1 The IGCSE class is determining the mass of a load using a balancing method.

Fig. 1.1 shows the apparatus.

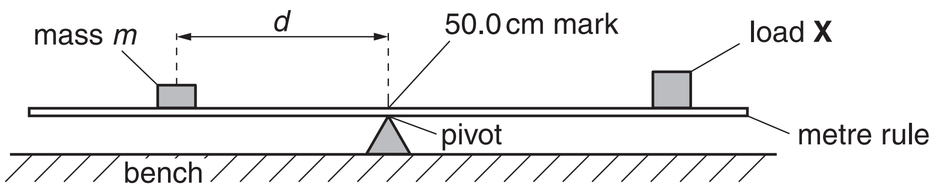


Fig. 1.1

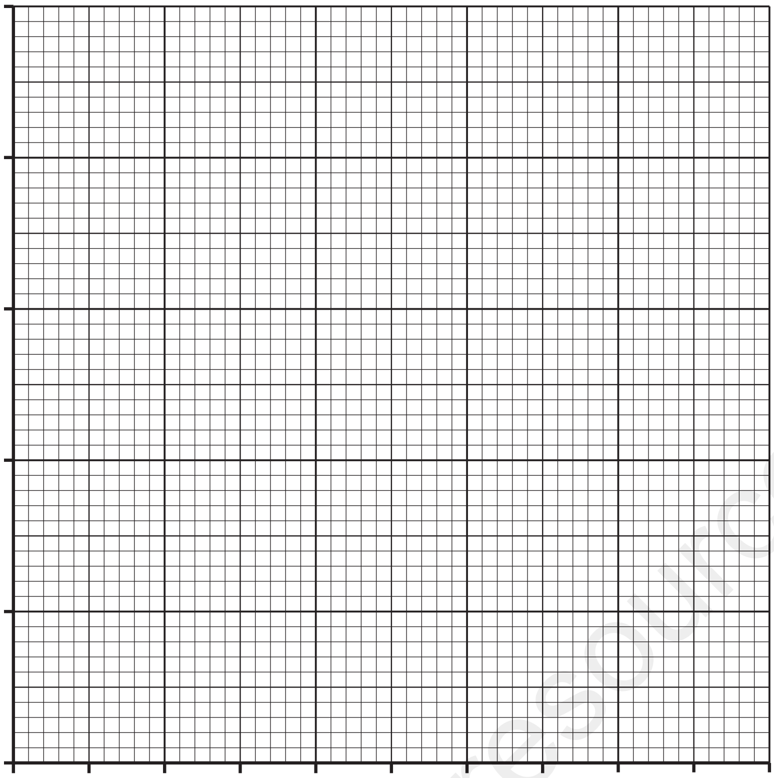
The load **X** has been taped to the metre rule so that its centre is exactly over the 90.0 cm mark. It is not moved during the experiment. A mass *m* of 40 g is placed on the rule and its position adjusted so that the rule is as near as possible to being balanced with the 50.0 cm mark exactly over the pivot. This is repeated using a range of masses. The readings are shown in Table 1.1

Table 1.1

m/g	d/cm	$\frac{1}{d} \Big/ \frac{1}{\text{cm}}$
40	30.2	
50	23.9	
60	20.0	
70	17.1	
80	15.1	

(a) For each value of *d*, calculate 1/*d* and record it in the table. [2]

(b) Plot a graph of m/g (y-axis) against $\frac{1}{d} \Big/ \frac{1}{\text{cm}}$ (x-axis).



[4]

(c) Determine the gradient G of the graph. Show clearly on the graph how you obtained the necessary information.

G = ... [2]

(d) Determine the mass μ of the load **X** using the equation $\mu = G/k$ where $k = 40.0\,\text{cm}$.

μ = ... [2]

(a) table:
1/*d* values correct
0.0331, 0.0418, 0.0500, 0.0585 (0.058 to 2 sig. fig.), 0.0662 [1]
consistent 2 or 3 significant figures [1]

(b) graph:
axes labelled [1]
scales suitable, <u>plots</u> occupying at least half grid [1]
plots all correct to ½ square (ecf) – take centre of plot if large [1]
well judged line thin line (≤½ square) [1]
(no mark if plots > ½ square)

(c) triangle <u>method</u> used and <u>shown</u> (any indication on graph) [1]
(triangle) using at least half line (can be seen in calculation) [1]

(d) μ 27 – 33 (NO ecf) [1]
2 or 3 significant figures and unit g [1]

[Total: 10]

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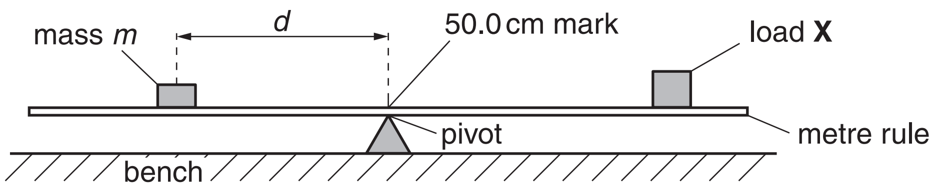

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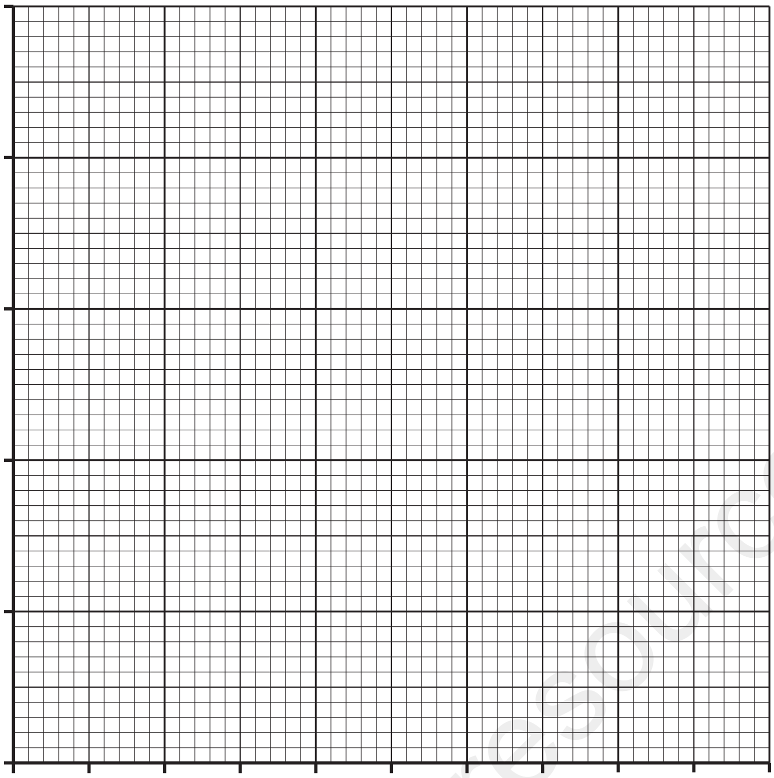

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[Total: 10]

3 The IGCSE class is determining the mass of a load **X** using a balancing method.

Fig. 5.1 shows the apparatus.

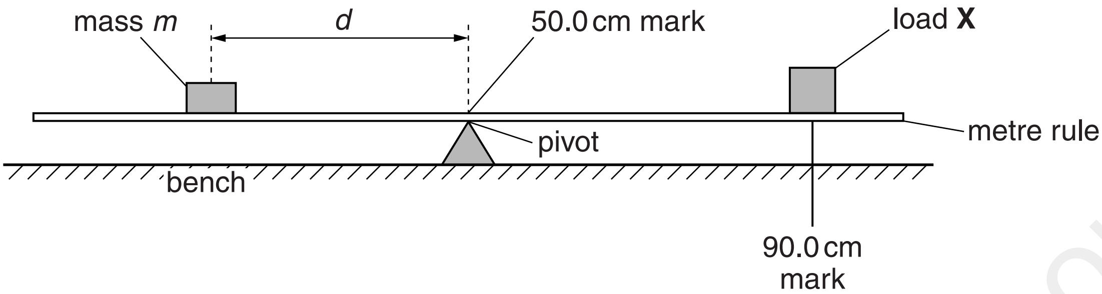

Fig. 5.1

The centre of the load **X** is fixed at the 90.0 cm mark on the rule.

A student uses a range of values of the mass *m* and determines the distance *d* from the pivot where the mass must be placed to balance the rule.
The readings are shown in Table 5.1.

Table 5.1

m/g	d/cm
40	30.2
50	23.9
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80	15.1

(a) Calculate the distance *x* between the centre of the load **X** and the centre of the rule.

x = ... [1]

(b) Suggest a reason for the student using a range of *m* values.

....

....

.... [1]

(c) Using each set of readings and the value of *x*, the student calculates values for the mass of the load **X**.

He writes his results: 30.2 g, 29.875 g, 30 g, 29.925 g, 30.2 g.

Use these results to calculate an average value for the mass of **X** and give it to a suitable number of significant figures for this type of experiment.

average value for the mass of **X** = ... [2]

(d) This type of balancing experiment is difficult to carry out.

Suggest one practical difficulty and one way to try to overcome the difficulty. You may draw a diagram, if you wish.

practical difficulty ....

....

....

way to overcome the difficulty

....

....
[2]

[Total: 6]

MARKING SCHEME:

(a)	40.0 or 40(cm)	[1]
(b)	accuracy / reliability / check readings / spot anomaly / o.w.t.t.e.	[1]
(c)	correct method used	[1]
	30 or 30.0(g)	[1]
(d)	rule never quite balances, o.w.t.t.e.	[1]
	take average position / nearest to balance, o.w.t.t.e.	[1]
		[Total: 6]

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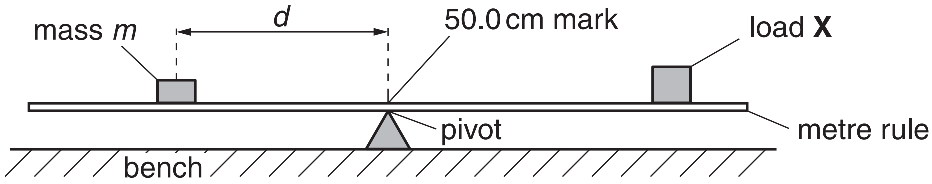

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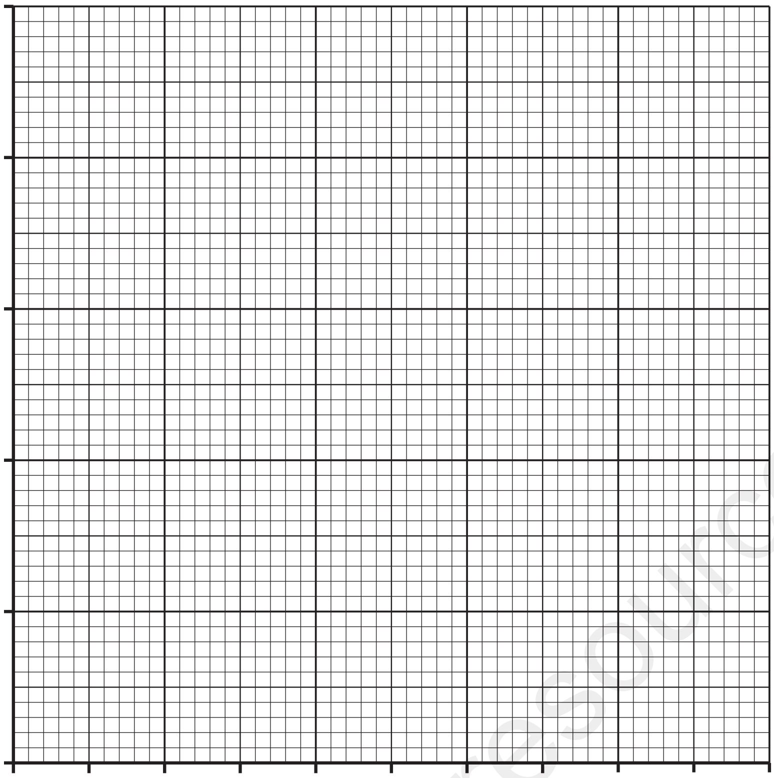

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