Cambridge Assessment International Education

Cambridge IGCSE™

8: Mechanics 2 – Topic questions

Paper 6

The questions in this document have been compiled from a number of past papers, as indicated in the table below.

Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
1	2016	June	61
1	2016	June	62
1	2016	November	61

The mark scheme for each question is provided at the end of the document.

You can find the complete question papers and the complete mark schemes (with additional notes where available) on the School Support Hub at www.cambridgeinternational.org/support

1 A student is determining the weight of a metre rule using a balancing method.

The apparatus is shown in Fig. 1.1.

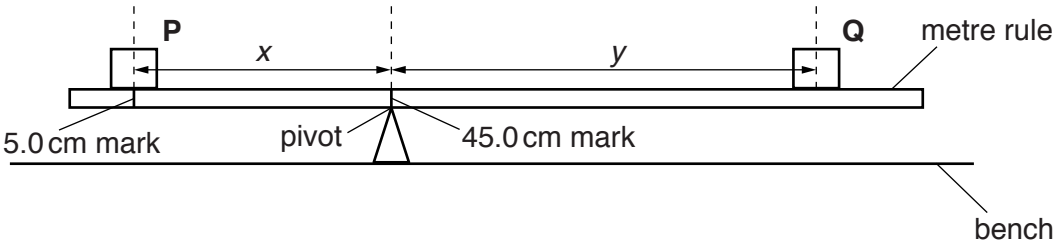


Fig. 1.1 (not to scale)

(a)

- The student places the load **P** on the metre rule at the 5.0 cm mark.
- She places the metre rule on the pivot at the 45.0 cm mark.
- She places load **Q** on the rule and adjusts its position so that the metre rule is as near as possible to being balanced.
- She measures the distance x between the centre of load **P** and the pivot and the distance y from the centre of load **Q** to the pivot.
- She repeats the procedure, placing the load **P** at the 10.0 cm mark, at the 15.0 cm mark, at the 20.0 cm mark and at the 25.0 cm mark. The readings are shown in Table 1.1.

Table 1.1

x/	y/	A/	B/
40.0	42.5		
35.0	36.0		
30.0	30.0		
25.0	24.0		
20.0	17.5		

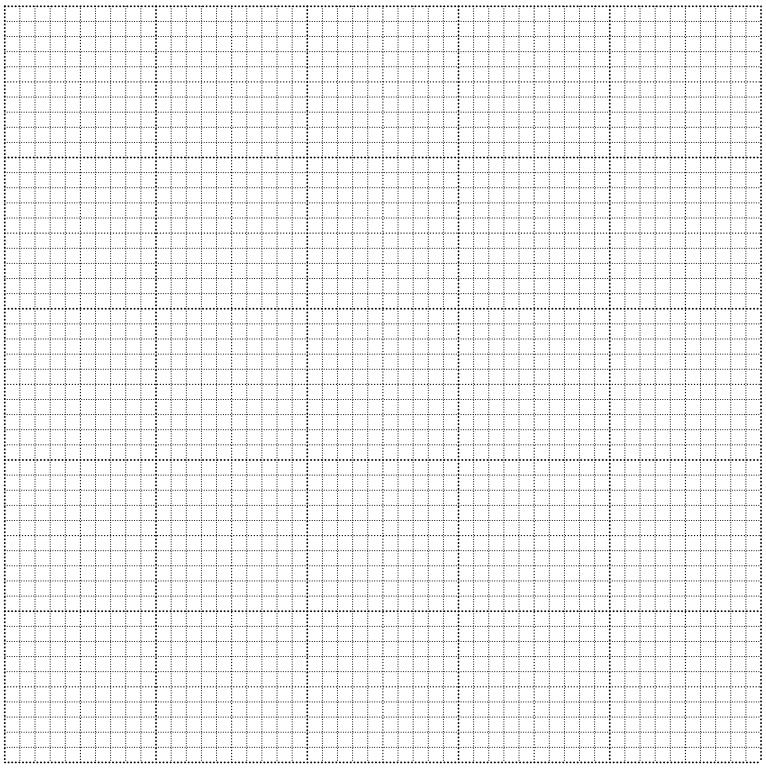
(i)

- For each value of x, calculate $A = Px$, where $P = 1.00$ N. Record the values in the table. P is the weight of load **P**.
- For each value of y, calculate $B = Qy$, where $Q = 0.80$ N. Record the values in the table. Q is the weight of load **Q**.

[1]

(ii) Complete the column headings in the table. [1]

(b) Plot a graph of A/N cm (y-axis) against B/N cm (x-axis). Start both axes at the origin (0,0).



[4]

(c) Using the graph, determine the vertical intercept Y (the value of A when $B = 0$ N cm). Show clearly on the graph how you obtained this value.

$Y =$ ..... [1]

(d) Calculate the weight W of the metre rule using the equation $W = \frac{Y}{z}$, where $z = 5.0$ cm.

$W =$ ..... [1]

(e) Suggest one practical reason why it is difficult to obtain exact results with this experiment.

.....

..... [1]

(f) The student uses an accurate electronic balance to obtain a second value for the weight of the metre rule.

weight obtained on the balance = ... 1.24 N .....

State and explain whether the two values for the weight agree within the limits of experimental accuracy.

statement .....

justification .....

.....

[1]

[Total: 10]

1 A student is investigating the stretching of a spring.

The apparatus is shown in Fig. 1.1.

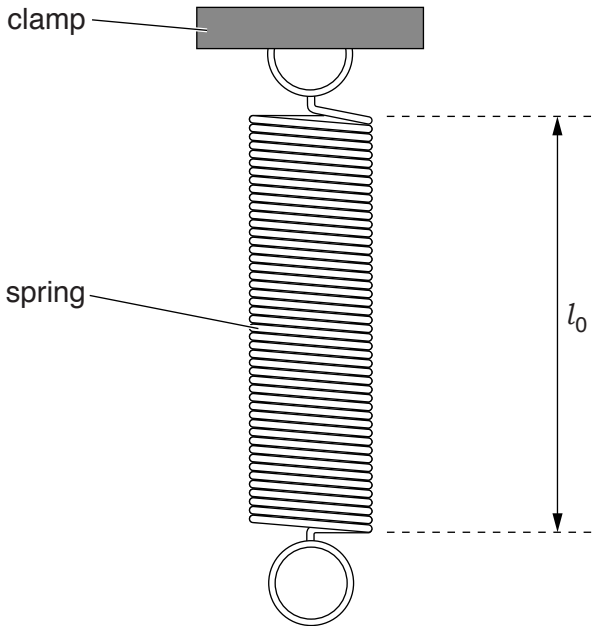


Fig. 1.1

(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	

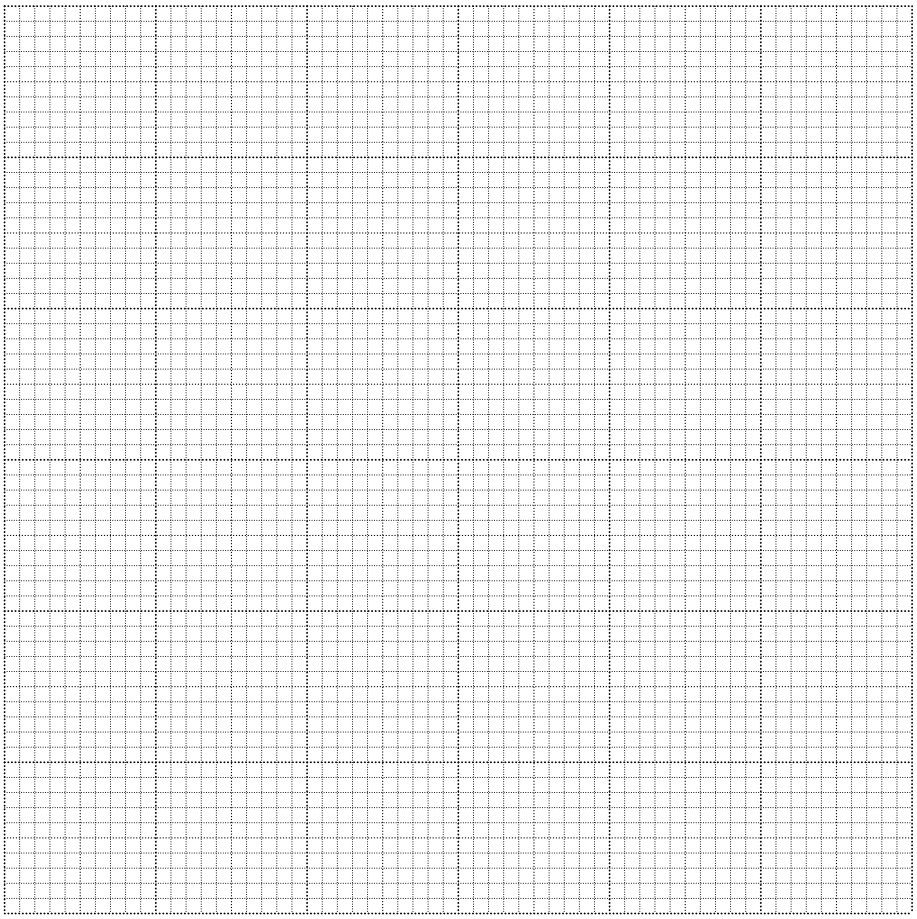
[1]

(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]

1 A student uses a pendulum to determine a value for the acceleration of free fall g.
Figs. 1.1 and 1.2 show the apparatus.

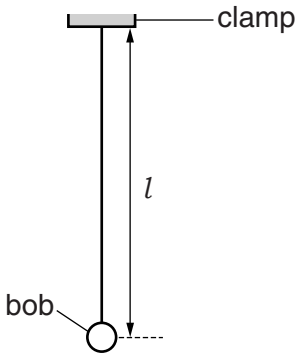


Fig. 1.1

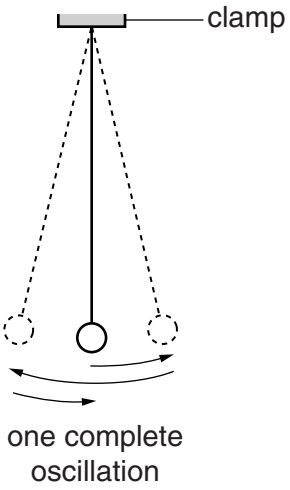


Fig. 1.2

(a) On Fig. 1.1, measure the length l of the pendulum.

l = ... cm [1]

(b) The student adjusts the pendulum until its length l = 50.0 cm. The length l is measured to the centre of the bob.

Explain briefly how the student avoids a parallax (line of sight) error when measuring length l.

.....

.....

.....[1]

(c) The student displaces the pendulum bob slightly and releases it so that it swings.

He measures the time t for 20 complete oscillations of the pendulum.

$t =$ 27.8 s

(i) Calculate the period T of the pendulum. The period is the time for one complete oscillation.

$T =$ .....[1]

(ii) Measuring the time for a large number of oscillations, rather than for one oscillation, gives a more accurate value for T.

Suggest one practical reason why measuring the time for 200 oscillations, rather than 20 oscillations, may **not** be suitable.

.....

.....[1]

(iii) Calculate T^2.

$T^2 =$ .....[1]

(iv) Calculate the acceleration of free fall g using the equation $g = \frac{4\pi^2 l}{T^2}$. Give your answer to a suitable number of significant figures for this experiment.

$g =$ ..... m/s^2 [2]

(d) The student checks the value of the acceleration of free fall g in a text book. The value in the book is $9.8\,m/s^2$.

(i) Suggest a practical reason why the result obtained from the experiment may be different.

.....

.....

.....[1]

(ii) Suggest **two** improvements to the experiment.

1. .....

.....

2. .....

.....
[2]

[Total: 10]

Question	Answer	Mark
1 (a) (i)	A and B values correct A: 40.0, 35.0, 30.0, 25.0, 20.0 B: 34.0, 28.8, 24.0, 19.2, 14.0	1
1 (a) (ii)	cm, cm, N cm, N cm	1
1 (b)	Axes correctly labelled with quantity, right way round Appropriate scales, starting at origin (0,0) All plots correct to ½ small square Good line judgement, thin, continuous, single line through the plots; with neat plots	1 1 1 1
1 (c)	method shown on graph U and correct to ½ small square	1
1 (d)	W = 1.0–1.4 no e.c.f	1
1 (e)	difficulty of achieving balance or other sensible suggestion	1
1 (f)	expect agree; allow e.c.f. explanation includes idea of close enough (or, e.c.f. too different)	1
		Total: 10
1 (a)	l_0 = 55 (mm) c.a.o.	1
1 (b) (i)	4, 9, 14, 19, 23 e.c.f **(a)**	1
1 (b) (ii)	viewing scale at right angles or use of straight edge/set square/pointer between bottom of spring and scale/ruler	1
1 (c)	axes correctly labelled with quantity and unit suitable scales all plots correct to ½ small square good line judgement, thin, continuous line, neat plots	1 1 1 1
1 (d) (i)	e = 17(mm) e.c.f **(a)**	1
1 (d) (ii)	method clearly shown on graph W value 3.5–3.75 unit N needed, no e.c.f from **(i)**	1 1
		Total: 10

Question	Answer	Mark
1 (a)	l = 4.1–4.2 (cm)	1
1 (b)	either suitable use of a horizontal straight edge, explained briefly OR holding rule close to pendulum OR line of sight perpendicular (to rule)	1
1 (c) (i)	T = 1.39(s) **OR** 1.4	1
1 (c) (ii)	pendulum may stop **OR** student may lose count	1
1 (c) (iii)	1.93 s^2 (e.c.f. allowed)	1
1 (c) (iv)	10.2(2) 2 or 3 sig figs	1 1
1 (d) (i)	Explanation of cause of inaccuracy in measurement of *t* or *l*. e.g. student did not react quickly enough when starting/stopping stopwatch **OR** difficulty in measuring accurately to centre of bob	1
1 (d) (ii)	Any two from: Use different length(s) Repeat timing Use of a fiducial mark Increased number of oscillations Plot a graph using length and time or time^2	2
		Total: 10

Notes about the mark scheme are available separately.