# MASS OF A BLOCK

**1** An IGCSE class is carrying out this experiment to determine the mass of a metal block.

Fig. 1.1 shows a spring drawn full size.

Fig. 1.2, also full size, shows the spring with a load of 100 g suspended from it.

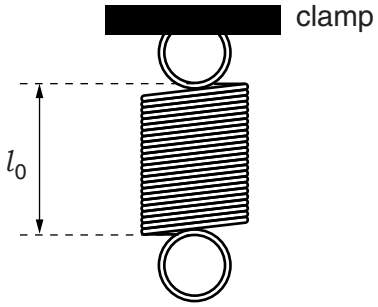


**Fig. 1.1**

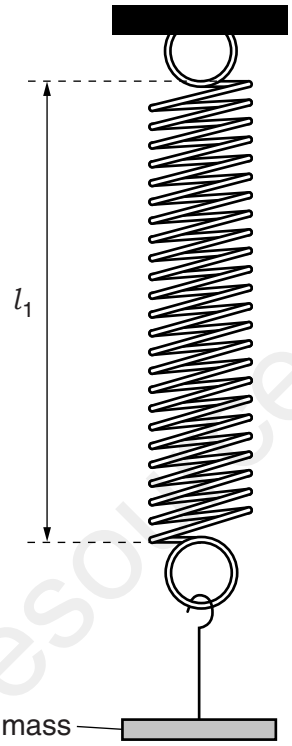


**Fig. 1.2**

**(a) (i)** On Fig. 1.1, measure the length $l_0$, in cm, of the spring without any load.

$l_0$ = ..... cm

**(ii)** On Fig. 1.2 measure the stretched length $l_1$, in cm.

$l_1$ = ..... cm
[1]

**(iii)** Calculate the extension $e_1$ of the spring using the equation $e_1 = (l_1 - l_0)$.

$e_1$ = .....[1]

**(iv)** Determine a value for $k$ using the equation $k = \frac{m}{e_1}$, where $m$ = 100 g.

$k$ = ..... unit .....[2]

**(b)** The apparatus is then set up as shown in Fig. 1.3.
The rule is at a small angle to the bench.

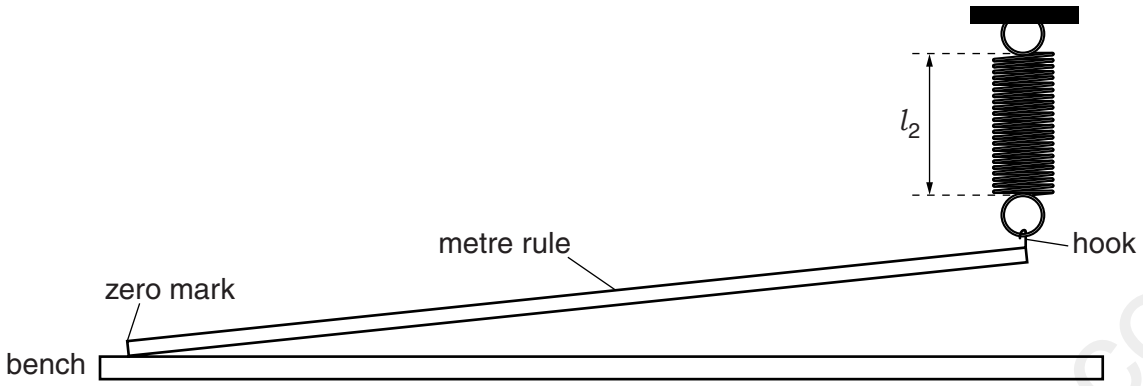


**Fig. 1.3**

A student measures the length of the stretched spring and obtains the result

$l_2$ = ..... 4.4 cm .....

**(i)** He then places a metal block **X** with its centre at the 40.0 cm mark on the rule.

Explain briefly how the student can make sure that the block is in the correct position. You may wish to use a diagram.

.....

.....

.....[1]

**(ii)** The student measures the new length $l_3$ of the spring and records it as

$l_3$ = ..... 7.5 cm .....

Determine the change in the extension $e_2$ due to block **X**, using the equation $e_2 = (l_3 - l_2)$.

$e_2$ = .....

**(iii)** Calculate the mass $M$ of block **X** using your answers to **(a)(iv)** and **(b)(ii)** and the equation $M = k\left(\frac{e_2}{0.40}\right)$.

$M$ = .....[2]

**(c)** Suggest two practical causes of inaccuracy in this experiment.

1. .....

.....

2. .....

.....

[2]

[Total: 9]

----------Marking Scheme----------

**(a) (i)** and **(ii)** $l_o$ = 2.0 and $l_1$ = 6.1 [1]

**(iii)** $e_1$ = 4.1cm unit required ecf from **1(a)(i)** and **1(a)(ii)** [1]

**(iv)** Correct calculation for $k$ = 24/24.4 ecf from **1(a)(iii)** [1]
Unit g/cm [1]

**(b) (i)** Appropriate method (can be written and/or in diagram)
e.g. measure half width of mass either side of 40 cm/mark centre of mass [1]

**(ii)** and **(iii)** $e_2$ seen and $M$ = 190 g (no ecf) unit required for $M$ [1]
2 or 3 significant figures [1]

**(c)** Any two from:
rule bends
mass not exactly at 40 cm
mass may slip
end of rule may slip
hook not directly above 0 cm
spring extension not uniform/owtte
proportional limit exceeded
mass irregular/C of G not at centre [2]

**[Total: 9]**