Practice exam-style paper

Paper 6 Alternative to Practical

[1 hour]

Write your answers on the question paper.

The number of marks is given in brackets [ ] at the end of each question or part question.

1 A student is measuring the volume of a cylindrical piece of wood by immersing it in water. The wood is less dense than water so that it floats.

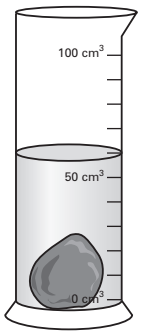


Fig. 1.1

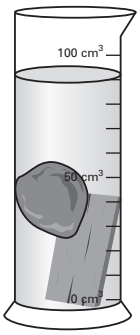


Fig. 1.2

a In Fig. 1.1, a small stone has been submerged in water in a measuring cylinder.

i Record the volume of the water + stone V_1 as shown by the measuring cylinder.

V_1 = ...

ii On Fig. 1.1, show how you would position your eye to obtain an accurate reading from the scale of the measuring cylinder. **[2]**

b In Fig. 1.2, the wood is immersed in the water and is held in position by the stone.

i Record the new level of the water, V_2.

V_2 = ...

ii Calculate the volume of the wood V_W using the equation $V_W = V_2 - V_1$

V_W = ...

iii Assuming that the experiment has been carried out correctly and carefully, suggest two reasons why the value V_W may be inaccurate.

Reason 1 .....

.....

Reason 2 .....

..... [2]

c Fig. 1.3 shows the second method used by the student. The piece of wood is attached to the stone using a length of string. The wood floats upwards but remains submerged.

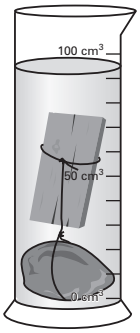


Fig. 1.3

i Record the new level of the water, V_3.

V_3 = ...

V_3 is greater than V_2 because the string also displaces water. Estimate the volume of the string.

Volume of string = ...

ii Suggest how this could be taken account of when determining the volume of the wood by this method.

.....

..... [2]

[Total: 6]

2 A student is trying to find the length of a pendulum which will have a period of exactly 1.00 s. Fig. 2.1 shows the apparatus used for this.

The pendulum consists of a string, tightly clamped at the top, and with a heavy spherical weight at the other end. The weight is called the pendulum bob.

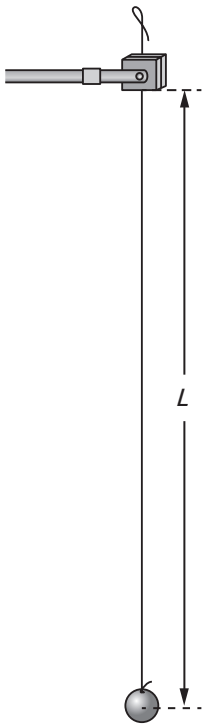


Fig. 2.1

a The length of the pendulum L is the distance from the top of the string to the centre of gravity of the bob.

Use a ruler to measure the length of the pendulum shown in Fig. 2.1.

length of pendulum = ...

i Fig. 2.1 is drawn one fifth actual size. Calculate the true length L of the pendulum.

L = ...

ii Suggest one way in which measuring the length of a pendulum can be difficult.

.....

..... [3]

b The student times 20 complete oscillations of the pendulum. Fig. 2.2 shows the reading on the student's digital stopwatch.

Fig. 2.2

i Calculate the time T for a single oscillation.

T = ...

ii The student timed 20 oscillations rather than a single oscillation. Give two reasons why it is difficult to time a single oscillation with precision.

Reason 1 .....

.....

Reason 2 .....

..... [3]

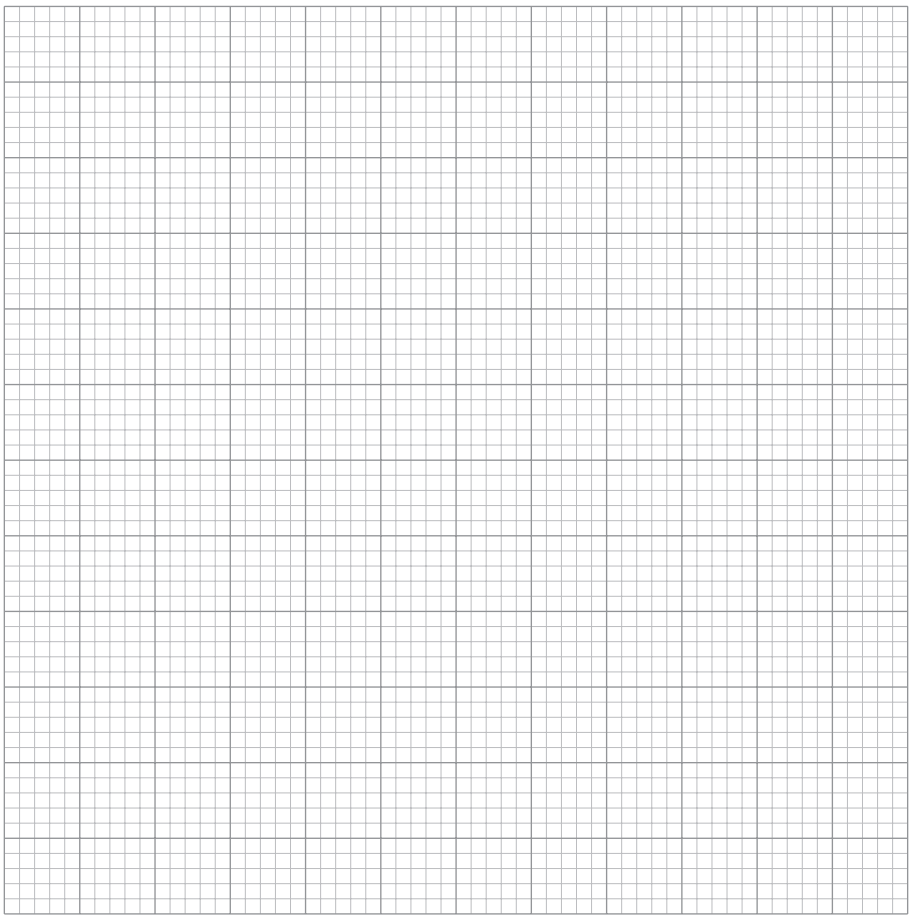
c Suggest one way in which the voltage across the resistor could be varied.

d The student makes several measurements of L and T. The results are shown in the table.

L /	*T* /
14.6	0.80
18.0	0.86
22.0	0.94
35.7	1.25
44.8	1.35

Complete the headings in the table.

On the grid below, draw a graph of T (on the y-axis) against L. You do not need to include the origin (0,0) on your graph.



Draw a smooth curve through the points.

From your graph, deduce a value for the length of the pendulum which will have a period T of 1.00 s.

length of 'one-second pendulum' = ...

On the graph, mark a section where it would have been useful to have another data point in order to make your answer more reliable. [4]

[Total: 10]

3 A student is investigating the resistance of a light bulb.

The student uses the circuit shown in Fig. 3.1 to measure the resistance of a single bulb. A resistor R is included in the circuit to limit the current in the bulb so that it does not burn out.

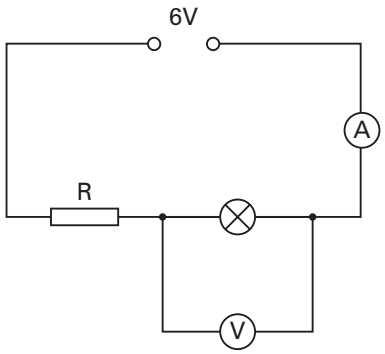


Fig. 3.1

a The ammeter shows that the current in the circuit is 0.25 A. The voltmeter shows that the p.d. across the bulb is 4.8 V.

Calculate the resistance of the bulb. Give your answer to 2 significant figures.

resistance = ... [2]

b The student now connects two identical bulbs in series with each other. In the space below, draw the circuit you would use to make measurements which would allow you to determine the combined resistance of the two bulbs.

The student predicts that the combined resistance of the two bulbs in series will be twice the resistance of a single bulb. Calculate their combined resistance.

combined resistance = ... [3]

c The student now investigates the resistance of the resistor on its own. To do this, the voltage across the resistor must be varied.

Suggest one way in which the voltage across the resistor could be varied.

.....

..... [1]

d The graph (Fig. 3.2) shows the student's results.

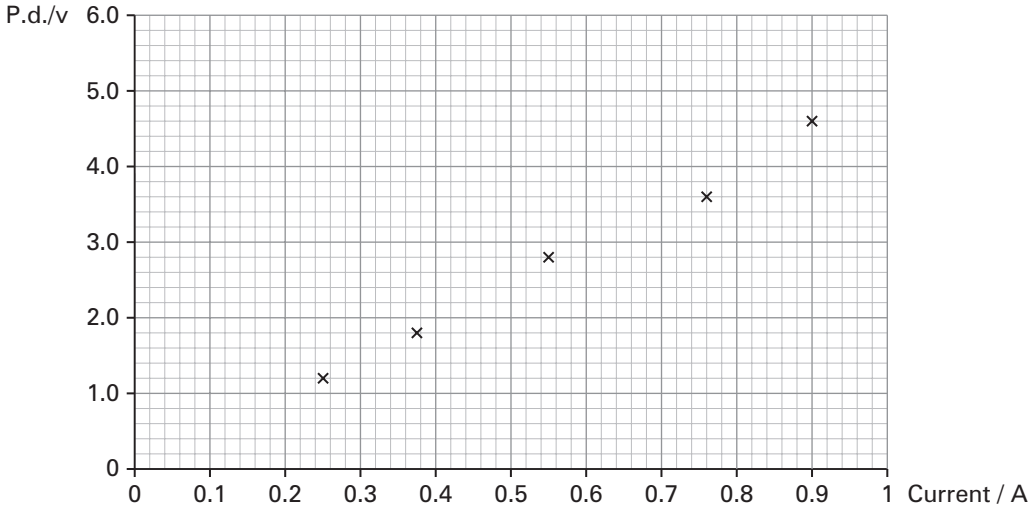


Fig. 3.2

Determine the gradient *G* of the graph. This is equal to the resistance of the resistor. Show clearly on the graph how you obtained the necessary information.

G = ... [3]

[Total: 9]

4 A student is investigating the cooling of a beaker of warm water when a lump of ice is added to it. The apparatus is shown in Fig. 4.1.

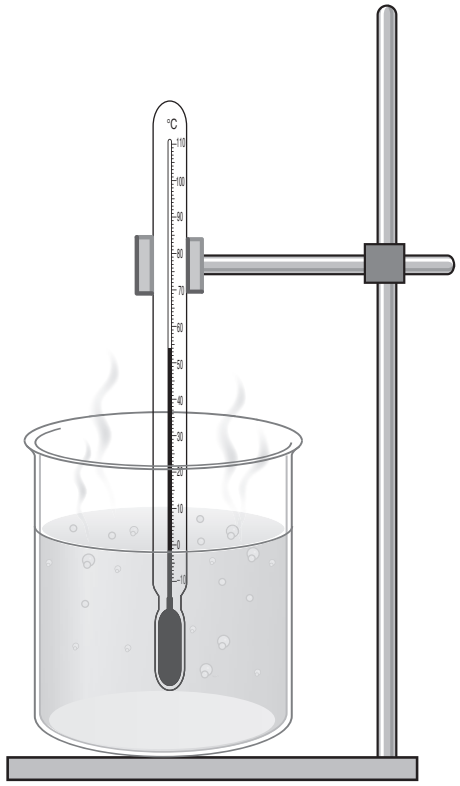


Fig. 4.1

a Fig. 4.1 shows the water before the ice has been added to it. Determine the temperature of the water.

temperature = ... °C [1]

b The student drops the ice in the water and records the temperature of the water at intervals of 5 minutes. The readings are 40 °C, 33 °C, 30 °C and 30 °C.

Record these results in the table.

time / minutes	temperature / °C
0	
5	
10	
15	
20	

At the end of the experiment, the student noticed that all of the ice had melted. From the results in the table, estimate the time at which the last of the ice melted.

time = ...

Explain how you deduced this answer from the data in the table.

.....

..... [4]

c Suggest one precaution the student should have taken in this experiment to ensure that the water was at a uniform temperature when each thermometer reading was taken.

.....

.....

The water in the beaker became colder because the ice melted. The student thinks that the water might also have been cooling because of convection. Suggest how the experiment could have been altered to prevent this.

.....

..... [3]

[Total: 8]

5 A student is determining the mass of a load **L** using a balancing method. Fig. 5.1 shows the apparatus.

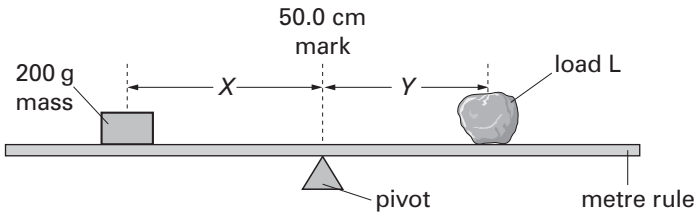


Fig. 5.1

The student places the load **L** at a distance from the pivot and then moves the 200 g mass until the rule is balanced. For each position of the load, the distances *X* and *Y* are measured.

The readings are shown in the table.

X / cm	*Y* / cm
42.0	23.3
36.0	19.8
24.6	13.6
18.2	9.5

a From the diagram, deduce whether the mass of **L** is greater than 200 g or less than 200 g. Tick the box.

greater than 200 g ☐

less than 200 g ☐

State one difficulty in measuring the distances *X* and *Y* and suggest how this might be overcome.

Difficulty .....

.....

How to overcome it .....

..... [3]

b The student plotted a graph of *X* against *Y*. A sketch of the graph is shown in Fig. 5.2.

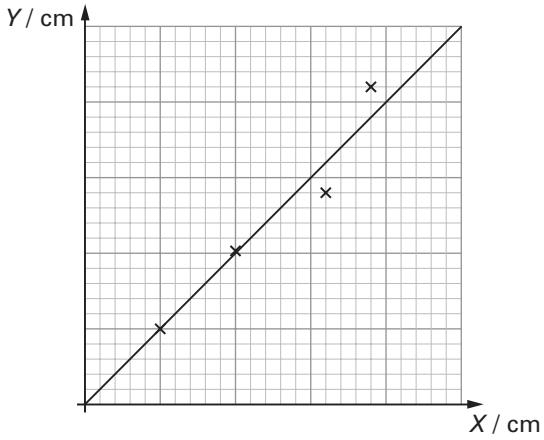


Fig. 5.2

Explain how the graph shows that *X* is proportional to *Y*.

.....

.....

The Principle of Moments suggests that the mass of **L** is given by:

$$\text{mass of } \mathbf{L} = \frac{X}{Y} \times 200 \text{ g}$$

Select the largest pair of values of *X* and *Y* from the table and use them to calculate a value for the mass of **L**.

mass of **L** = ... g

Suggest a method the student could have used to get a more reliable result for the mass of **L** using all of the values of *X* and *Y* obtained, rather than just one pair of values.

.....

..... [3]

[**Total: 6**]