IGCSE Cambridge Topical Past Papers

PHYSICS 9-1

0972 Paper 6

2020 — 2025

1 - (0972/61_Summer_2020_Q1)

A student investigates the balancing of a metre rule.

Fig. 1.1 shows the arrangement.

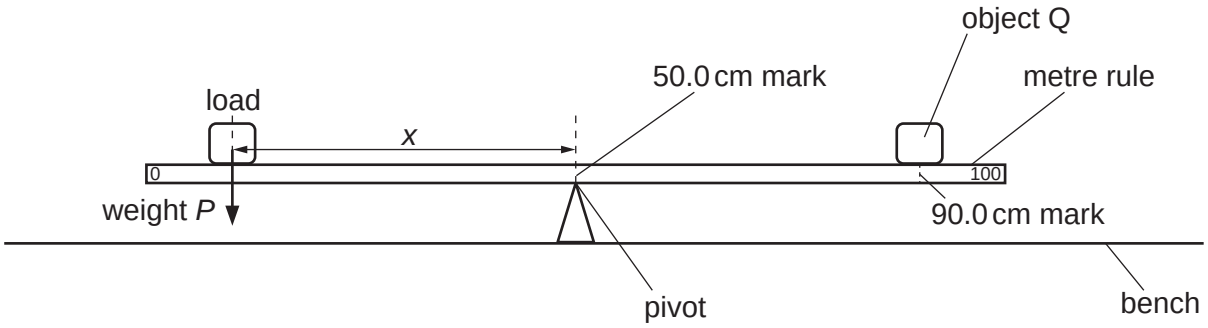


Fig. 1.1

(a) The student places the metre rule on the pivot at the 50.0 cm mark. He places an object Q on the metre rule with its centre at the 90.0 cm mark. He places a load of weight P = 2.0 N on the metre rule and adjusts the position of the load so that the metre rule is as near as possible to being balanced.

He measures the distance x from the centre of the load to the pivot.

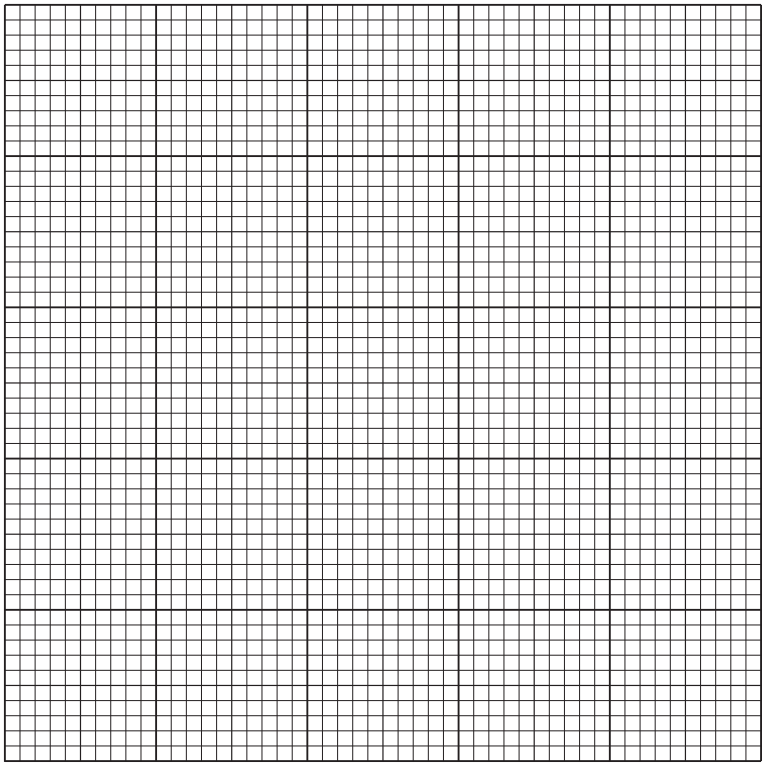
He repeats the procedure using loads of weight P = 3.0 N, 4.0 N, 5.0 N and 6.0 N. All the values of P and x are recorded in Table 1.1.

Table 1.1

P / N	x / cm	$\frac{1}{x} \Big/ \frac{1}{\text{cm}}$
2.0	40.0	
3.0	27.0	
4.0	20.0	
5.0	15.9	
6.0	13.3	

Calculate, and record in Table 1.1, the values of $\frac{1}{x}$. [2]

(b) Plot a graph of P/N (y-axis) against $\frac{1}{x} \Big/ \frac{1}{\text{cm}}$ (x-axis). Start both axes at the origin (0,0).



[4]

(c) In this experiment, x_{max}, the maximum possible value for x is 50.0 cm. Calculate $\frac{1}{x_{max}}$.

$\frac{1}{x_{max}}$ = ... $\frac{1}{\text{cm}}$

Use the graph to determine the minimum value of P required to balance the metre rule in this experiment. Show clearly on the graph how you determined this value.

minimum value of P = ... [2]

(d) In this experiment, the width of object Q is slightly greater than the width of the metre rule. Explain briefly how you would place the object Q as accurately as possible on the 90.0 cm mark of the metre rule. You may draw a diagram.

.....

.....

.....

..... [1]

(e) In this experiment, it is difficult to determine the exact position of the load that will make the metre rule balance.

(i) Explain briefly why this is difficult.

.....

.....

..... [1]

(ii) Explain briefly how you would find the best position of the load that will make the metre rule balance.

.....

.....

..... [1]

[Total: 11]

2 - (0972/62_Summer_2020_Q1)

A student investigates the period of a pendulum. Fig. 1.1 and Fig. 1.2 show the apparatus she uses.

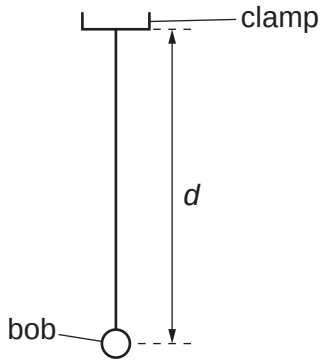


Fig. 1.1

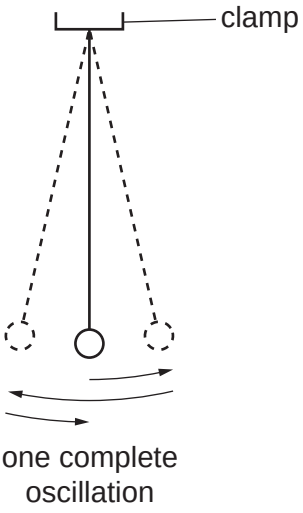


Fig. 1.2

(a) Explain briefly, with the help of a diagram, how you would use a metre rule and set square to measure the length *d* of a pendulum as accurately as possible.

Diagram:

.....

.....

..... [3]

(b) The student adjusts the pendulum so that *d* = 50.0 cm. She displays the bob slightly and releases it so that it swings. Fig. 1.2 shows one complete oscillation of the pendulum.
She measures the time t_1 for 20 complete oscillations.

(i) Record the time t_1 shown in Fig. 1.3.

Fig. 1.3

t = ... [1]

(ii) Calculate the period T_1 of the pendulum. The period is the time for one complete oscillation.

T_1 = ... [1]

(c) The student adjusts the pendulum until the distance d is 100.0 cm.

She repeats the procedure and records the time t_2 for 20 oscillations and the period T_2.

t_2 = 39.80 s

T_2 = 1.99 s

She measures the mass m_A of the pendulum bob. The reading on the balance is shown in Fig. 1.4.

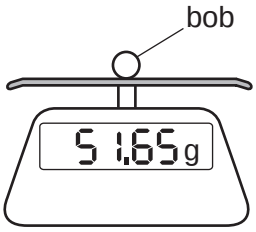


Fig. 1.4

Record mass m_A of the pendulum bob to the nearest gram.

m_A = ... g [1]

The student repeats the procedure using a pendulum bob of mass m_B.

m_B = 109 g

She obtains these results:

d = 50.0 cm

T_3 = 1.39 s

d = 100.0 cm

T_4 = 2.02 s

(d) **(i)** Using the results T_1, T_2, T_3 and T_4, for the period of each of the pendulums, tick (✓) the response that matches your results within the limits of experimental accuracy.

☐ the period T is affected by d only

☐ the period T is affected by both d and m

☐ the period T is affected by m only

☐ the period T is not affected by d or m

[1]

(ii) Justify your answer to **(d)(i)** by reference to the results.

.....

..... [1]

(e) The student now investigates the effect of the size of the oscillations on the period of the pendulum.

(i) Suggest briefly how you would measure the size of an oscillation. You may draw a diagram.

.....

..... [2]

(ii) State **one** variable that you would keep constant during this part of the investigation.

..... [1]

[Total: 11]

3 - (0972/62_Summer_2020_Q3

A student investigates some thermal properties of sand and water.

Fig. 3.1 shows the apparatus.

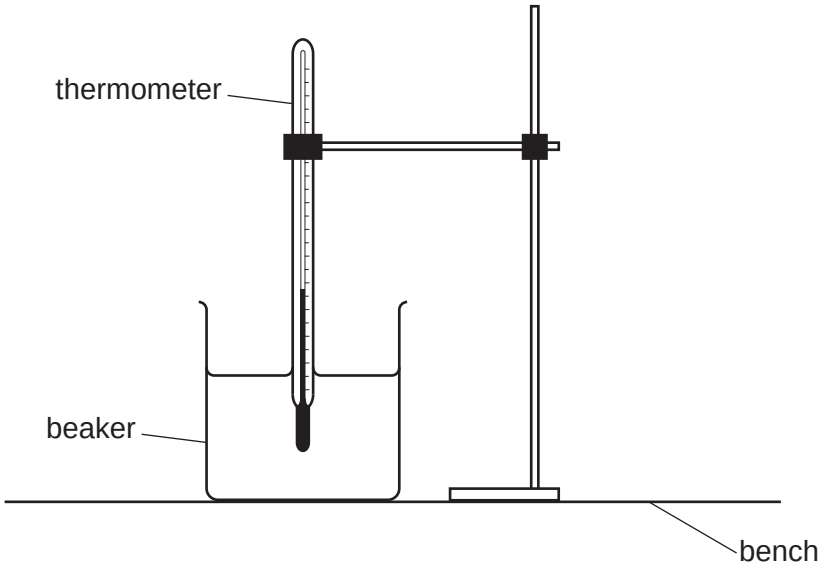


Fig. 3.1

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

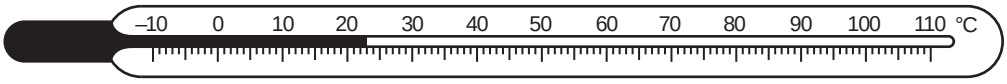


Fig. 3.2

θ_S = ... °C [1]

(b) The student is supplied with hot water at a temperature θ_H. She records the temperature of the hot water.

θ_H = ... 84 °C .....

She pours 100 cm^3 of hot water into a beaker that contains sand. Initially, the sand is at room temperature.

She measures the highest temperature θ_M of the mixture.

θ_M = ... 70 °C .....

(i) Calculate the rise in temperature θ_R of the sand using the equation $\theta_R = (\theta_M - \theta_S)$.

θ_R = ... °C [1]

(ii) Explain briefly what the student does after pouring the hot water into the sand and before taking the temperature, in order to obtain a reliable value for θ_M.

..... [1]

(iii) Calculate the fall in temperature θ_F of the hot water using the equation $\theta_F = (\theta_H - \theta_M)$.

θ_F = ... °C

Calculate the ratio S using the equation $S = \frac{\theta_R}{\theta_F}$. Give your answer to a suitable number of significant figures for this experiment.

S = ... [1]

(c) The student pours 100 cm^3 of the hot water into a clean beaker that contains 100 cm^3 of water at room temperature. She records the highest temperature θ_M of the mixture.

θ_M = 49° C

Calculate the rise in temperature θ_R of the cold water using the equation $\theta_R = (\theta_M - \theta_S)$. Use the value of room temperature θ_S recorded in **(a)**.

θ_R = ...

Calculate the fall in temperature θ_F of the hot water using the equation $\theta_F = (\theta_H - \theta_M)$.

θ_F = ...

Calculate the ratio W using the equation $W = \frac{\theta_R}{\theta_F}$.

W = ... [2]

(d) The student studies the thermal properties of sand and water. She predicts that S should be equal to 6 × W.

State whether the results support the prediction. Justify your answer by reference to the readings.

statement .....

justification .....

.....

.....

[2]

(e) Suggest **two** temperatures that it would be sensible to keep constant when carrying out the experiments.

1. .....

2. .....

[2]

(f) The student measures the volume of the dry sand using a measuring cylinder before carrying out the experiment. Tick (✓) the boxes that show the precautions that she should take in order to obtain an accurate reading.

☐ Take the reading at the bottom of the meniscus.

☐ Tap the measuring cylinder to make sure the top of the sand is horizontal.

☐ View the scale of the measuring cylinder at right angles.

[1]

[Total: 11]

4 - (0972/62_Summer_2020_Q4)

A student investigates the bending of 1 m length strips of different materials. She compares how far they bend when loaded at one end.

Plan an experiment to investigate how the material from which the strips are made affects the bending of the strips when loaded at one end.

The following apparatus is available to the student:

strips of wood, plastic, steel and aluminium, each of length 1 m
a set of slotted masses
a metre rule
a G-clamp (used to hold the strips to the laboratory bench).

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

In your plan, you should:

- draw a diagram to show the arrangement of the apparatus
- explain briefly how you would carry out the investigation, including the measurements you would take
- state the key variables to be kept constant
- 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)
- explain how you would use the results to reach a conclusion.

..... [7]

[Total: 7]

1 - (0972/61_Summer_2020_Q1)

(a)	0.025, 0.037, 0.050, 0.063, 0.075	**1**
	Consistent significant figures	**1**
(b)	Graph: Axes correctly labelled and right way round	**1**
	Suitable scales	**1**
	All plots correct to $\frac{1}{2}$ small square	**1**
	Good line judgement, thin, continuous line	**1**
(c)	(0.02) Method shown clearly on graph	**1**
	Value correct to $\frac{1}{2}$ small square	**1**
(d)	Clear wording or diagram	**1**
(e)(i)	Difficult to obtain balance point	**1**
(e)(ii)	Idea of obtaining nearest to balance	**1**

2 - (0972/62_Summer_2020_Q1)

(a)	clear diagram showing use of set square and rule with horizontal line of set square across to vertical rule from approximate centre of bob	**1**
	rule positioned to enable measurement of *d* from bottom of clamp	**1**
	wording to include perpendicular viewing of the rule	**1**
(b)(i)	$t_1 = 28.12$ (s)	**1**
(b)(ii)	$T_1 = 1.406$ (s)	**1**
(c)	$m_A = 52$	**1**
(d)(i)	first box only ticked (error carried forward possible)	**1**
(d)(ii)	justified by correct reference to results	**1**
(e)(i)	rule or protractor used	**1**
	method explained / diagram drawn	**1**
(e)(ii)	length	**1**

3 - (0972/62_Summer_2020_Q3

(a)	23	**1**
(b)(i)	47	**1**
(b)(ii)	stir	**1**
(b)(iii)	14 and 3.36 or 3.4	**1**
(c)	26, 35 and 0.74(3)	**1**
	S and *W* with no units	**1**
(d)	statement to match results	**1**
	justification to match statement and including clear reference with appropriate number from the results	**1**
(e)	room temperature	**1**
	temperature of hot water	**1**
(f)	second and third boxes ticked	**1**

4 - (0972/62_Summer_2020_Q4)

	MP1	diagram showing strip clamped to bench with majority overhanging	**1**
	MP2	means to measure bending, e.g. vertical metre rule at end of strip	**1**
	MP3	add load at / near end of strip and measure the amount of depression	**2**
	MP4	repeat with other strips	
	MP5	variables any **one** from: all strips to have same width / thickness / profile use of same load(s) allowance for unloaded depression	**1**
	MP6	table with columns for material, load and depression with correct units	**1**
	MP7	strip that bends most with same load is most bendy / alternative wording	**1**