

BLANK PAGE



You may not need to use all of the materials provided.

1 In this experiment, you will investigate the equilibrium of a metre rule.

(a) You have been provided with a metre rule with a 100 g mass attached to it.

- Set up the apparatus as shown in Fig. 1.1.

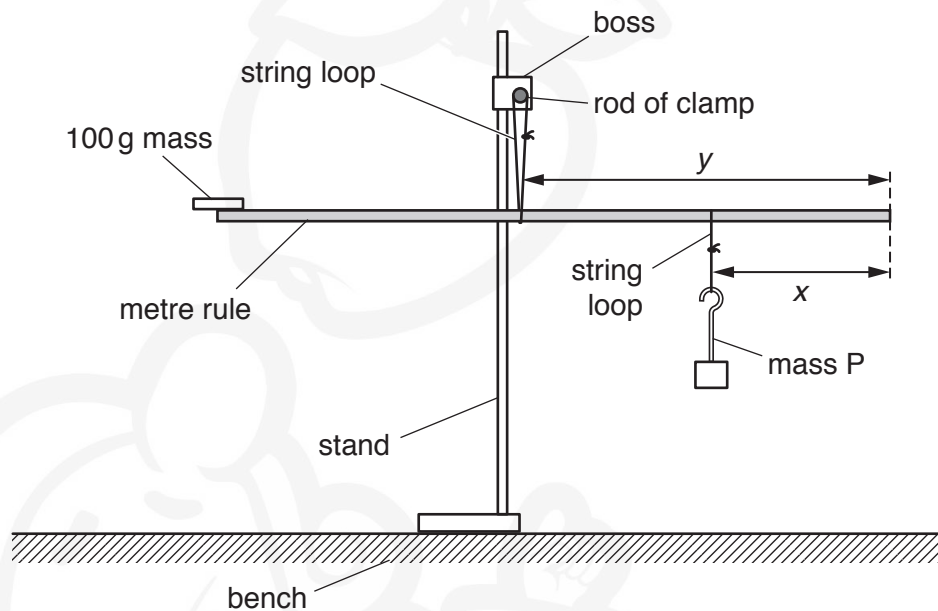


Fig. 1.1

The distance between the end of the rule and the string loop from which mass P is suspended is x , as shown in Fig. 1.1.

The distance between the same end of the rule and the string loop suspended from the rod of the clamp is y .

- Position mass P so that x is approximately 30 cm.
- Without changing x , adjust the position of the rule until it balances.
- Measure and record x and y .

$x =$

$y =$

[2]

- (b) Change x . Adjust the position of the rule until it balances. Measure and record x and y .

Repeat until you have six sets of values.

Record your results in a table.

[8]

- (c) (i) Plot a graph of y on the y -axis against x on the x -axis.

[3]

- (ii) Draw the straight line of best fit.

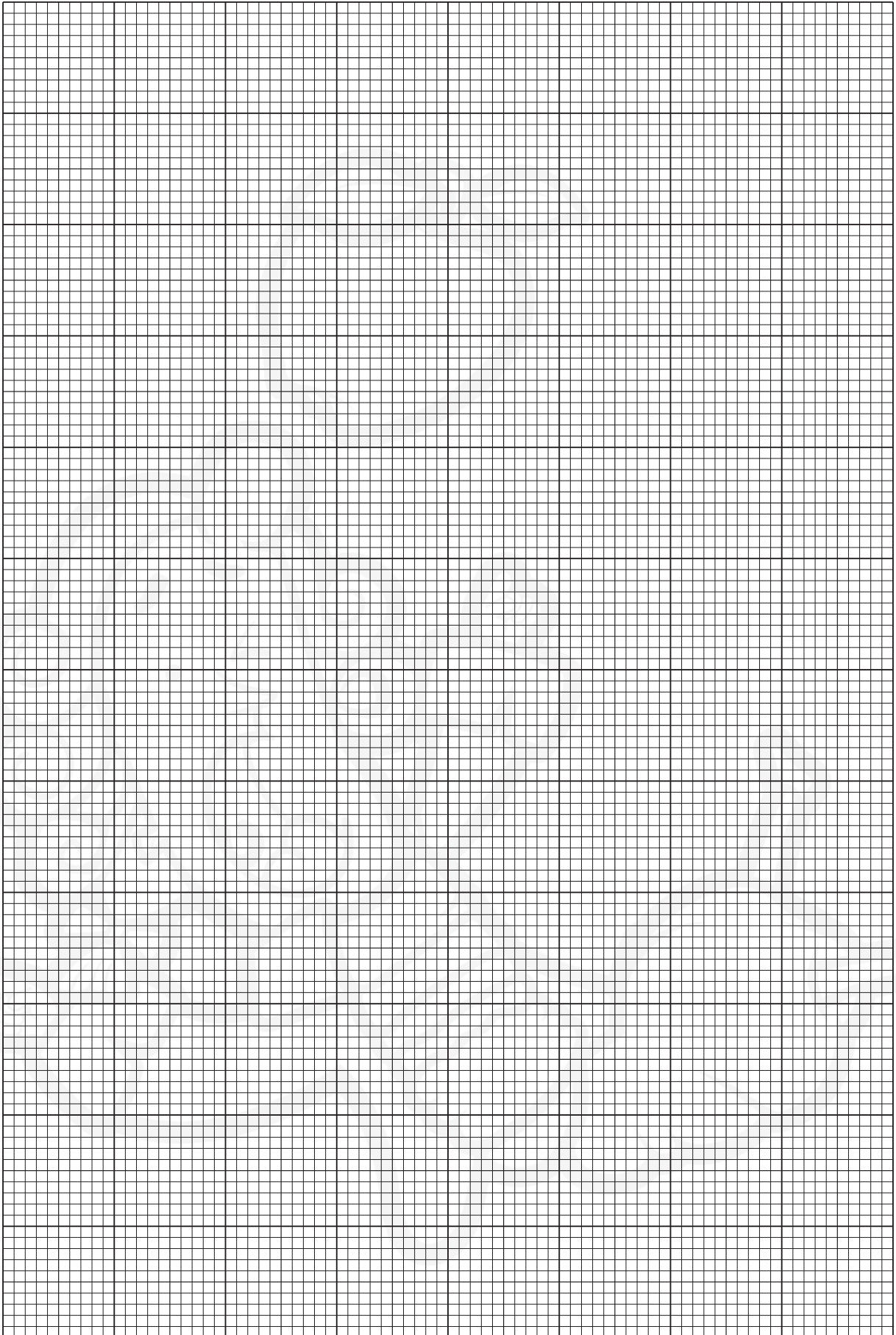
[1]

- (iii) Determine the gradient and y -intercept of this line.

gradient =

y -intercept =

[2]



- (d) It is suggested that the quantities y and x are related by the equation

$$y = Ax + B$$

where A and B are constants.

Using your answers in (c)(iii), determine the values of A and B .
Give appropriate units.

$$A = \dots\dots\dots$$

$$B = \dots\dots\dots$$

[2]

- (e) Theory suggests that

$$A = \frac{2M}{3M + Q}$$

where M is the mass of the metre rule and $Q = 0.100 \text{ kg}$.

Determine a value for M .

Give your answer to three significant figures. Include an appropriate unit.

$$M = \dots\dots\dots [2]$$

[Total: 20]

BLANK PAGE



You may not need to use all of the materials provided.

2 In this experiment, you will investigate the motion of a magnet connected to some springs.

(a) (i) You have been provided with two magnets A and B and three connected springs.

- Use the tape to attach magnet A to the springs as shown in Fig. 2.1.

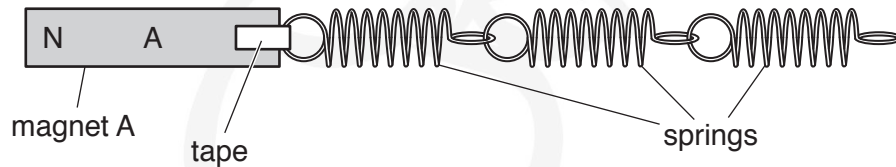


Fig. 2.1

- Set up the apparatus as shown in Fig. 2.2, with the N poles of magnets A and B facing each other.

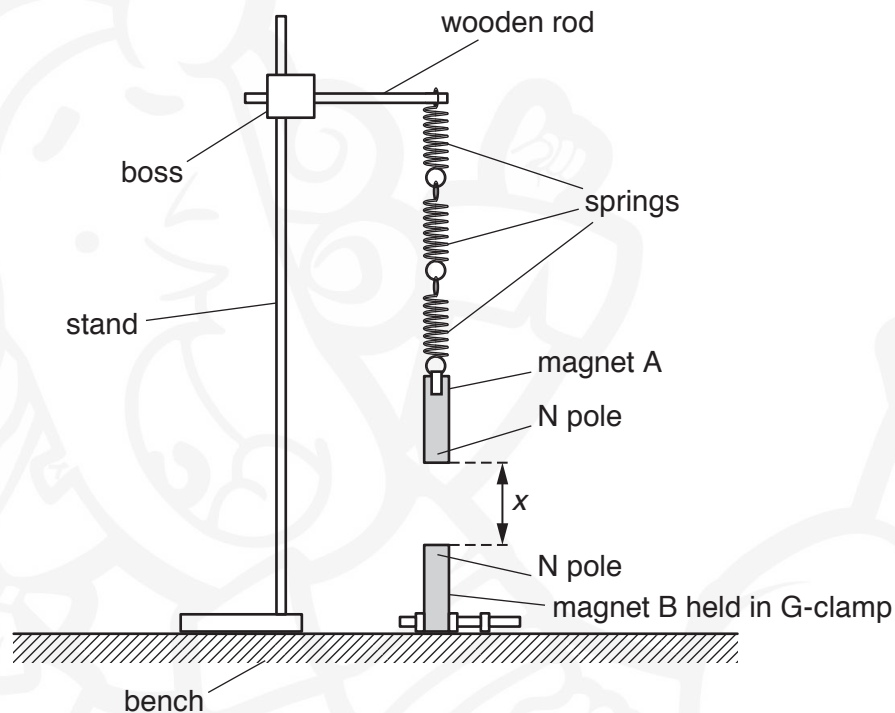


Fig. 2.2

- The distance between the magnets is x .

Adjust the height of the wooden rod until x is approximately 7 cm.

- Measure and record x .

$x = \dots\dots\dots$ [1]

(ii) Estimate the percentage uncertainty in your value of x .

percentage uncertainty = [1]

- (b) (i)
- Pull magnet A down through a short distance.
 - Release the magnet. The magnet will oscillate.
 - Determine the period T_1 of these oscillations.

$T_1 = \dots\dots\dots$ s [2]

- (ii)
- Reverse magnet B in the G-clamp so that its S pole is at the top.
 - Adjust the position of the wooden rod until x has the same value as in (a)(i).
 - Determine the period T_2 of the oscillations of magnet A.

$T_2 = \dots\dots\dots$ s [1]

(iii) Calculate $T_2 - T_1$.

$T_2 - T_1 = \dots\dots\dots$ s [1]

- (c)
- Reverse magnet B so that its N pole is at the top.
 - Adjust the position of the wooden rod until x is approximately 10 cm.
 - Measure and record x .

$x =$

- Repeat (b) using this value of x .

$T_1 =$ s

$T_2 =$ s

$T_2 - T_1 =$ s
[3]

- (d) It is suggested that the relationship between T_1 , T_2 and x is

$$T_2 - T_1 = \frac{k}{x^3}$$

where k is a constant.

- (i) Using your data, calculate two values of k .

first value of $k =$

second value of $k =$

[1]

- (ii) Justify the number of significant figures that you have given for your values of k .

.....

.....

..... [1]

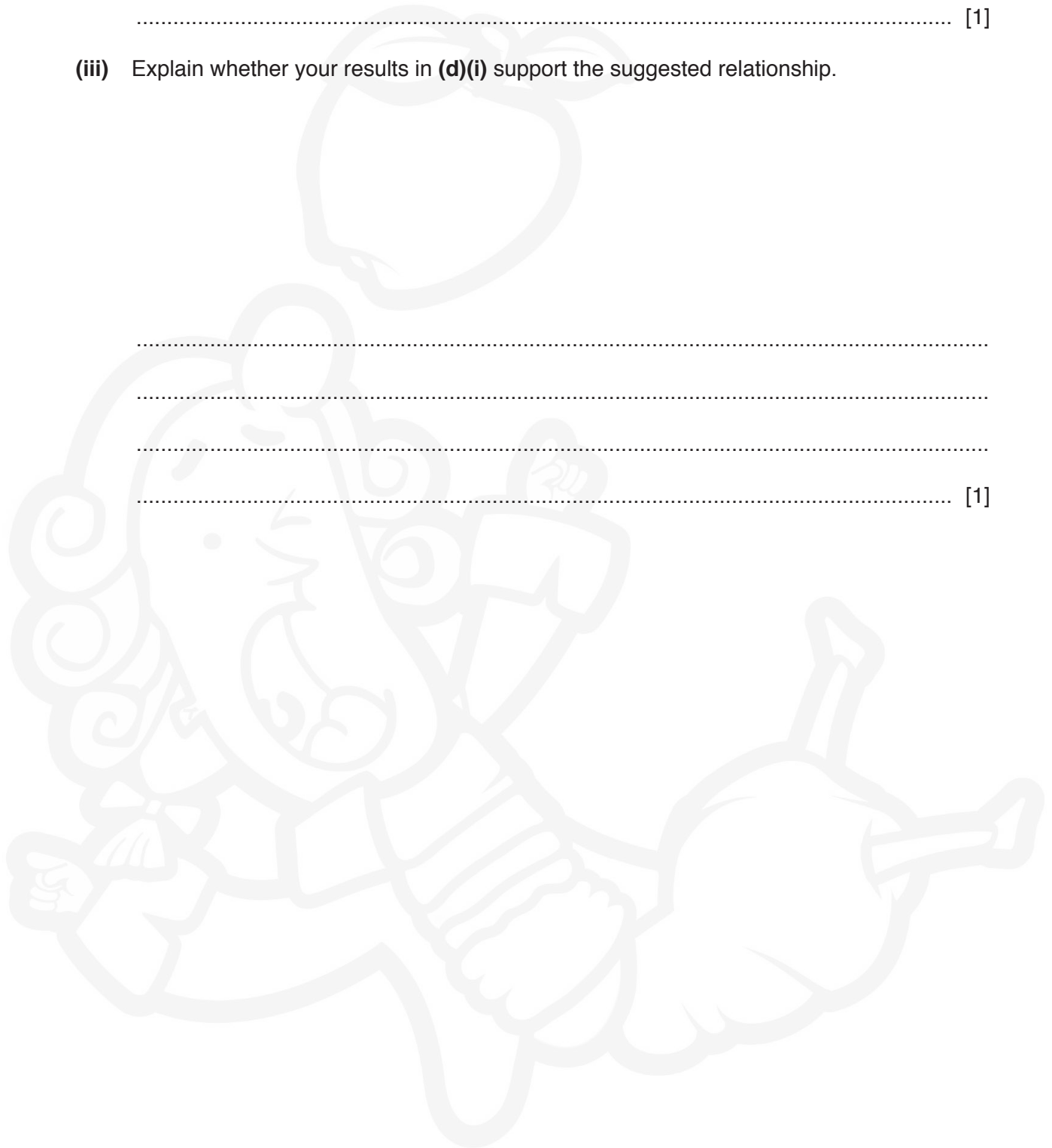
- (iii) Explain whether your results in (d)(i) support the suggested relationship.

.....

.....

.....

..... [1]



(e) (i) Describe four sources of uncertainty or limitations of the procedure for this experiment.

1.
.....
 2.
.....
 3.
.....
 4.
.....
- [4]

(ii) Describe four improvements that could be made to this experiment. You may suggest the use of other apparatus or different procedures.

1.
.....
 2.
.....
 3.
.....
 4.
.....
- [4]

[Total: 20]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.