Hooke's Law

Question Paper 1

Level	IGCSE
Subject	Physics
Exam Board	CIE
Topic	General Physics
Sub-Topic	Hooke's Law
Paper Type	Alternative to Practical
Booklet	Question Paper 1

Time Allowed: **58 minutes**

Score: **/48**

Percentage: **/100**

1 A student is investigating the stretching of a spring.

The apparatus is shown in Fig. 1.1.

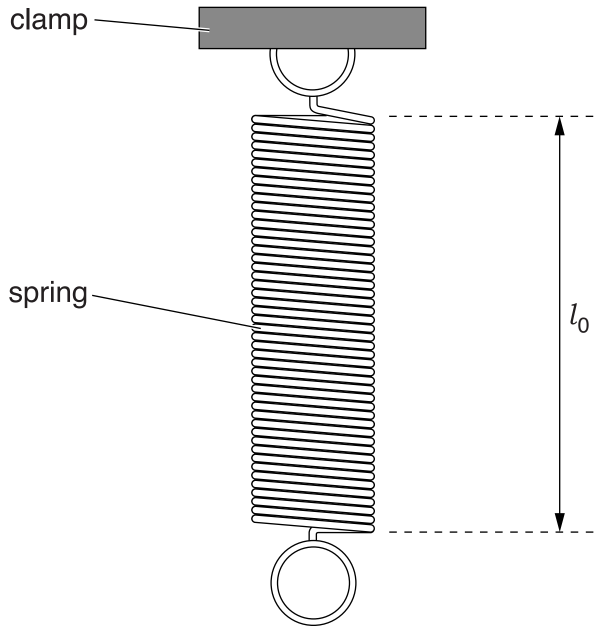


Fig. 1.1

(a) On Fig. 1.1, measure the unstretched length l_0 of the spring. Record l_0 in the first row of Table 1.1. [1]

(b) The student hangs a load L of 1.0 N on the spring and measures the new length l of the spring. She repeats the measurements using loads of 2.0 N, 3.0 N, 4.0 N and 5.0 N. The readings are shown in Table 1.1.

(i) For each set of readings, calculate the extension e of the spring using the equation $e = (l - l_0)$. Record the values of e in the table.

Table 1.1

L / N	l / mm	e / mm
0.0		0
1.0	59	
2.0	64	
3.0	69	
4.0	74	
5.0	78	

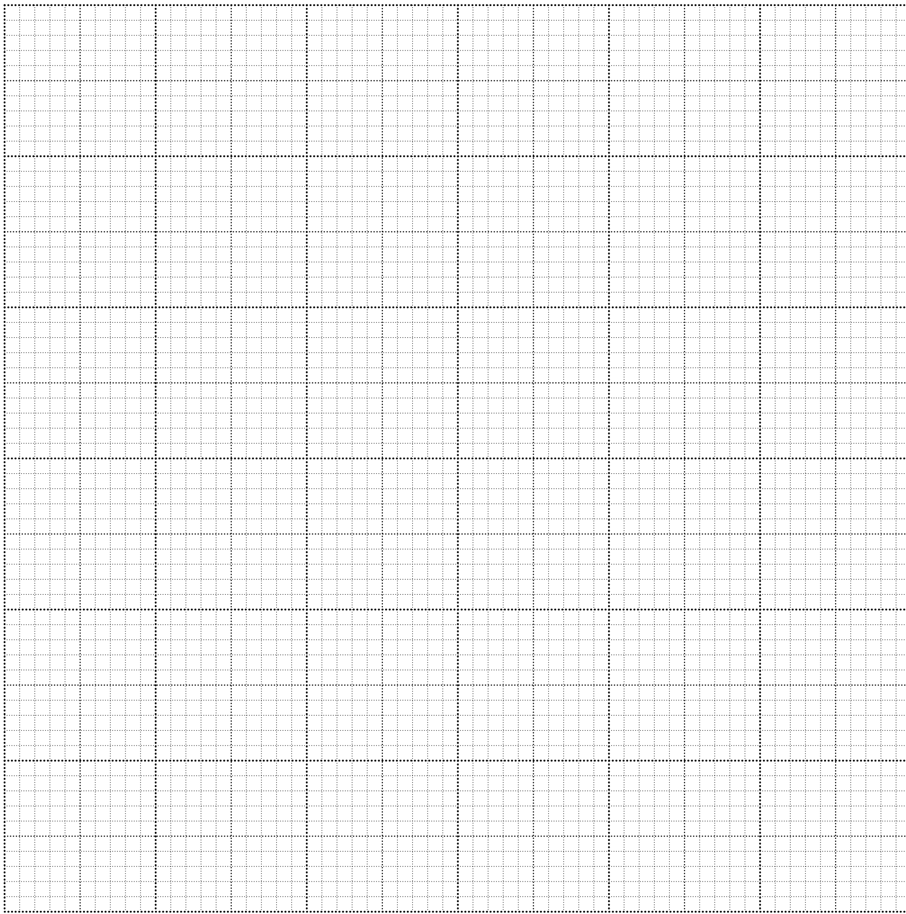
[1]

(ii) Explain briefly one precaution that you would take in order to obtain reliable readings.

....

....[1]

(c) Plot a graph of *e*/mm (*y*-axis) against *L*/N (*x*-axis).



[4]

(d) The student removes the load from the spring and hangs an unknown load **X** on the spring. She measures the length *l* of the spring.

l = 72 mm

(i) Calculate the extension *e* of the spring.

e = ... [1]

(ii) Use the graph to determine the weight *W* of the load **X**. Show clearly on the graph how you obtained the necessary information.

W = ... [2]

[Total: 10]

2 The class is investigating the behaviour of a spring, and then using the spring to determine the weight of an object.

The apparatus is shown in Fig. 2.1.

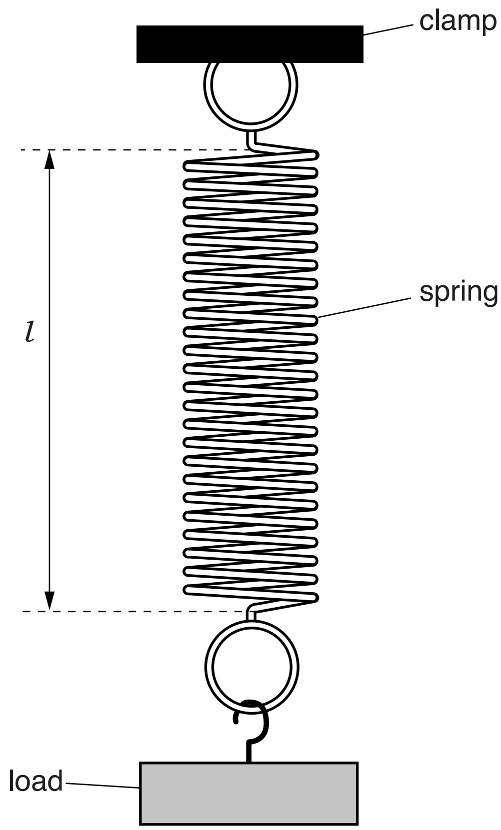


Fig. 2.1

(a) A load of weight L = 1.0 N is hung on the spring. The stretched length l of the spring, as indicated in Fig. 2.1, is recorded in Table 2.1.

Suggest a precaution that you would take when measuring the length of the spring, to ensure a reliable reading. You may draw a diagram.

....

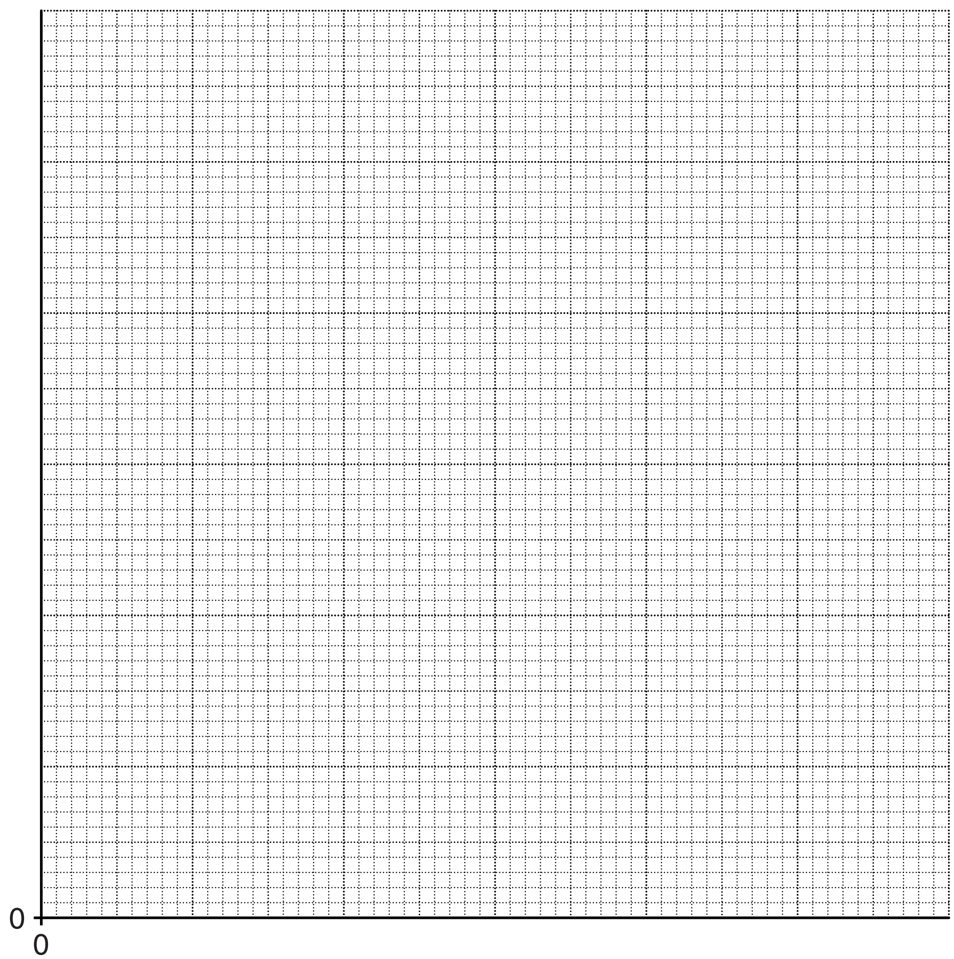
....[1]

(b) Step **(a)** is repeated for values of L = 2.0 N, 3.0 N, 4.0 N and 5.0 N. The readings are shown in Table 2.1.

Table 2.1

L/N	l/cm
1.0	6.1
2.0	9.0
3.0	13.4
4.0	16.8
5.0	21.0

Plot a graph of l/cm (y-axis) against L/N (x-axis).



[4]

(c) Use your graph to determine the length l_0 of the spring with no load attached.

l_0 = ...[1]

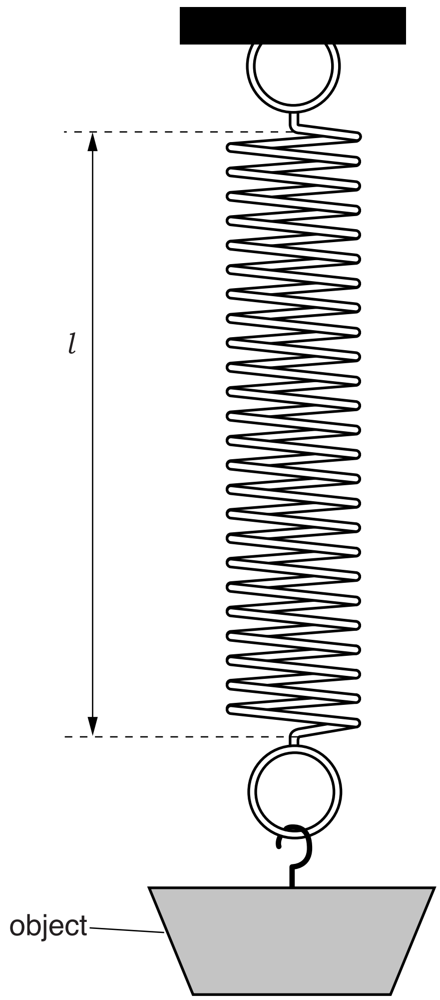


Fig. 2.2

(d) The loads are removed and an object is suspended from the spring, as shown in Fig. 2.2.

(i) On Fig. 2.2, measure the stretched length l of the spring.

l = ...[1]

(ii) Use the graph, and your reading from **(d)(i)**, to determine the weight W of the object. Show clearly on the graph how you obtained your answer.

W = ... N
[2]

(e) A student measures the weight of a different load using this same method. He gives the weight as 2.564 N.

Explain why this is not a suitable number of significant figures for this experiment.

....

....

....[1]

[Total: 10]

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

Fig. 1.1 shows the apparatus

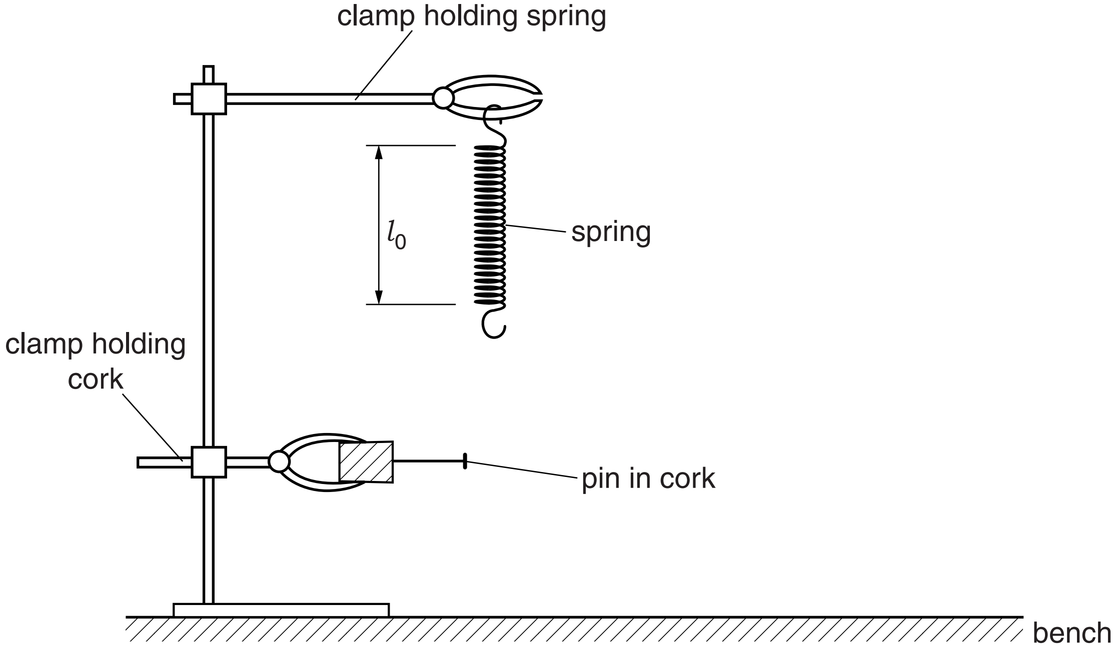


Fig. 1.1

(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.

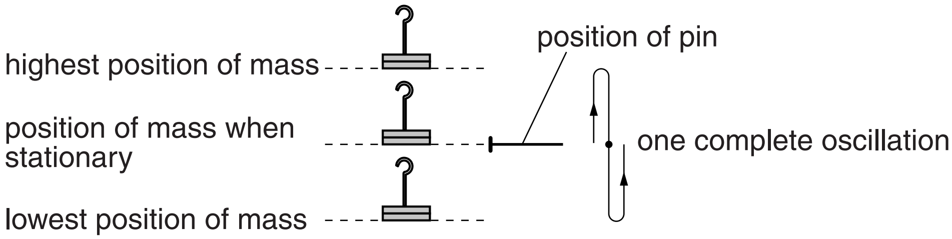


Fig. 1.2

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]

4 The IGCSE class is investigating the stretching of a spring.

Fig. 5.1 shows the apparatus.

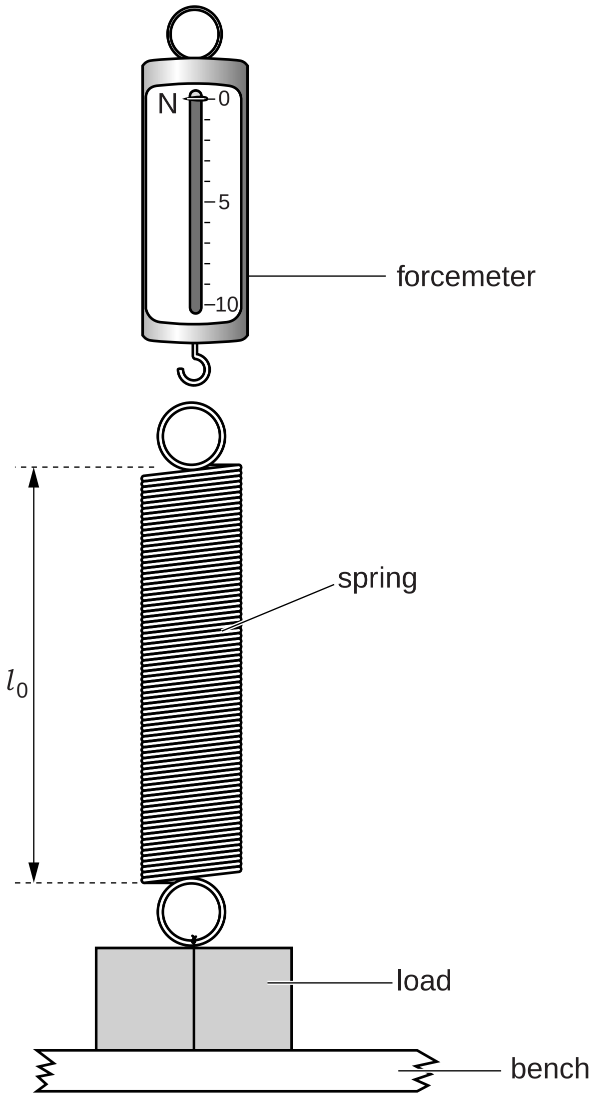


Fig. 5.1

(a) On Fig. 5.1, measure the unstretched length l_0 of the spring, in mm.

l_0 = ... mm [1]

(b) A student hangs the spring on the forcemeter with the load attached to the bottom of the spring, as shown in Fig. 5.1. The load remains on the bench.

He gently raises the forcemeter until it reads 1.0 N. He measures the new length l of the spring. He repeats the procedure using a range of forcemeter readings. The readings are recorded in Table 5.1.

Table 5.1

F / N	l / mm	e / mm
1.0	67	
2.0	77	
3.0	91	
4.0	105	
5.0	115	

(i) Calculate the extension e of the spring, for each set of readings, using the equation $e = (l - l_0)$. Record the values of e in Table 5.1. [1]

(ii) Plot a graph of e / mm (y-axis) against F / N (x-axis).

[5]

(iii) Determine the gradient G of the graph. Show clearly on the graph how you obtained the necessary information.

G = ... [2]

[Total: 9]

5 The IGCSE class is investigating the stretching of a spring.

Fig. 1.1 shows the experimental set up.

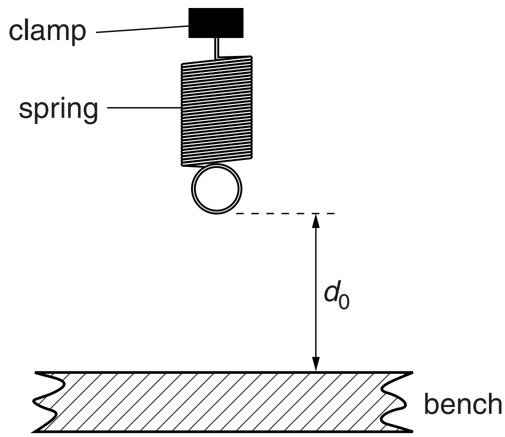


Fig. 1.1

(a) On Fig. 1.1, measure the vertical distance d_0, in mm, between the bottom of the spring and the surface of the bench.

d_0 = ... mm [1]

(b) The diagram is drawn 1/10th actual size. Calculate the actual distance D_0, in mm, between the bottom of the spring and the surface of the bench.

D_0 = ... mm [1]

(c) A student hangs a 1.0 N load on the spring. He measures and records the distance *D* between the bottom of the spring and the surface of the bench, and the value of the load *L*.

He repeats the procedure using loads of 2.0 N, 3.0 N, 4.0 N and 5.0 N. The distance readings are shown in Table 1.1.

Calculate the extension *e* of the spring, for each set of readings, using the equation $e = (D_0 - D)$. Record the values of *L* and *e* in Table 1.1.

Table 1.1

L / N	*D* / mm	*e* / mm
	199	
	191	
	179	
	171	
	160	

[2]

(d) Plot a graph of e/mm (y-axis) against L/N (x-axis).

[4]

(e) Determine the gradient G of the graph. Show clearly on the graph how you obtained the necessary information.

G = ... [2]

(f) When making measurements, the student is careful to avoid a line-of-sight error.

Suggest one other precaution that the student should take when measuring the distance D between the bottom of the spring and the surface of the bench.

....

.... [1]

[Total: 11]