1 The IGCSE class is investigating the motion of a mass hanging on a spring.

Fig. 1.1 shows the apparatus

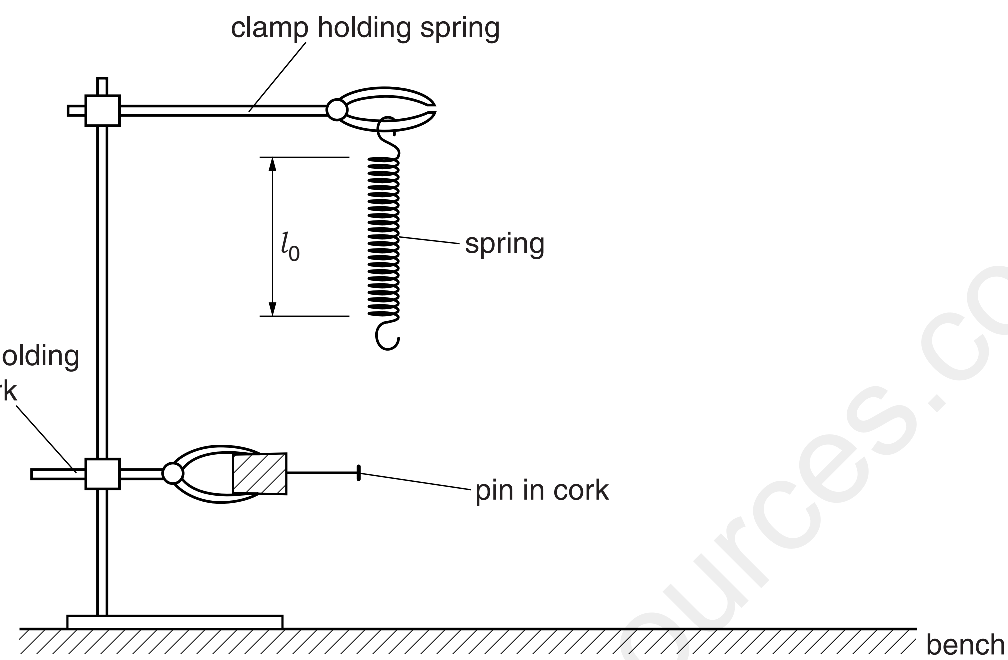

Fig. 1.1

(a) On Fig. 1.1, measure the length l_0 of the unstretched spring, in mm.

l_0 = ... mm [1]

(b) The diagram is drawn one tenth of actual size. Write down the actual length L_0 of the unstretched spring, in mm.

L_0 = ...mm [1]

A student hangs a 300 g mass on the spring and measures the new length L of the spring.

L = 255 mm

(i) Calculate the extension e of the spring using the equation $e = (L - L_0)$.

e = ...mm

(ii) Calculate a value for the spring constant k using the equation $k = \frac{F}{e}$, where F = 3.0 N. Include the appropriate unit.

k = ...

[2]

(c) The student adjusts the position of the lower clamp so that the pin is level with the bottom of the mass when the mass is not moving. She pulls the mass down a short distance and releases it so that it oscillates up and down. Fig. 1.2 shows one complete oscillation.

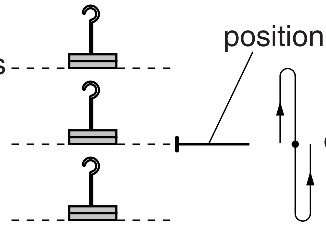

Fig. 1.2

She measures the time *t* taken for 20 complete oscillations.

t = ...26.84 s..........

Calculate the time *T* taken for one complete oscillation.

T = ... [1]

(d) She replaces the 300 g mass with a 500 g mass. She repeats the timing as described in part **(c)**.

t = ...34.48 s..........

(i) Calculate the time *T* taken for one complete oscillation.

T = ...

(ii) The student suggests that the time taken for the oscillations of the spring should not be affected by the change in mass.

State whether her results support this suggestion and justify your answer by reference to the results.

statement ....

justification ....

....

....

[2]

(e) Explain briefly how you avoid a line-of-sight (parallax) error when measuring the length of a spring in this type of experiment. You may draw a diagram.

....

....

....[1]

[Total: 8]

MARKING SCHEME:

(a) (b) 21 (mm) [1]

210 (mm) ecf from l_0 [1]

(b) 45 (mm) and
0.067 or 0.0667 (N / mm), 2 or 3 sig. figs.
ecf from l_0 and L_0 [1]

correct unit N / mm or N / m or N / cm as appropriate [1]

(c) T = 1.342 (s) or 1.34 (s) [1]

(d) T = 1.724 s (no mark)
statement NO (ecf from **(c)**) [1]

difference too large (for experimental inaccuracy) (ecf) [1]

(e) clear diagram or explanation that indicates:
perpendicular viewing of spring or scale
OR appropriate use of horizontal pointer / set square / rule, etc.
OR rule touching / very close to spring [1]

[Total: 8]