OSCILLATIONS-METER RULE

1 The IGCSE class is investigating the swing of a loaded metre rule.

The arrangement of the apparatus is shown in Fig. 5.1.

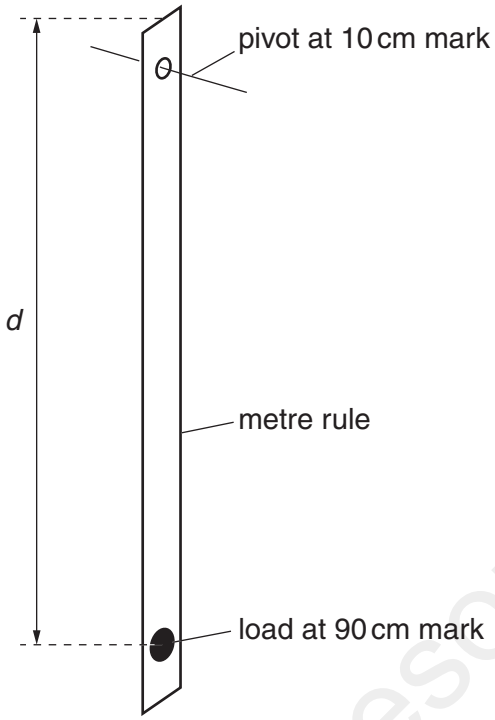


Fig. 5.1

A student displaces the rule a small distance to one side and allows it to swing. The time t taken for 10 complete swings is recorded. She calculates the time T taken for one swing. She repeats the procedure using different values of the distance d.

The readings are shown in the Table 5.1.

Table 5.1

0.900	18.4	1.84	
0.850	17.9	1.79	
0.800	17.5	1.75	
0.750	17.1	1.71	
0.700	16.7	1.67	

(a) Complete the column headings in the table. [3]

(b) Explain why the student takes the time for ten swings and then calculates the time for one swing, rather than just measuring the time for one swing.

.....

.....[1]

(c) The student tries to find a relationship between T and d. She first suggests that $T \times d$ is a constant.

(i) Calculate the values of $T \times d$ and enter the values in the final column of the table.

(ii) State whether or not the results support this suggestion and give a reason for your answer.

Statement .....

.....

Reason .....

.....
[2]

(a) column 1: d, m (or in words) [1]
columns 2 and 3: t, T (or in words) [1]
columns 2 and 3: s, s (or in words) [1]

(b) accuracy/reducing uncertainty/sensible comment on reaction time [1]

(c) **(i)** at least <u>three</u> correct values entered in table
1.66, 1.52, 1.40, 1.28, 1.17 (at least 2 significant figures) c.a.o [1]

(ii) statement matches result (expect NO) <u>AND</u>
justification matches statement and by reference to result
(expect decreasing, not equal, not constant, different, changing, wtte)
allow ecf from **(i)** [1]

[Total: 6]

2 A student is investigating the oscillation of a metre rule that has one end resting on the laboratory bench. The other end is held above the level of the bench by a spring attached at the 90.0 cm mark. The arrangement is shown in Fig. 2.1.

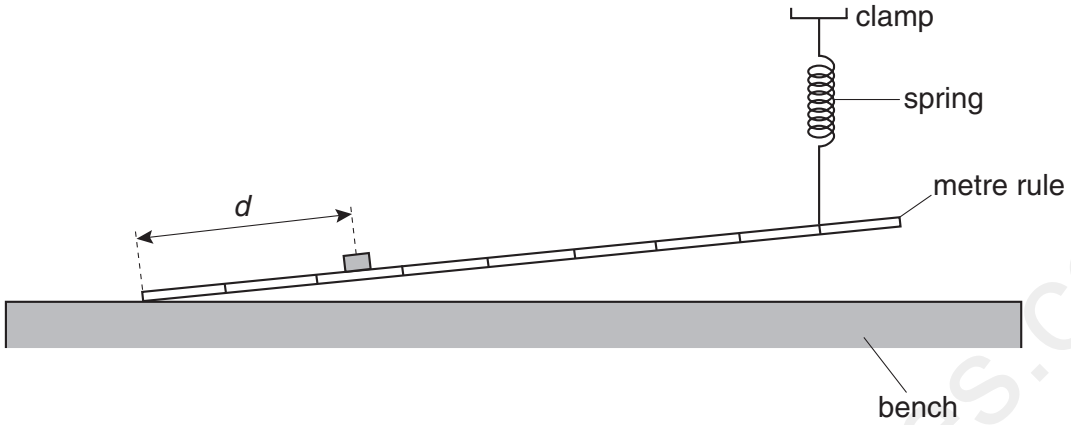


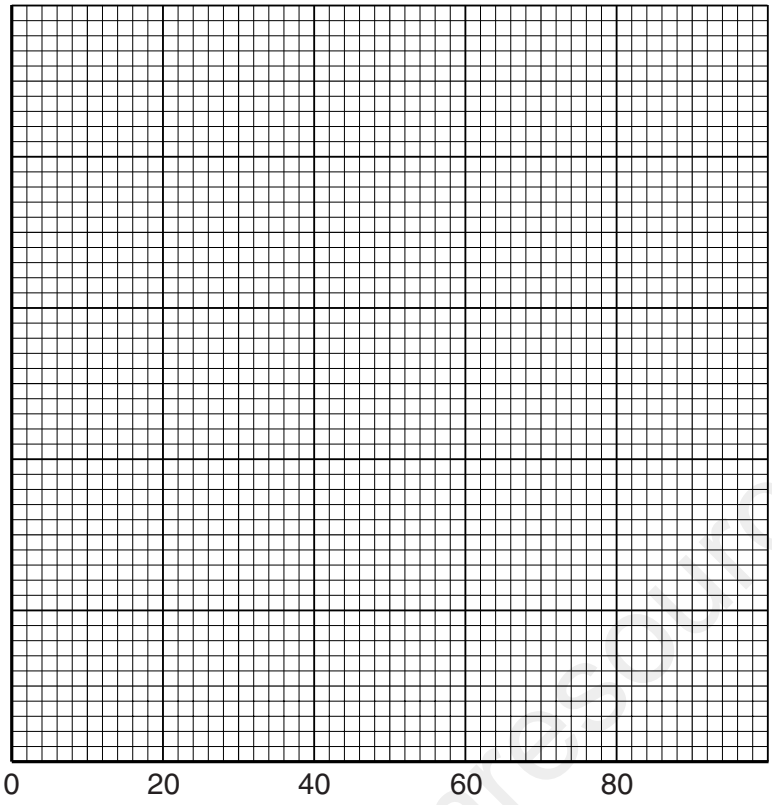
Fig. 2.1

The period of oscillation is changed by moving a 200 g mass to different positions along the rule. The student records the time t taken for 10 oscillations of the end of the rule for each position of the mass. He measures the distance d from the end of the rule to the mark under the centre of the mass. The readings are shown in the table.

d / cm	t / s	T / s
20.0	3.4	
40.0	4.4	
50.0	4.9	
60.0	5.3	
70.0	6.0	
80.0	6.3	

(a) Calculate the period T for each set of readings and enter the values in the table. [2]

(b) Plot a graph of d / cm (x-axis) against T / s (y-axis). The scale on the x-axis has been started for you. [5]



(c) Using the graph, determine the period T when the distance d is 55.0 cm.

T = ... [2]

(d) The student suggests that T should be proportional to d. State with a reason whether your results support this suggestion.

statement .....

reason .....

..... [2]

(a)	All T values correct (0.34, 0.44, 0,49, 0.53, 0.60, 0.63)	1
	All T values to 2 sf OR all to 3sf	1
(b)	Graph:	
	Scales suitable	1
	Scales labeled and with units	1
	Plots correct to ½ sq (-1 each error)	2
	Line judgement	1
	Line thickness (and small, neat plots)	1
(c)	T = 0.51 (s) correct answer only; NO ecf	1
(d)	Statement: NO	1
	Reason: line not through origin (or equivalent)	1
	(allow mark if candidate describes str. line or constant gradient)	
	TOTAL	**11**