

DETERMINING THE MASS OF AN OBJECT

1 Some students are determining the mass of a block U by a balancing method.

They are using the apparatus shown in Fig. 1.1.

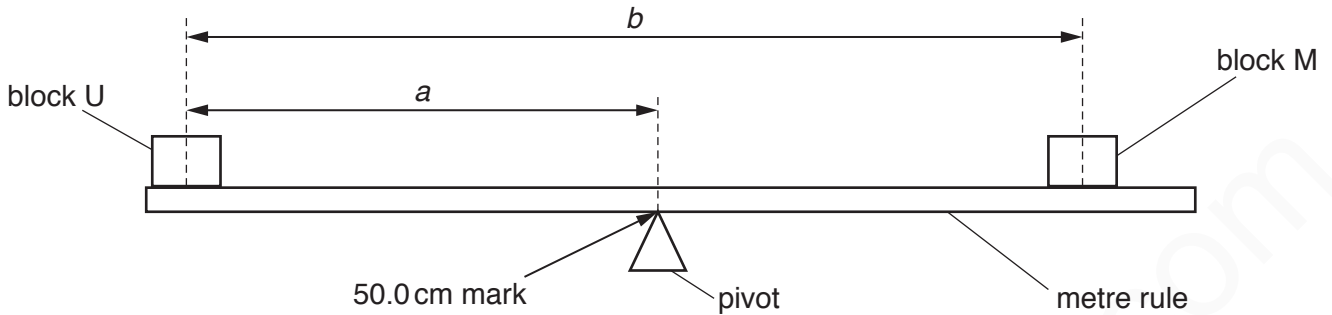


Fig. 1.1

- (a) One student places the metre rule on the pivot at the 50.0 cm mark and then places block U with its centre at the 5.0 cm mark. Suggest why it might be difficult to place block U accurately at the 5.0 cm mark. Explain how the student could overcome this difficulty. You may draw a diagram.

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.....
..... [1]

- (b) (i) The student places block M on the metre rule as shown in Fig. 1.1 and adjusts the position of block M until the metre rule is as near to being balanced as possible.

Briefly describe a method to find the position at which the metre rule is as near to being balanced as possible.

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..... [1]

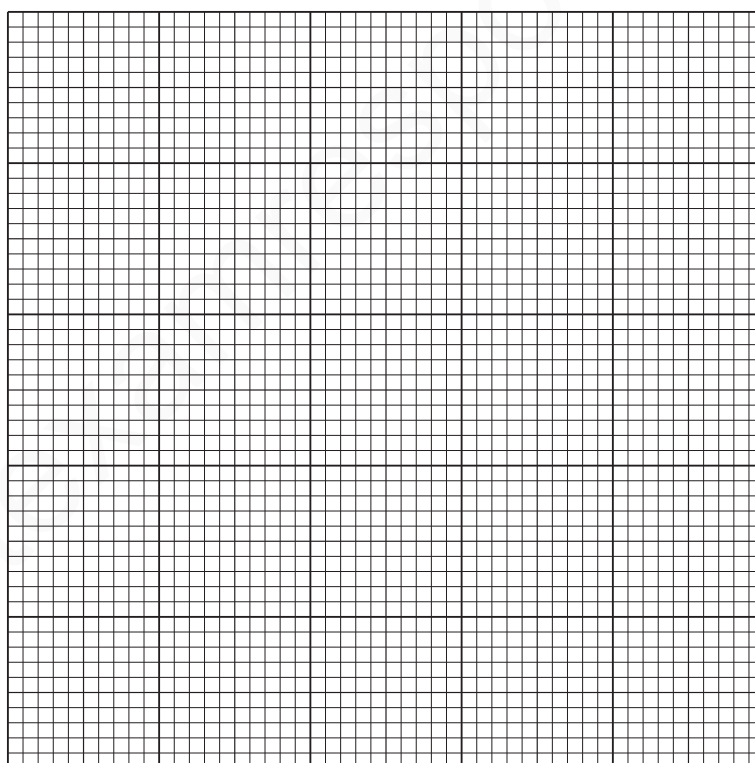
- (ii) The student determines the distance a between the centre of block U and the pivot. He also determines the distance b between the centre of block U and the centre of block M. He repeats the procedure for positions of block U at the 10.0 cm, 15.0 cm, 20.0 cm and 25.0 cm marks.

His results are shown in Table 1.1.

Table 1.1

position of block U/cm	a/cm	b/cm
5.0	45.0	65.5
10.0	40.0	59.0
15.0	35.0	51.8
20.0	30.0	45.0
25.0	25.0	38.6

Plot a graph of b/cm (y -axis) against a/cm (x -axis). You do not need to start the axes at the origin (0,0).



[4]

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

$$G = \dots\dots\dots [1]$$

- (ii) Calculate the mass M_U of block U using the equation $M_U = (G - 1) \times k$, where $k = 200\text{g}$.

Record the value of M_U to a suitable number of significant figures for this experiment.

$$M_U = \dots\dots\dots [2]$$

- (d) A student suggests that a and b are proportional.
State whether the results support this suggestion.
Justify your statement by reference to some results from Table 1.1.

statement

justification

.....

.....

[2]

[Total: 11]

MARKING SCHEME

(a)	(difficult to see centre of block) and valid method, e.g. <ul style="list-style-type: none"> • (measure width of block and) add $\frac{1}{2}$ width to 5.0 cm to find position for edge of block • mean value of marks at both edges of mass • mark centre line of mass and align with mark on rule 	1
(b)(i)	move block back and forth to find the point of balance / owtte	1
(b)(ii)	graph:	
	axes labelled correct orientation, with quantity and unit	1
	appropriate scales (plots occupying at least $\frac{1}{2}$ grid)	1
	plots all correct to less than $\frac{1}{2}$ small square and precise plots	1
	well-judged line <u>and</u> thin line	1
(c)(i)	G present <u>and</u> triangle method seen on graph	1
(c)(ii)	M_U in range 61.0 to 81.0 (g)	1
	2/3 sig figs and unit	1
(d)	a and b are proportional	1
	b/a constant within limits of experimental accuracy / owtte	1