MEASURING MASS -BALANCING METHOD-[MOMENTS]

1 A student measures the mass M of an object using a balancing method.

(a) Procedure

The student:

- fixes the object securely to a metre rule with the centre of the object directly over the 15.0 cm mark
- places a pivot directly under the 50.0 cm mark
- places a mass m = 80 g on the rule
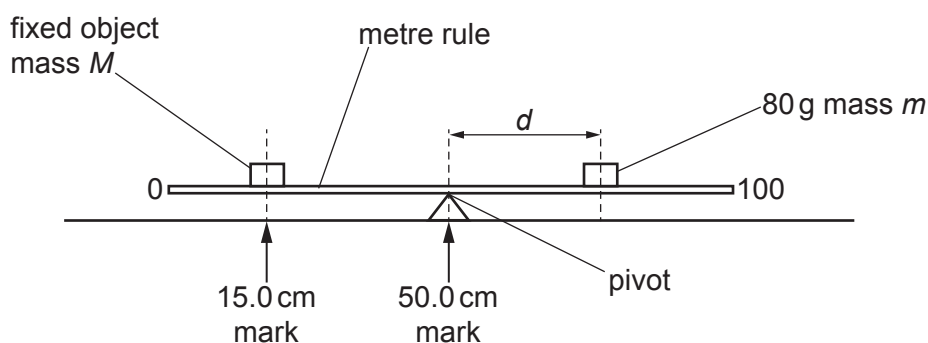- adjusts the position of the mass until the rule is as close as possible to balance, as shown in Fig. 6.1.

Fig. 6.1

Fig. 6.2 shows the position of the 80 g mass on the rule at balance.
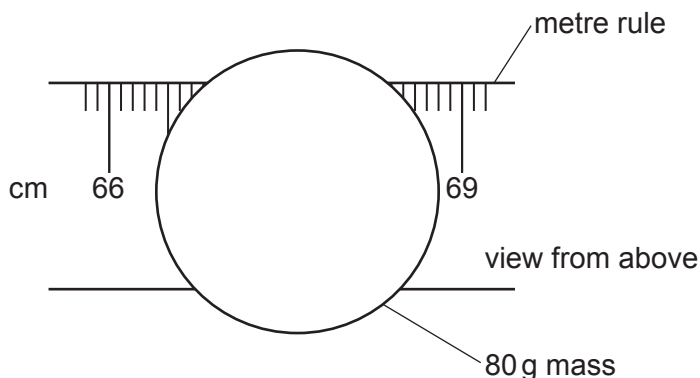

Fig. 6.2

(i) Take readings from the metre rule to determine the position p of the centre of the 80 g mass on the rule to the nearest 0.1 cm.

Show your working.

p = ... cm [2]

(ii) Calculate the distance d from the centre of the 80 g mass to the 50.0 cm mark on the rule.

Use the equation shown.

$$d = p - 50$$

Record this distance in Table 6.1.

Table 6.1

mass m /g	distance d /cm	$(m \times d)$ /g cm
80		
60	23.2	1392
40	35.0	1400

[1]

(b) The student repeats the procedure in **(a)** using masses of 60 g and 40 g.

The results are shown in Table 6.1.

(i) Calculate the product $(m \times d)$ for the 80 g mass.

Record your answer in Table 6.1. [1]

(ii) State the relationship between distance d and mass m.

....

.... [1]

(c) The teacher says that the product $(m \times d)$ for each mass is constant.

Quantities can be considered to be equal, within the limits of experimental error, if their values are within 10% of each other.

Compare your values of $(m \times d)$ for each mass in Table 6.1.

State, giving a reason, if you agree with the teacher.

statement ....

reason ....

....

[1]

(d) (i) Use the values of the product ($m \times d$) from Table 6.1 to calculate the average value of ($m \times d$).

$$(m \times d)_{AV} = \text{... g cm } [1]$$

(ii) The mass M of the fixed object is calculated using the equation shown.

$$M = \frac{(m \times d)_{AV}}{35}$$

Use your result from **(d)(i)** to calculate M.

$$M = \text{.. g } [1]$$

(e) State **one** practical problem that makes it difficult to get accurate measurements when doing this experiment.

....

.... [1]

(f) Another student repeats the procedure with a 20 g mass instead of the 80 g mass.

Suggest the problem the student encounters when doing this experiment with the 20 g mass.

....

.... [1]

[Total: 10]

MARKSCHEME:

(a)(i)	66.4 and 68.8 ; 67.6 ;		2
(a)(ii)	17.6 ;		1
(b)(i)	1408 ;		1
(b)(ii)	as mass / *m* decreases distance / *d* increases ;		1
(c)	agree and at least **one** calculation of 10% or it's equivalent ;		1
(d)(i)	1400 ;		1
(d)(ii)	*M* = 40 ;		1
(e)	difficult to balance the rule ;		1
(f)	rule isn't long enough ;		1