

3.6.3 Physics Paper 3 (232/3)

Question one

You are provided with the following:

- a micrometer screw gauge (to be shared)
- a vernier calliper (to be shared)
- glass tube
- a wire labelled **M**
- some sellotape
- one 50 g mass
- some masses (totalling 40 g)
- a meter rule
- 100 ml beaker
- a stand boss and clamp
- a stop watch
- a source of light
- a screen
- some water
- a measuring cylinder

PART A

Proceed as follows:

- (a) Using a micrometer screw gauge, measure and record the diameter of the wire labelled **M**. (1 mark)

$d = \dots\dots\dots$ mm

$d = \dots\dots\dots$ m.

- (b) Using wire **M**, make a spring as follows:

- (i) Use some sellotape to fix one end of the wire **M** (about 2.5 cm) along the glass tube;
- (ii) Hold firmly the part of the wire under the tape with one hand. Use the other hand to wind 30 turns as closely and tightly as possible. (see *figure 1*)

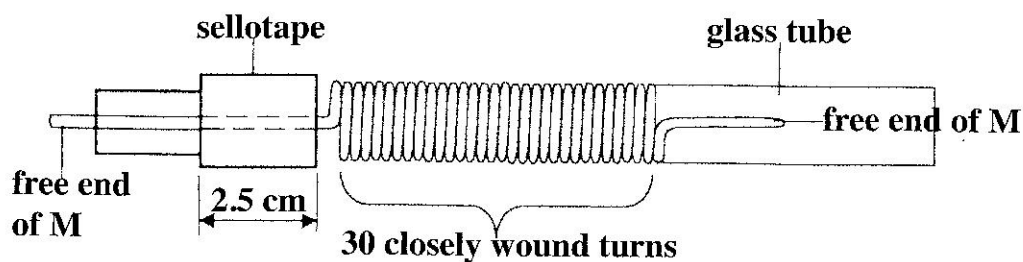


Figure 1

- (c) Remove the sellotape and release the spring from the tube.
(The spring will slightly unwind and some turns will disappear)
 Bend the free ends as shown in **figure 2**.

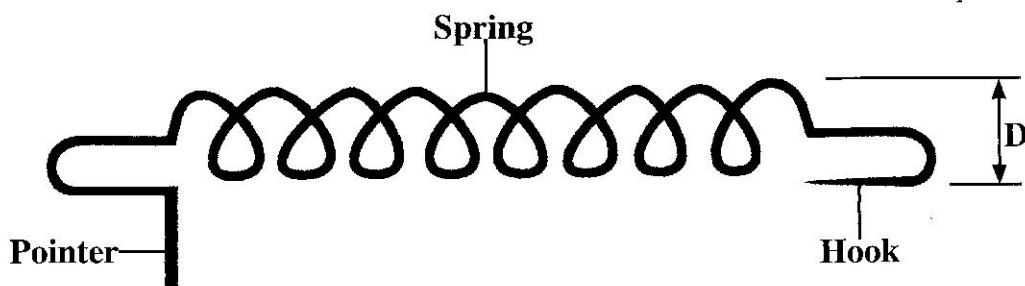


Figure 2

- (d) Using a vernier callipers, measure and record the external diameter **D** of the spring.

(1 mark)

D = cm

D = m.

- (e) Suspend the spring and a 50 g mass from a retort stand as shown in **figure 3**.

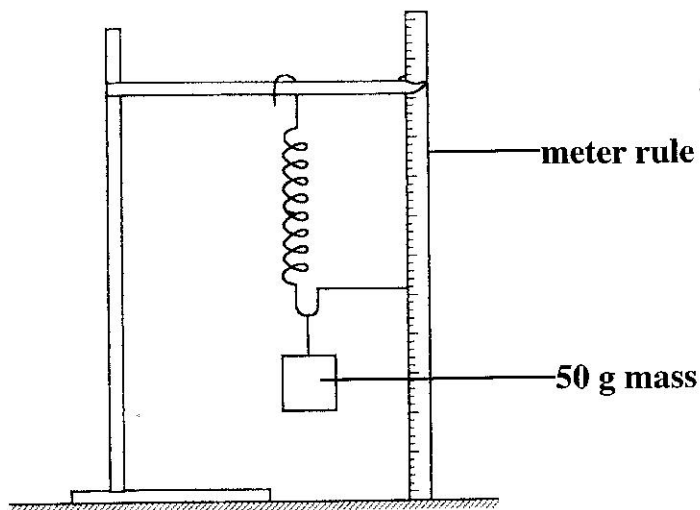


Figure 3

Count and record the number of turns **N** of the suspended spring.

(1 mark)

N =

- (f) Add 40 g to the 50 g mass and record the extension **X** of the spring due to the 40 g.

(1 mark)

X = cm

X = m

- (g) Determine c given that (1 mark)

$$c = \frac{0.4}{X}$$

- (h) Determine n given that (2 marks)

$$c = \frac{nd^4}{8ND^3}$$

- (i) With the spring still loaded with the 90 g, pull the lower mass slightly downwards and let go so that the mass oscillates vertically. Record the time t for 20 oscillations. Hence determine the period T .

$t = \dots\dots\dots$ (s) (1 mark)

$T = \dots\dots\dots$ (s) (1 mark)

- (j) Determine Z given that

$$T = 2\pi\sqrt{\frac{m}{Z}}$$

where m is the mass in kg on the spring. (2 marks)

PART B

Proceed as follows:

- (k) Place the 100 ml beaker on a meter rule and pour 80 cm³ of water into it. Arrange a lamp (source of light) and a screen on either side of the beaker. (see figure 4)

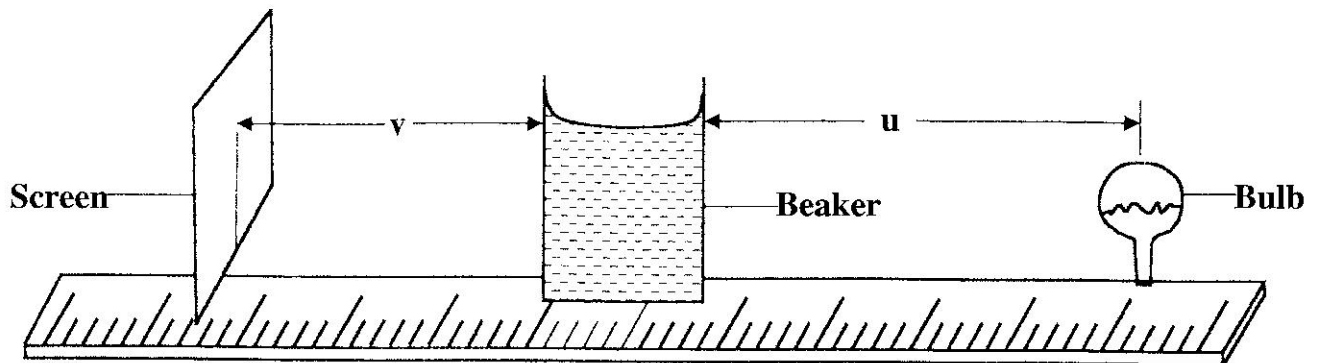


Figure 4

- (l) Adjust the position of the lamp on the metre rule so that its centre is a distance $u = 12$ cm from the beaker. Switch on the light. Adjust the position of the screen until a well focused vertical line (*the image of filament*) is formed on the screen. Measure and record in **table 1** the image distance V between the screen and the beaker.

- (m) Repeat part (l) for other values of **u** shown in **table 1** and complete the table.

Table 1

Distance u (cm)	12	16	20
Distance V (cm)			
$y = \frac{uv}{u+v}$			

(4 marks)

- (o) (i) With the meter rule outside the beaker, measure the height **h** of the water meniscus above the bench. (1 mark)

h = cm

- (ii) Determine the value of **P** given that (1 mark)

$$P = \frac{5}{\sqrt{h}}$$

- (iii) Hence determine the value of **f** given that $f = \frac{P}{2m} + 1$ to one decimal place. (2 marks)

Question two

You are provided with the following:

- an ammeter
- a voltmeter
- two cells (size D)
- a cell holder
- a switch
- a wire labelled **L** mounted on a millimetre scale
- a micrometer screw gauge (to be shared)
- six connecting wires at least four with crocodile clips

Proceed as follows:

- (a) Using a micrometer screw gauge, measure and record the diameter **d** of the wire **L**. (1 mark)

d = mm

d = m.

- (b) Place the two cells **in series** in the cell holder and use the voltmeter to measure the total electromotive force (emf) E_0 of the battery. (1 mark)

$E_0 = \dots\dots\dots$ V.

- c) Starting with the switch open, connect the circuit as shown in **figure 5**. **P** and **Q** are points on the wire **L** such that **PQ** is 60 cm. (*PQ should remain 60 cm throughout the experiment*) **N** is a point on the wire such that **PN** is 10 cm (0.1 m).

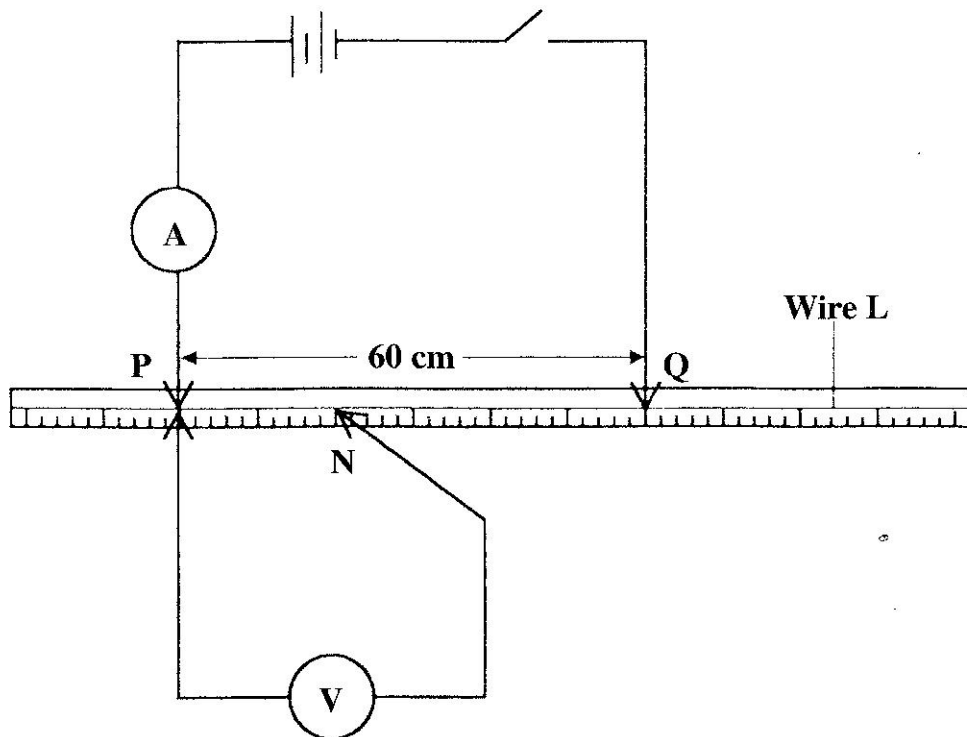


Figure 5

- (d) (i) Close the switch and record the current **I**. (1 mark)

$I = \dots\dots\dots$ A.

- (ii) Measure and record in **table 2** the potential difference across **PN**.
- (iii) Measure and record the potential difference across **PN** for the other values of **PN** shown in **table 2** and complete the table. (*The current is expected to remain constant*) Hint: *The switch should be closed only when reading the voltmeter.*

Table 2

Length PN (m)	0.1	0.2	0.3	0.4	0.5	0.6
p.d (V)						
Resistance $\left(\frac{V}{I}\right) \Omega$						

(6 marks)

(e) On the grid provided, plot a graph of resistance (y-axis) against length. (3 marks)

(f) From the graph, determine:

(i) the slope **S** and its units. (3 marks)

(ii) the constant **k** and its units given that

$$S = \frac{4k}{\pi d^2} \quad (3 \text{ marks})$$

(g) Determine constant **t** given that

$$t = \frac{E_0 - V_n}{I}$$

where V_n is the p.d at PN = 0.6 m. (2 marks)