1 A student investigates the balancing of a metre ruler.

Fig. 1.1 shows the apparatus.

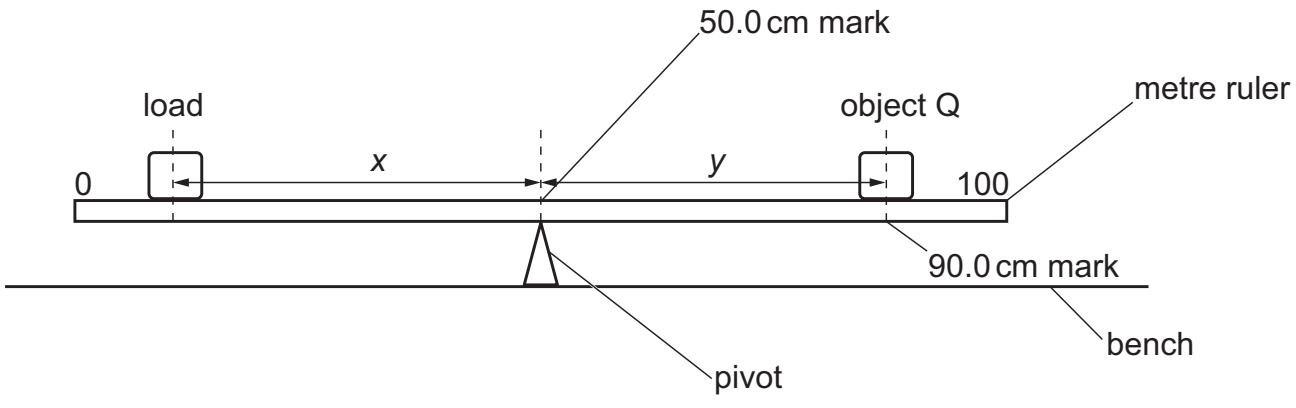

Fig. 1.1

(a) The student places a metre ruler on a pivot at the 50.0 cm mark.

She places an object Q with its centre on the metre ruler at the 90.0 cm mark.

Determine the distance *y* from the 50.0 cm mark to the centre of the object Q.

y = ... cm [2]

(b) She places a 2.0 N load on the metre ruler.

She adjusts the position of the load so that the metre ruler is as near as possible to being balanced.

She measures the distance *x* from the centre of the load to the 50.0 cm mark.

x = 21.5 cm

(i) Calculate the weight *W* of object Q, using the equation $W = \frac{x}{y} \times 2.0\,\text{N}$.

Give your answer to a suitable number of significant figures for this experiment.

W = ... N [2]

She repeats the procedure, using a 3.0 N load. She does not change the position of object Q.

x = 14.8 cm

(ii) Calculate a new value of the weight *W* of object Q, using the equation $W = \frac{x}{y} \times 3.0\,\text{N}$.

Give your answer to a suitable number of significant figures for this experiment.

W = ... N [1]

(c) State and explain whether your two values of *W* are equal within the limits of experimental accuracy. Refer to the values of *W* in your answer.

statement .....

explanation .....

.....

.....
[2]

(d) Explain how you ensure that the centre of object Q is directly over the 90.0 cm mark of the metre ruler. You may draw a diagram.

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..... [1]

(e) It is difficult to find the position of the load to obtain the exact balance of the metre ruler.

Explain how you try to overcome this difficulty.

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..... [1]

(f)

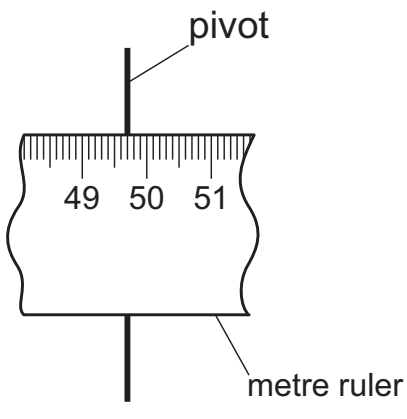

Fig. 1.2

Fig. 1.2 shows the metre ruler balanced on the pivot with no loads. The balance point shows the position of the centre of mass of the metre ruler.

Determine the distance *d* between the 50.0 cm mark on the metre ruler and the centre of mass.

Show your working.

d = ... [2]

[Total: 11]