

- 1 A student investigates the period of a pendulum.

Fig. 1.1 shows the set-up.

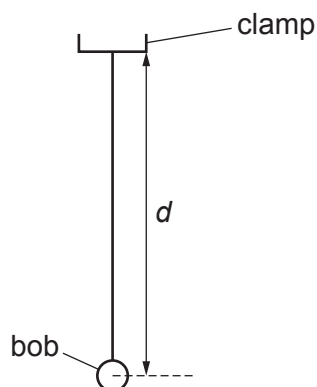


Fig. 1.1

- (a) The distance d is measured from the bottom of the clamp to the centre of the bob.

The student adjusts the length of the pendulum until $d = 50.0$ cm.

He displaces the bob slightly and releases it so that it swings.

He uses a stop-watch to measure the time t for 10 complete oscillations.



Fig. 1.2

- (i) Fig. 1.2 shows the reading on the stop-watch.

Record, in Table 1.1, the time t for 10 complete oscillations. [1]

- (ii) Calculate and record in Table 1.1, the period T of the pendulum. The period is the time for one complete oscillation. [1]

- (iii) Calculate T^2 and record your value in Table 1.1. [1]

- (iv) Write the units in the column headings. [2]

Table 1.1

$d/$	$t/$	$T/$	$T^2/$
50.0			
100.0	20.20	2.02	4.08

- (b) The student repeats the procedure in (a) using $d = 100.0$ cm. The readings and results are shown in Table 1.1.

Another student suggests that T^2 is directly proportional to d .

Explain briefly how to test the suggestion using the results in Table 1.1.

.....

 [2]

- (c) The procedure can be repeated to plot a graph.

Suggest additional values of d that are suitable for the experiment.

.....
 [1]

- (d) Explain how you would measure the distance d as accurately as possible. Draw a diagram to help your explanation.

.....
 [2]

- (e) Explain why timing 10 oscillations gives a more accurate result for the period T than timing one oscillation.

.....
 [1]

[Total: 11]

- 2 A student investigates the resistance of a wire.

Fig. 2.1 shows the circuit used.

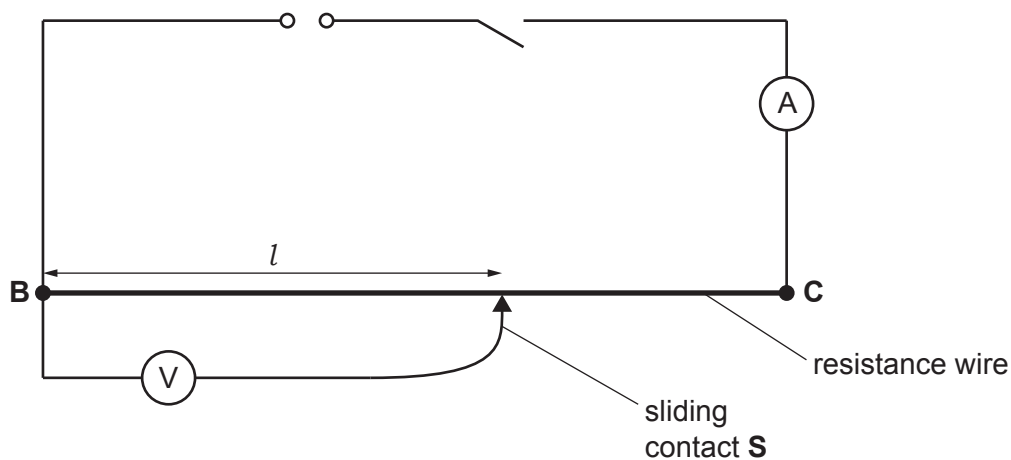


Fig. 2.1

- (a) The student places a sliding contact **S** at a distance $l = 40.0$ cm from **B**.

She measures the potential difference (p.d.) V across the length l of the resistance wire.

She measures the current I in the circuit.

The meters are shown in Fig. 2.2 and Fig. 2.3.

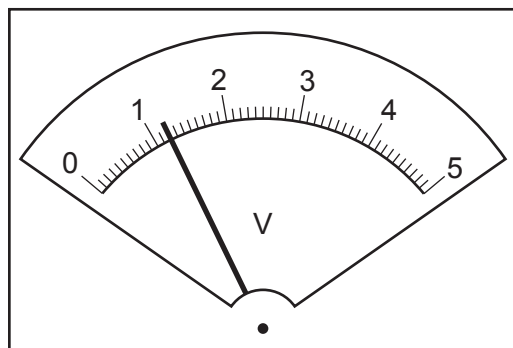


Fig. 2.2

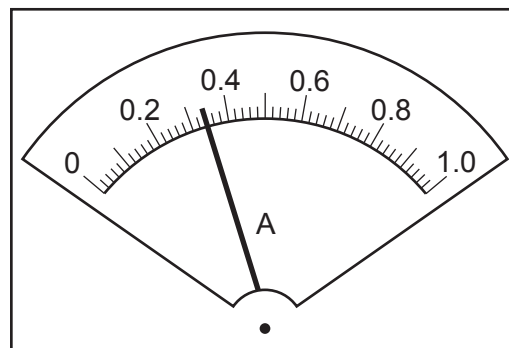


Fig. 2.3

- (i) Write down the current I .

$I = \dots\dots\dots$ [1]

- (ii) Record the potential difference V reading in the first row of Table 2.1. [1]

- (b) The student repeats the procedure in (a) using $l = 50.0$ cm, 60.0 cm, 70.0 cm and 80.0 cm.

The readings are shown in Table 2.1.

- (i) Calculate, and record in Table 2.1, the values of resistance R using the equation

$$R = \frac{V}{I}.$$

[2]

(ii) Complete the column headings in Table 2.1.

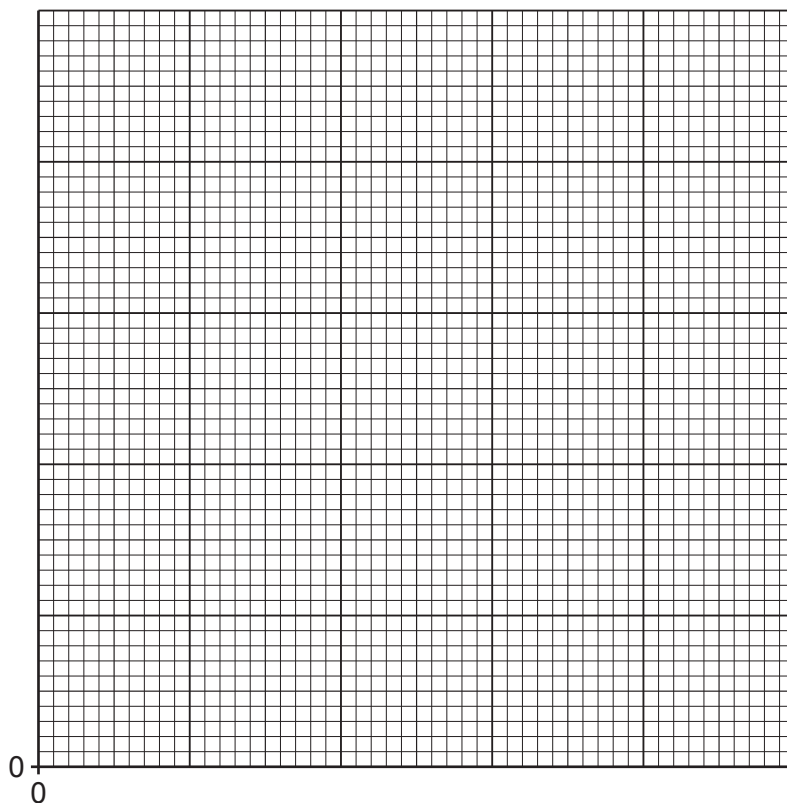
[1]

Table 2.1

$l/$	$V/$	$R/$
40.0		
50.0	1.5	
60.0	1.8	
70.0	2.1	
80.0	2.4	

(c) Plot a graph of R (y -axis) against V (x -axis). Start both axes at the origin (0,0).

Draw the best-fit line.



[4]

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

$G = \dots\dots\dots$ [2]

[Total: 11]

3 A student investigates the cooling of water under different conditions.

Fig. 3.1 shows the set-up.

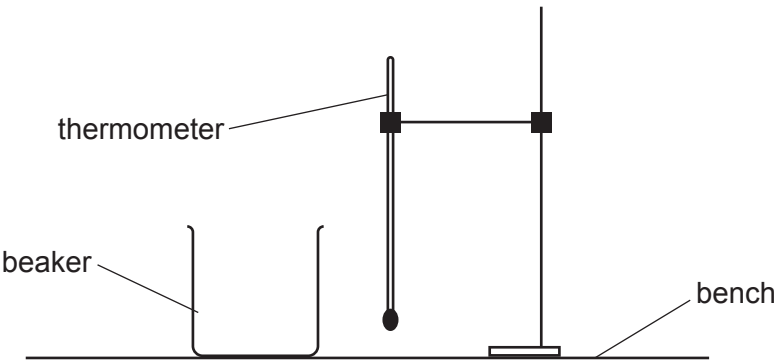


Fig. 3.1

(a) The thermometer in Fig. 3.2 shows the room temperature θ_R at the beginning of the experiment. Record θ_R .

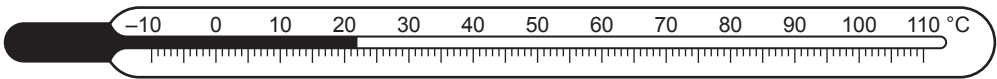


Fig. 3.2

$\theta_R = \dots\dots\dots$ [1]

(b) The student pours 200 cm³ of hot water into the beaker. He places the thermometer in the water.

He records the temperature θ of the hot water at time $t = 0$. He immediately starts a stop-watch.

He records the temperature at 30 s intervals. The temperature readings are shown in Table 3.1.

(i) Write the times in the first column of Table 3.1. [1]

(ii) Complete the column headings in Table 3.1.

Table 3.1

$t/$	$\theta/$
	95
	86
	78
	72
	68
	66
	65

[1]

- (c) (i) Calculate the decrease in temperature $\Delta\theta_1$ between time $t = 0$ and time $t = 90$ s.

$$\Delta\theta_1 = \dots\dots\dots [1]$$

- (ii) Calculate the difference in temperature $\Delta\theta_S$ between the temperature at time $t = 0$ and room temperature θ_R .

$$\Delta\theta_S = \dots\dots\dots [1]$$

- (iii) Calculate the decrease in temperature $\Delta\theta_2$ between time $t = 90$ s and time $t = 180$ s.

$$\Delta\theta_2 = \dots\dots\dots$$

Calculate the difference in temperature $\Delta\theta_T$ between the temperature at time $t = 90$ s and room temperature θ_R .

$$\Delta\theta_T = \dots\dots\dots [1]$$

- (d) A student suggests that the decrease in temperature of the water in 90 s should be greater when the starting temperature is greater.

- (i) State whether the results agree with this suggestion. Justify your statement by reference to the results.

statement

justification

.....

.....

[2]

- (ii) Suggest how you would continue the experiment, using the same apparatus and method, to investigate the suggestion.

.....

.....

.....

..... [2]

- (e) Refer to Table 3.1. Estimate the temperature of the water in the beaker after cooling for a further 90 s.

..... [1]

[Total: 11]

- 4 A student investigates the effect of changing the colour of light on the focal length of a lens.

The focal length f of a lens is given by the equation $f = \frac{uv}{(u + v)}$.

The distance u is the distance between an object and the lens. The distance v is the distance between the lens and the image that is formed on a screen.

Plan an experiment to investigate the effect of changing the colour of light on the focal length of a lens.

The following apparatus is available to the student:

- illuminated object
- a selection of coloured filters to change the colour of the light
- converging lens
- screen
- metre ruler.

Other apparatus normally available in a school laboratory can also be used.

In your plan, you should:

- draw a labelled diagram to show the arrangement of the apparatus
- explain briefly how you would do the investigation, including the measurements you would take
- draw a suitable table, with column headings, to show how you would display your readings (you are **not** required to enter any readings in the table)
- state how you would use your results to reach a conclusion.