

SMART EXAM RESOURCES
0654 COORDINATED SCIENCES
PHYSICS
MOTION-SET-2-QP-MS

1

A student measures the acceleration of free fall g using a spring.

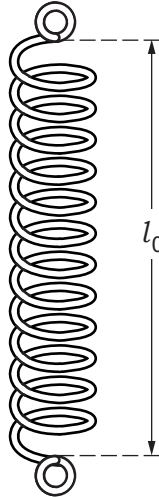


Fig. 3.1

- (a) Measure and record the unstretched length l_0 of the spring shown in Fig. 3.1 to the nearest millimetre.

$l_0 = \dots\dots\dots$ mm [1]

- (b) The student attaches the spring to a clamp as shown in Fig. 3.2 and suspends a 200 g mass on the spring.

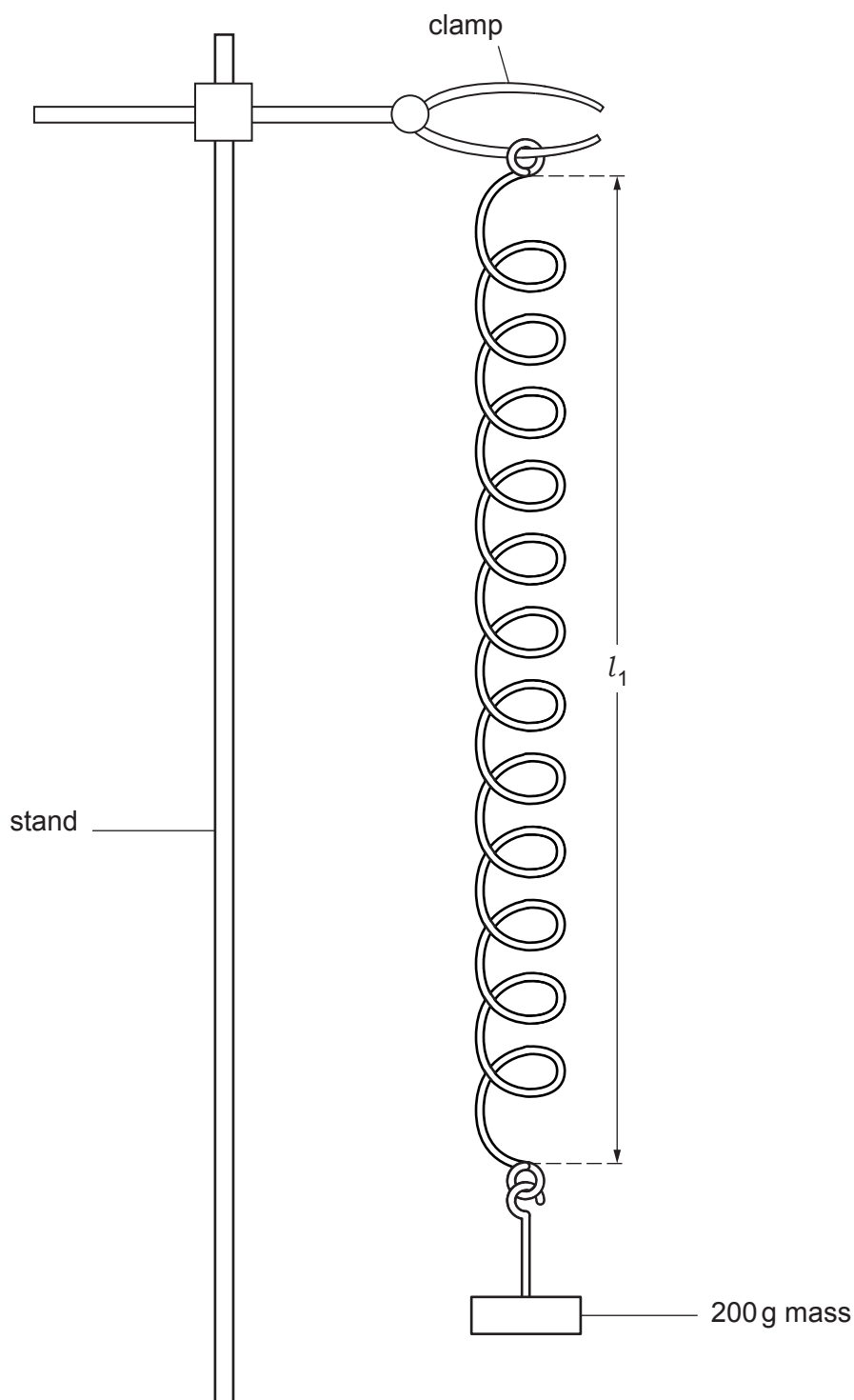


Fig. 3.2

Measure the stretched length l_1 of the spring.

$$l_1 = \dots\dots\dots\text{mm}$$

Calculate the extension e of the spring produced by the mass. Use the equation shown.

$$e = l_1 - l_0$$

Record your value in Table 3.1.

[1]

Table 3.1

mass m /g	extension e /mm	time t taken for 20 oscillations/s	period T /s	T^2/s^2
200		11.22	0.561	0.31
300	118	13.34	0.667	
400	160	15.81	0.791	0.63
500	202	17.87	0.894	0.80

(c) The student pulls the mass down a small distance and releases it. The mass oscillates up and down. The period T of the oscillations is the time taken for **one** oscillation.

- She measures the time t taken for 20 oscillations and records this time in Table 3.1.
- She repeats the procedure for masses of 300 g, 400 g and 500 g.

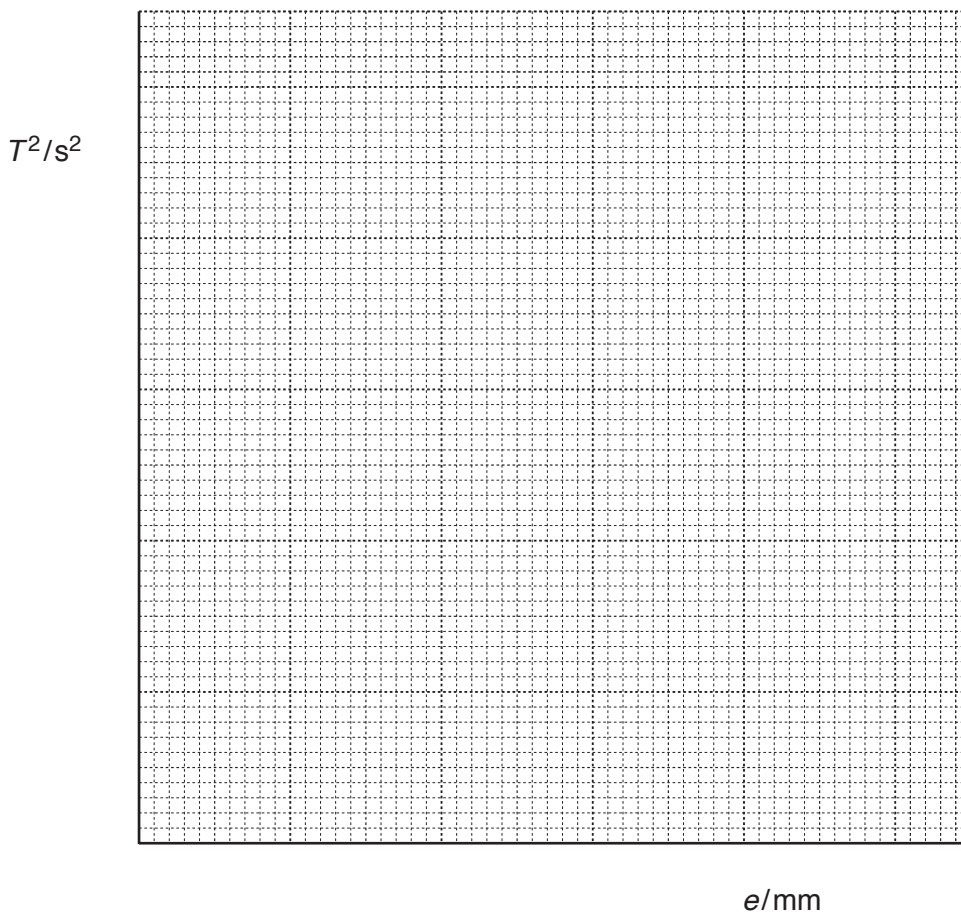
Her results are shown in Table 3.1.

Calculate the missing value of T^2 .

Record your answer in Table 3.1.

[1]

(d) (i) On the grid provided, plot a graph of T^2 (vertical axis) against e . Start your axes at (0,0).



[2]

(ii) Draw the best-fit straight line.

[1]

(iii) Calculate the gradient of your line.

Show all working and indicate on your graph the values you chose to enable an accurate value of the gradient to be calculated.

gradient =[2]

(iv) Use your answer to (d)(iii) and the equation shown, to determine a value for the acceleration of free fall g .

$$g = \frac{0.0395}{\text{gradient}}$$

$g = \dots\dots\dots\text{m/s}^2$ [1]

(e) It is important to avoid line-of-sight (parallax) errors when measuring the length of a spring.

Describe how you would avoid this error.

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

MARK SCHEME

(a)	55 mm ;	1
(b)	$l_1 = 137$ mm and $e = 82$ mm ;	1
(c)	0.44 ;	1
(d)(i)	suitable choice of scales (\geq half the grid used) and starting at 0,0 ; 3 plots correct to half a small square ;	2
(d)(ii)	good best-fit line judgement ;	1
(d)(iii)	indication on graph of how data were obtained AND more than half the line used ; correct calculation ;	2
(d)(iv)	correct calculation of g ;	1
(e)	view perpendicularly to rule / scale / equivalent; rule close to spring ; use of fiducial marker;	1