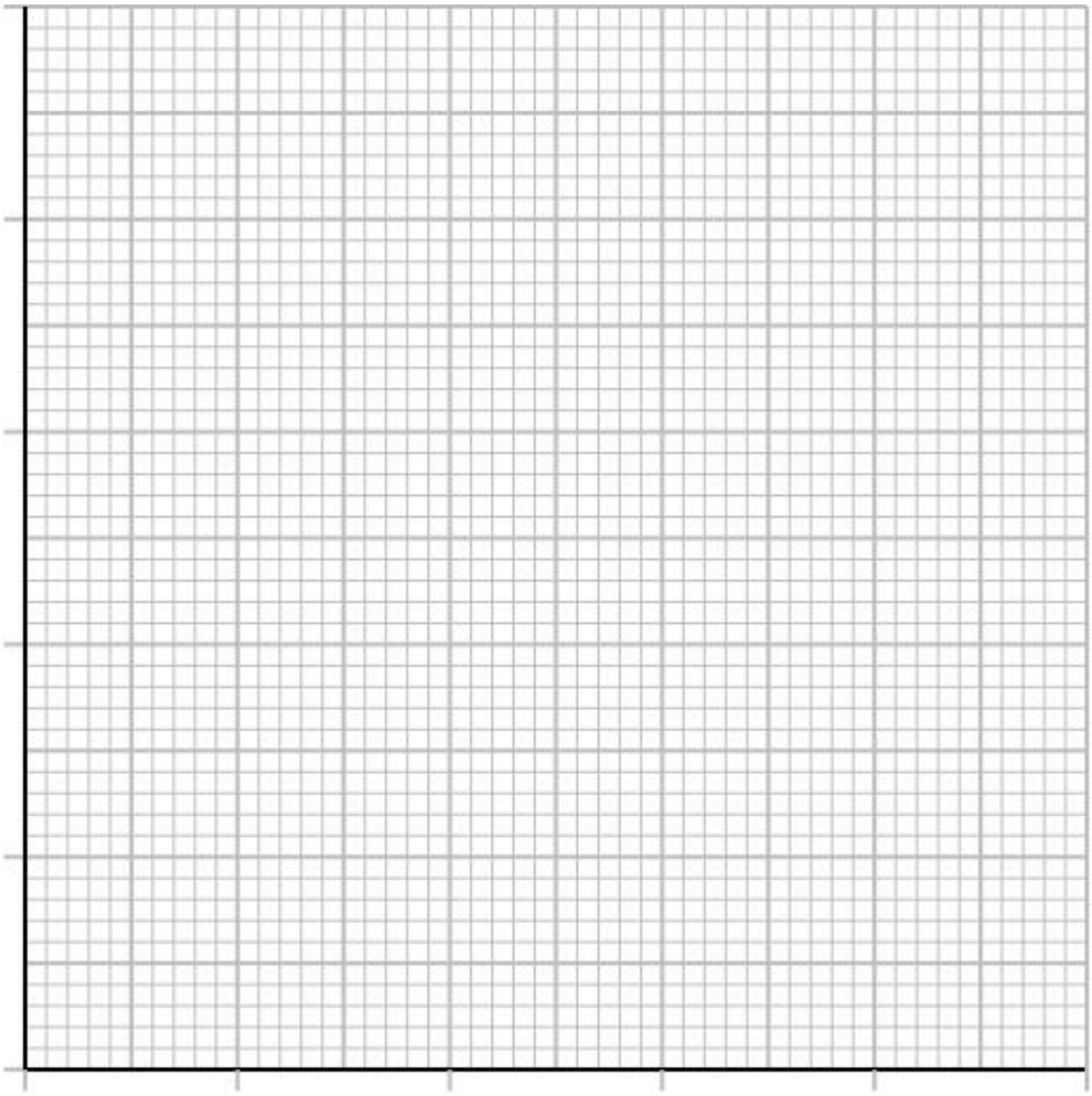
Add an appropriate amount of water to the beaker and **record** ...spring.

Complete the table of results... [4 marks]

It is **not** necessary to use all of the rows in the table

Volume of water added / ml	Position of bottom of spring / cm	Weight of water added / N	Extension of spring / cm

Plot an appropriate graph ... [4 marks]



Use the graph to determine the spring ... [1 mark]

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Use the graph to determine... [1 mark]

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Part 2 [5 marks]

Record the position of ... [1 mark]

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Record the distance (d) between ... [1 mark]

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Record the volume ...used. [1 mark]

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Use the measurements ... to **Calculate** the mass of the ... [1 mark]

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Explain which of the two results ... [1 mark]

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Part 4 [13 marks]

Explain why the force meter ... [1 mark]

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Explain why the carboard ... [1 mark]

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Calculate the normal...

Measure the ...and take an average

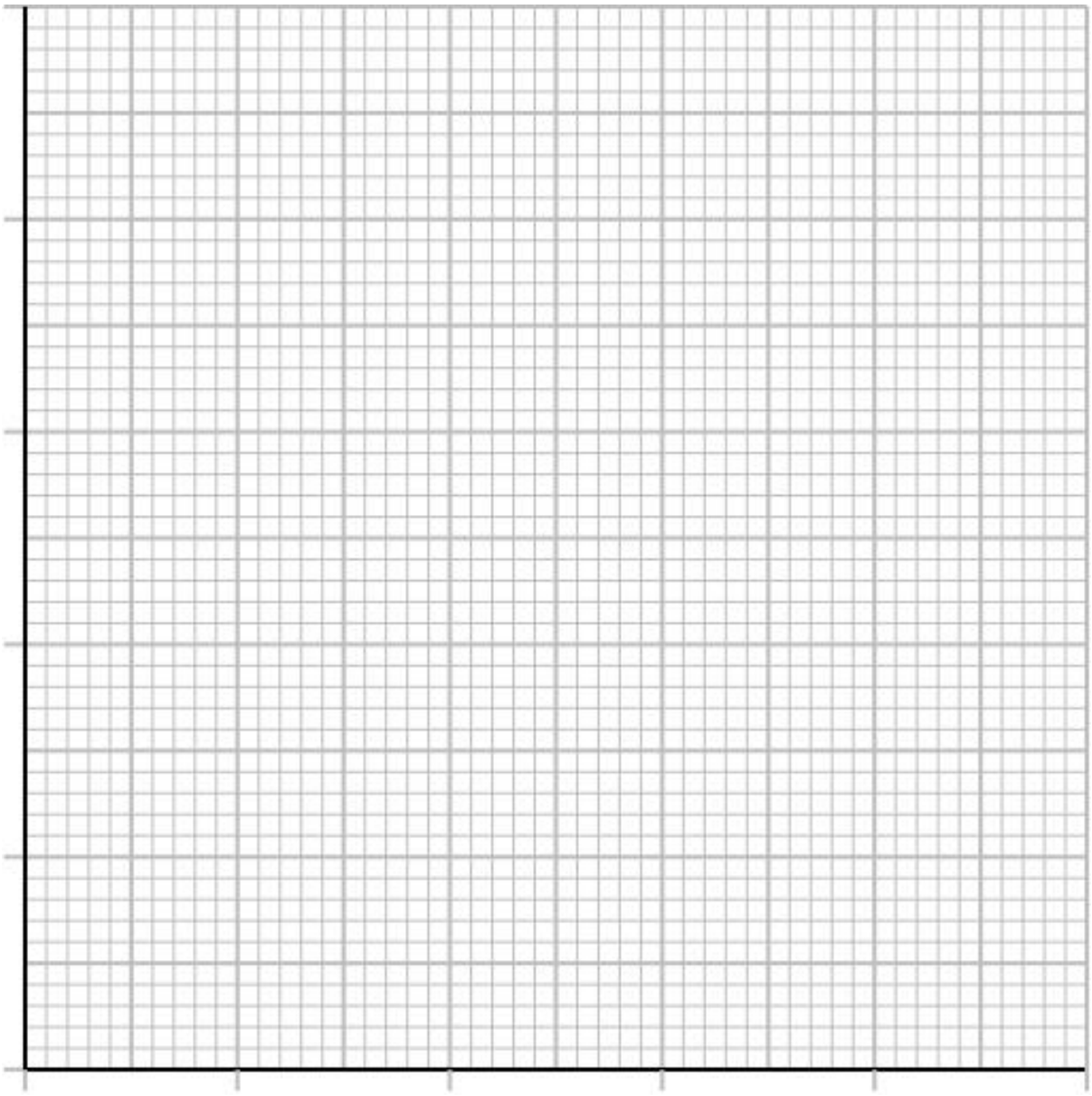
Repeat for an appropriate ...

Record your results in the table [4 marks]

It is **not** necessary to use all the rows in the table

Volume of water added / ml	Normal contact force / N	Friction force (trial 1) / N	Friction force (trial 2) / N	Friction force (trial 3) / N	Average friction force / N

Use a graphical method to ... [4 marks]



Determine the numerical value of the.... [1 mark]

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Considering the experimental technique and the quality of your results, **discuss** ...

[2 mark]

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