Cambridge Assessment International Education

Cambridge IGCSE™

4: Mechanics 1 – 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	62
2	2016	June	61
2	2016	March	62

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 investigating the stretching of a spring.

The apparatus is shown in Fig. 1.1.

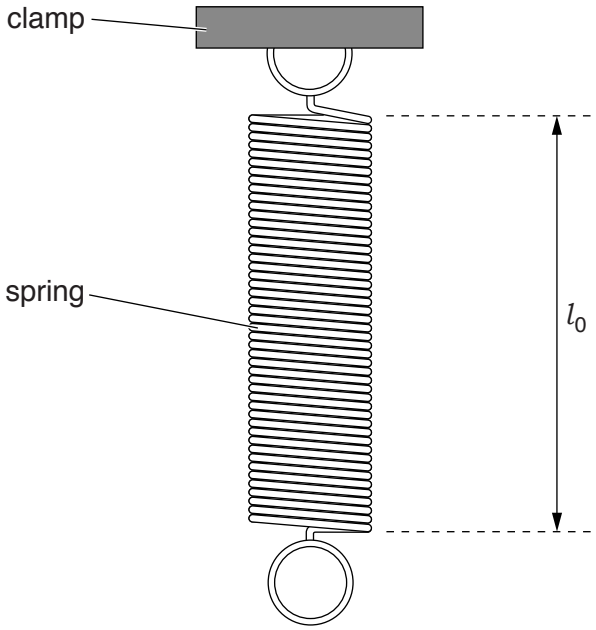


Fig. 1.1

(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	

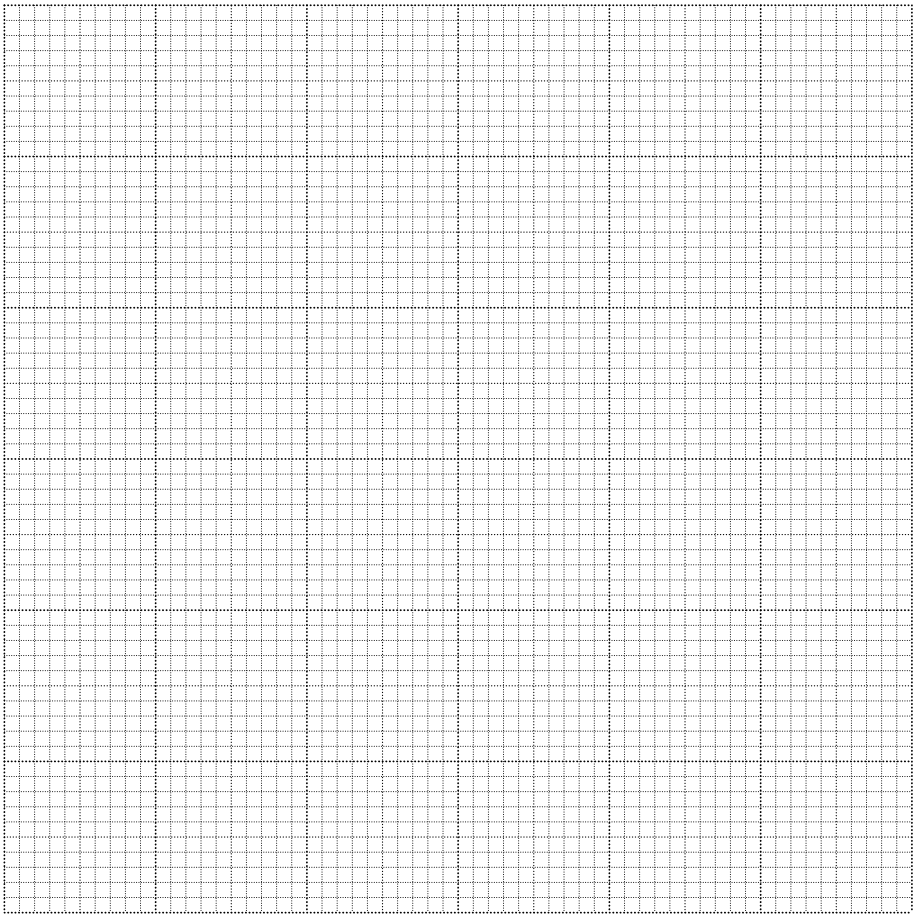
[1]

(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 A student is heating water in a beaker using an electrical heater.

(a) He measures the potential difference V across the heater and the current I in the heater.

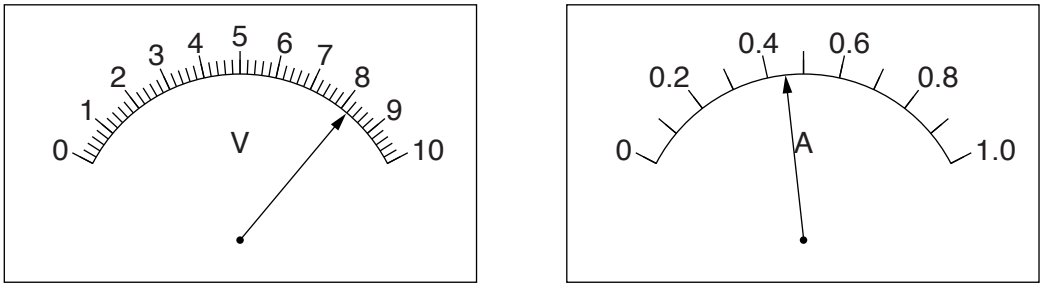


Fig. 2.1

Write down the readings shown on the meters in Fig. 2.1.

V = ...

I = ...
[3]

(b) He measures the temperature of the water before heating.

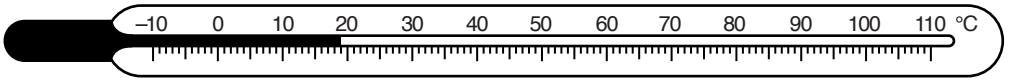
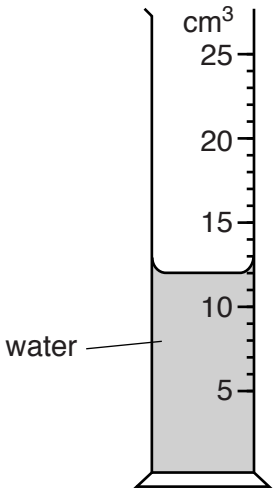


Fig. 2.2

Write down the temperature reading θ shown in Fig. 2.2.

θ = ... [1]

(c) On Fig. 2.3, draw a line and an eye to show clearly the line of sight required to read the volume of water in the measuring cylinder.



[1]

Fig. 2.3

[Total: 5]

2 The class is carrying out an experiment to determine the density of glass.

Each student has a test-tube, as shown in Fig. 2.1.

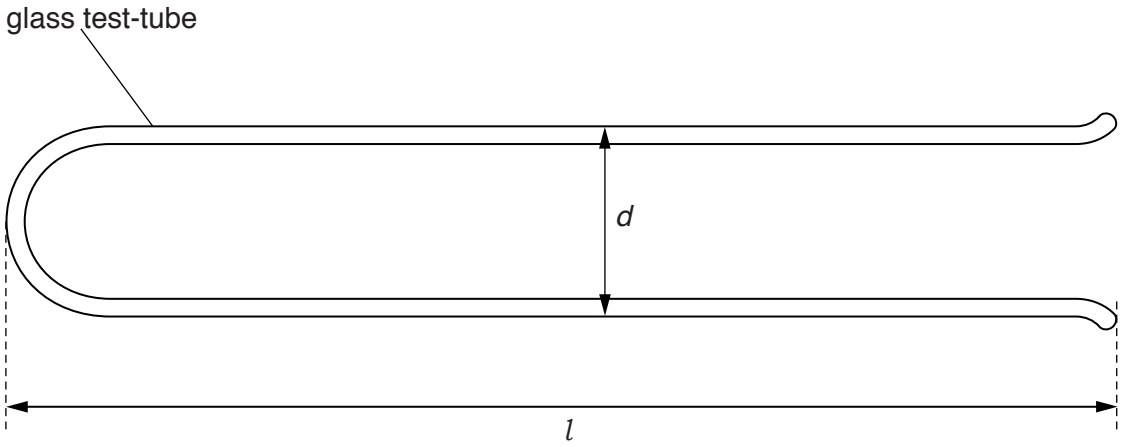


Fig. 2.1

(a) (i) • Measure the length l of the test-tube shown in Fig. 2.1.

l = ... cm

• Measure the external diameter d of the test-tube.

d = ... cm
[1]

(ii) A student uses two wooden blocks to help him to measure the diameter d of the test-tube.

Describe his method. You may draw a diagram. Include one precaution which could be taken to ensure that the value of d is as reliable as possible.

.....

.....

.....[2]

iii) Assuming that the test-tube is an approximate cylinder, calculate a value for its external volume V_1 using the equation $V_1 = \frac{\pi d^2 l}{4}$.

V_1 = ... cm^3 [1]

(b) The test-tube is completely filled with water and then the water from the test-tube is poured into a measuring cylinder.

(i) Read and record the volume V_2 of the water as shown in Fig. 2.2.

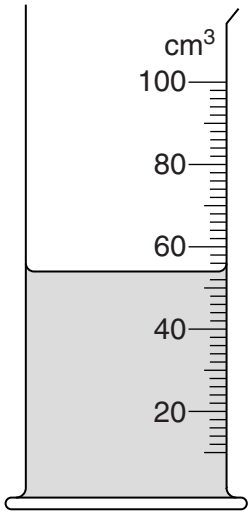


Fig. 2.2

V_2 = ... cm^3 [1]

(ii) Describe briefly how you would read the measuring cylinder to obtain a reliable value for the volume of water. You may add to Fig. 2.2 to illustrate your explanation.

.....

.....

.....[1]

(iii) Calculate the volume V_3 of the glass, using the equation $V_3 = V_1 - V_2$.

V_3 = ... cm^3 [1]

(c) One student uses a balance to measure the mass m of the test-tube, as shown in Fig. 2.3.

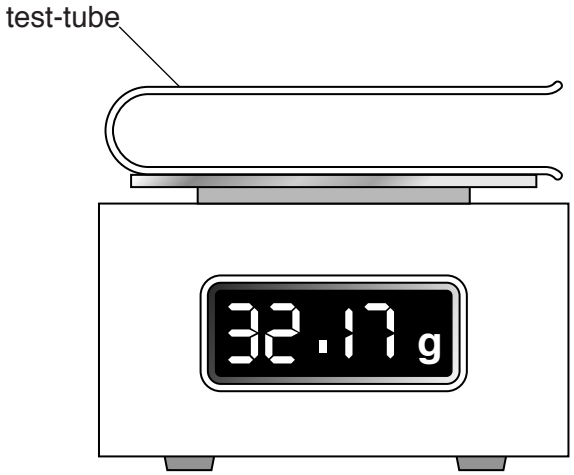


Fig. 2.3

(i) Calculate the density ρ of the glass, using the equation $\rho = \frac{m}{V_3}$.

ρ = ... [2]

(ii) Other students are using a balance which only measures to the nearest gram.

Record the mass m of the test-tube to the nearest gram.

m = ... g [1]

(d) The precision of the balance does not affect the accuracy of this experiment.

State one possible source of inaccuracy in the experiment. Explain what effect this inaccuracy would have on the value obtained for ρ.

.....

.....

.....

.....

.....[2]

[Total: 12]

Question	Answer	Mark
1 (a)	l_0 = 55 (mm) c.a.o.	1
1 (b) (i)	4, 9, 14, 19, 23 ecf (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)	Graph: • 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) ecf (a)	1
1 (d) (ii)	method clearly shown on graph W value 3.5–3.75 Unit N needed No ecf from (i)	1 1
		Total: 10
2 (a)	8.2 0.44–0.45 Units V and A	1 1 1
2 (b)	19(°C)	1
2 (c)	perpendicular to scale and at bottom of meniscus	1
		Total: 5

Question	Answer	Mark
2 (a) (i)	*l = 14.7 AND d = 2.5*	1
2 (a) (ii)	boiling tube between blocks and ruler spanning gap suitable precaution e.g. measure in (at least) 2 places and take average, avoid lip, ensure blocks smooth, no dirt between tube and block	1 1
2 (a) (iii)	$V_1 = 72$	1
2 (b) (i)	$V_2 = 54$	1
2 (b) (ii)	line of sight perpendicular to reading/read from bottom of meniscus	1
2 (b) (iii)	V_3 correctly calculated	1
2 (c) (i)	ρ = 1.7 to 1.8 unit g / cm^3	1 1
2 (c) (ii)	m = 32 (g)	1
2 (d)	suitable source of inaccuracy, e.g. • any reference to why tube is not a cylinder, • tube may contain some water when mass taken, • difficult to fill to brim and then pour out appropriate effect on value of ρ <u>explained</u>	1 1
		Total: 12

Notes about the mark scheme are available separately.