

KCSE 2013 physics paper 3

3.5.3 Physics Paper 3 (232/3)

Question 1 . This question consists of **two parts A and B**; attempt both parts.

PART A

You are provided with the following:

- a pendulum bob
- a stop-watch
- two metre rules
- two retort stands, two bosses and two clamps.
- some thread.

Proceed as follows:

- (a) Clamp one metre rule horizontally on the two stands so that the graduations are in a vertical plane. Suspend the pendulum bob from the metre rule with two pieces of thread so that the length of each thread from the point of support on the metre rule to the pendulum bob is 50 cm. See **figure 1**. **The length of each thread will remain 50 cm throughout the experiment. The height of the metre rule above the bench should be at least 65 cm.**

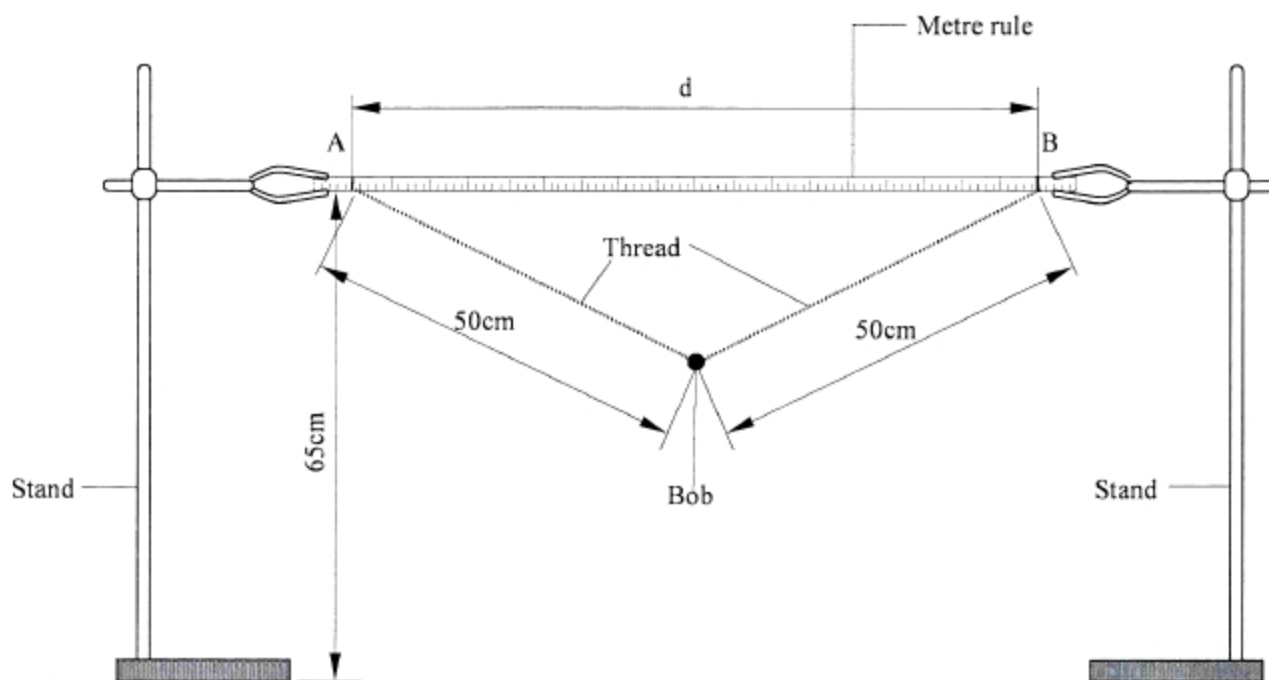


Figure 1

- (b) Set the distance **d** between **A** and **B** to be 70 cm. Displace the pendulum bob slightly in the plane perpendicular to the vertical line in the metre rule for 20 oscillations.

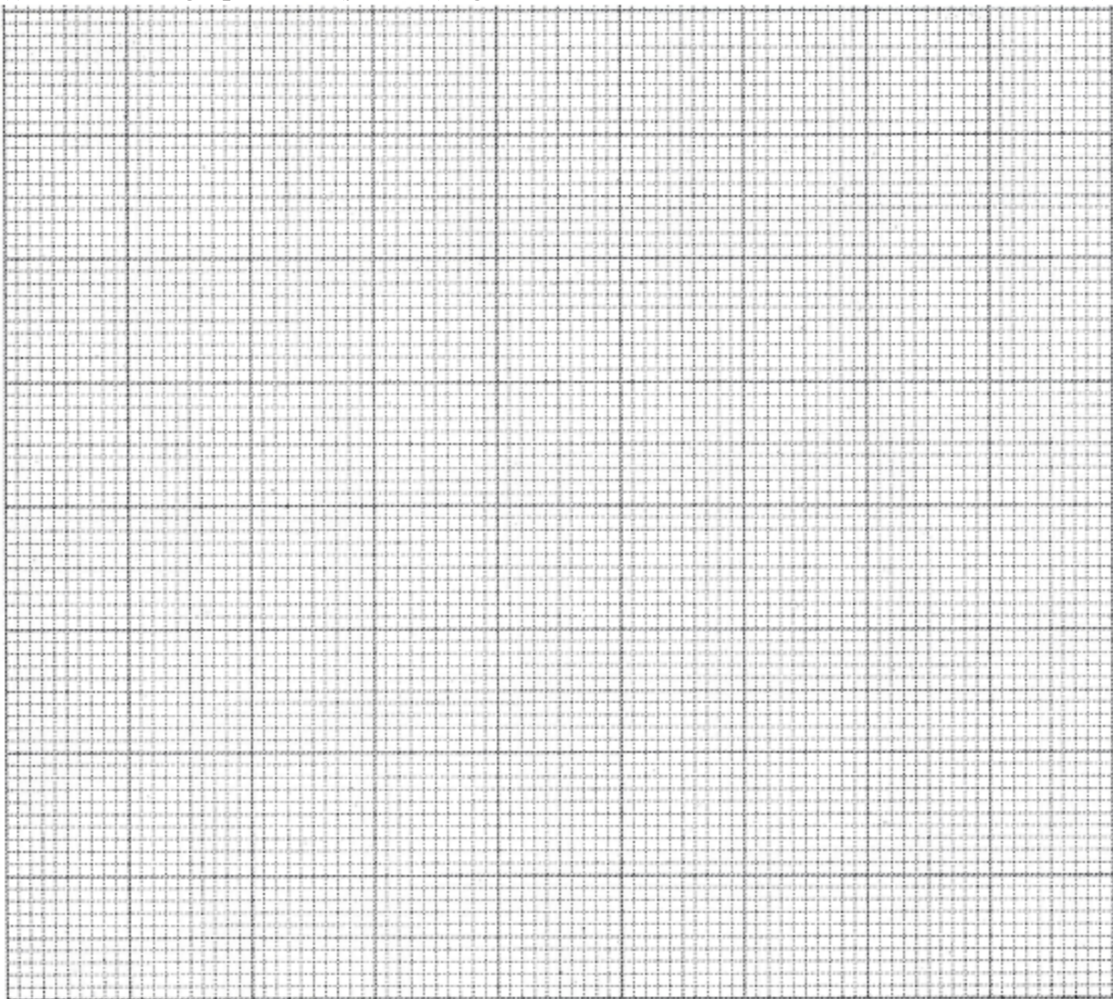
(c) Repeat the procedure in (b) for other values of d shown in **table 1**. Complete the table.

Table 1 Distance d (cm)	70	60	50	40
time t for 20 oscillations (s)				
Period T =				
T^4 (s ⁴)				
d^2 (cm ²)				

(4 marks)

(d) (i) Plot a graph of T^4 (y - axis) against d^2 .

(4 marks)



(ii) Determine the slopes S of the graph.

(2 marks)

(iii) Given that $S = \frac{4}{K^2}$, determine the value of K.

(2 marks)

PART B

You are provided with the following apparatus.

- one Bar magnet
- a pivoting balance (to be shared)
- stop watch

Proceed as follows.

- (e) Using the ruler, measure the length L and breadth b for the magnet.

$L = \dots\dots\dots$ m

$b = \dots\dots\dots$ m (1 mark)

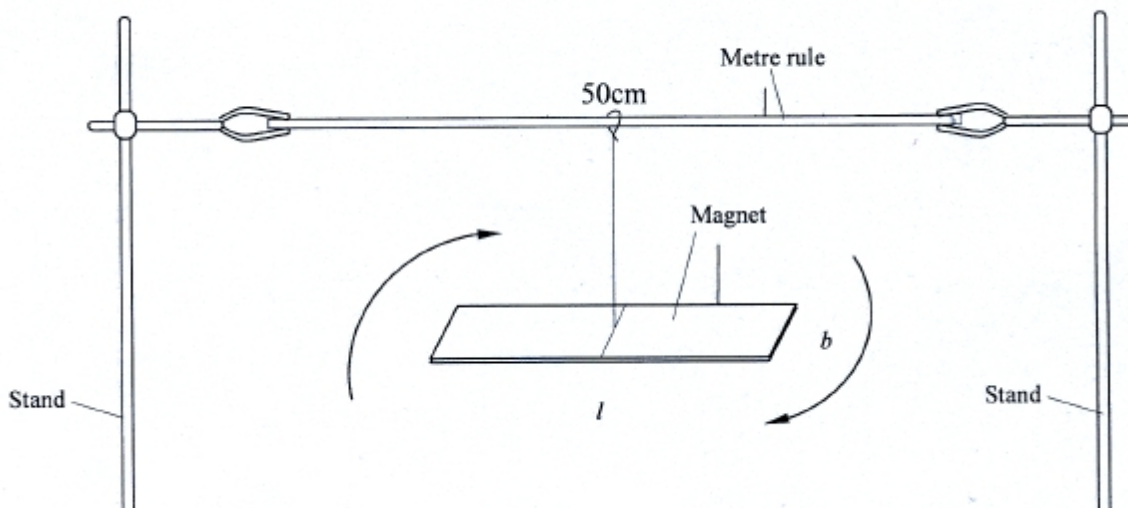
- (f) Use the balance to measure the mass M of the magnet.

$M = \dots\dots\dots$ kg. (1 mark)

- (g) Determine P given that $P = \frac{M(L + b)}{3}$. (2 marks)

- (h) Clamp the magnet from the centre of the metre rule. Using its length and breadth suspend both in a horizontal plane as shown in **figure 2**.

Keep away all unnecessary magnetic materials including voltmeter from this



- (i) (I) Displace one end of the magnet through a small angle and let it oscillate about a vertical axis through its centre as shown by the arrows. Measure the time t for 10 oscillations. (1 mark)

(a) $t = \dots\dots\dots$ s

(II) Determine the period T of the oscillations. $2\pi = \frac{P}{G}$

(2 marks)

Question 2

This question consists of **two** parts **A** and **B**, attempt both parts.

PART A

You are provided with the following

- a voltmeter
- a capacitor
- a switch
- a stop watch
- five connecting wires
- two cells and a cell holder

Proceed as follows:

(a) Connect the circuit as shown in **figure 3**.

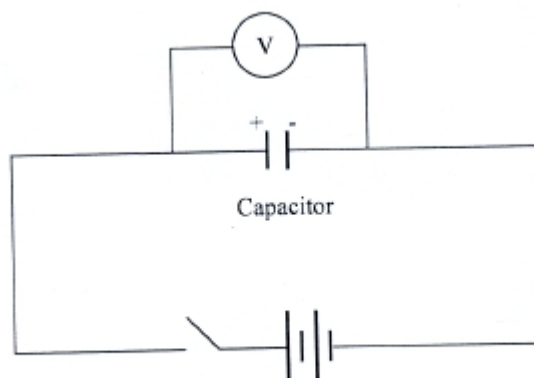


Figure 3

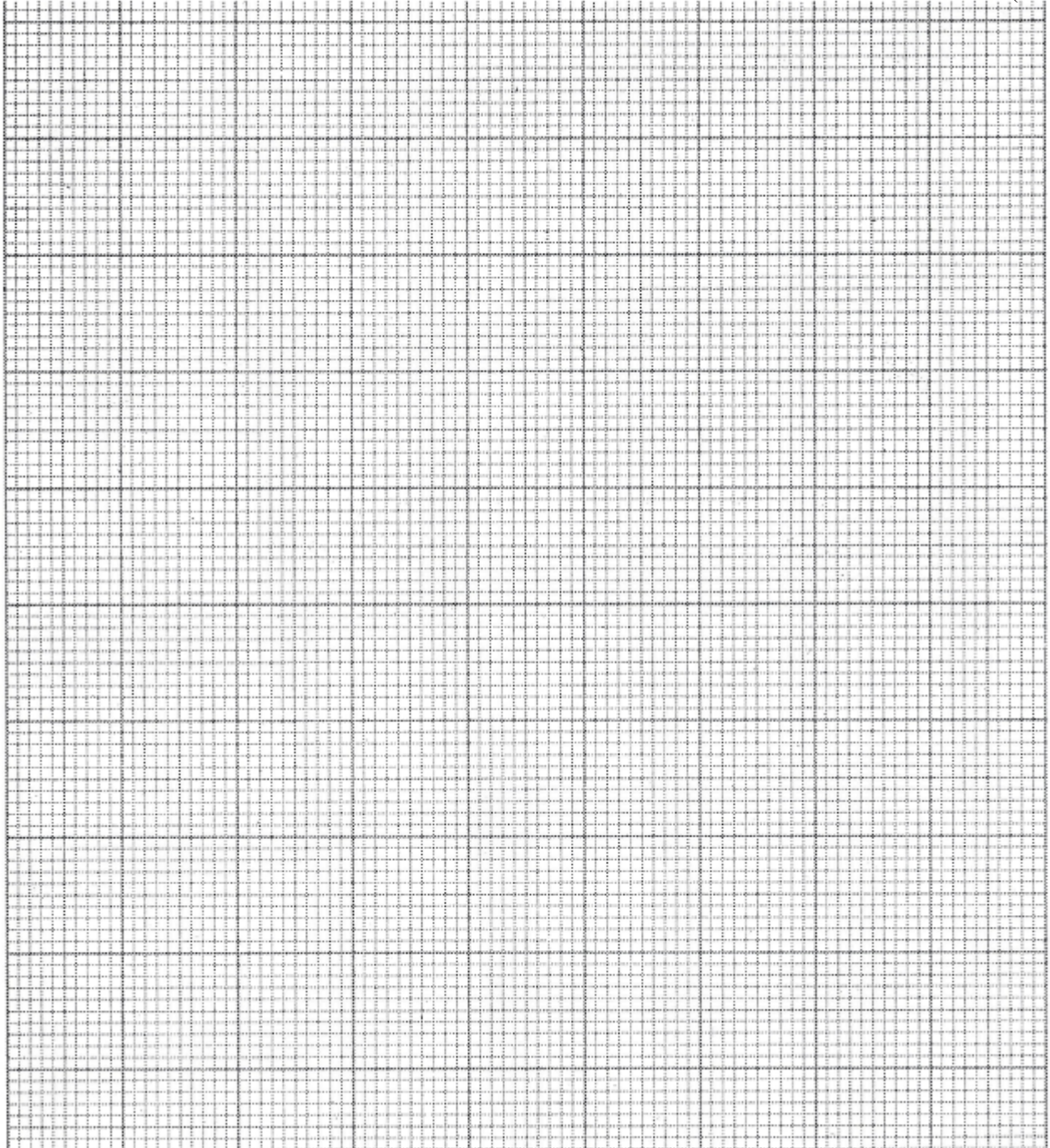
~~(Positive to positive and negative to negative)~~ and those of the battery are correctly connected,

- (b) Close the switch, read and record the maximum voltage V_0 , across the capacitor..... volts (1 mark)
- (c) While the voltmeter shows the maximum voltage V_0 , open the switch and start the stop watch simultaneously. Stop the stop watch when the voltage has dropped from V_0 to $\frac{V_0}{2}$. Read and record the time taken in **table 2**.
- (d) Reset the stop watch and close the switch. Repeat the procedure in (c) for the other values shown in **table 2**.

Table 2

Voltage (V)	2.5	2.25	2.0	1.75	1.50	1.25
Time, t (s)						

(3 marks)



- (e) (i) On the grid provided, plot a graph of Voltage V (y-axis) against time t, (4 marks)
- (ii) Use the graph to determine the time **t** at which $V = \frac{V_0}{2}$ (1 mark)
- t** = seconds

- (f) Determine the resistance R of the voltmeter given that
 $t = 0.693CR$ where C is the capacitance of the capacitor.

(1 mark)

PART B

You are provided with the following:

- a triangular glass prism
- a metre rule
- a 50 g mass
- some hot water
- some cold water
- some thread
- a thermometer
- one stand, one boss and one clamp
- a beaker

Proceed as follows:

- (g) Using a piece of thread suspend the metre rule from the clamp on the stand and adjust the position of the thread until the metre rule balances horizontally. Note this position, O of the thread. **(This position of the thread must be maintained throughout the experiment).**
- (h) Using another piece of thread suspend the glass prism from the meter rule at a point 35 cm from O . Suspend the 50 g mass on the opposite side of O using another piece of thread. Adjust the position of the thread attached to the 50 g mass until the metre rule balances once more. **See figure 4.**

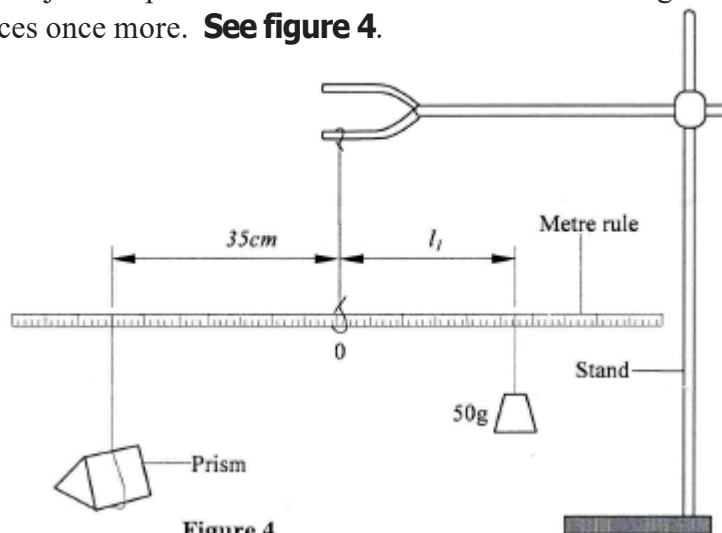


Figure 4

- (i) Determine the distance l_1 between O and the point of support of the 50 g mass.
- (ii) Use the principle of moments to determine the weight W_1 of the prism in air. (1 mark)
 (Take $g = 10 \text{ N kg}^{-1}$) (1 mark)

prism still at 35 cm from O, determine the distance l_2 of the 50 g mass at which the rule

- (i) Put cold water into the beaker (approximately three quarter ($\frac{3}{4}$) full). With the glass balances when the prism is fully submerged in the cold water. **See figure 5.**

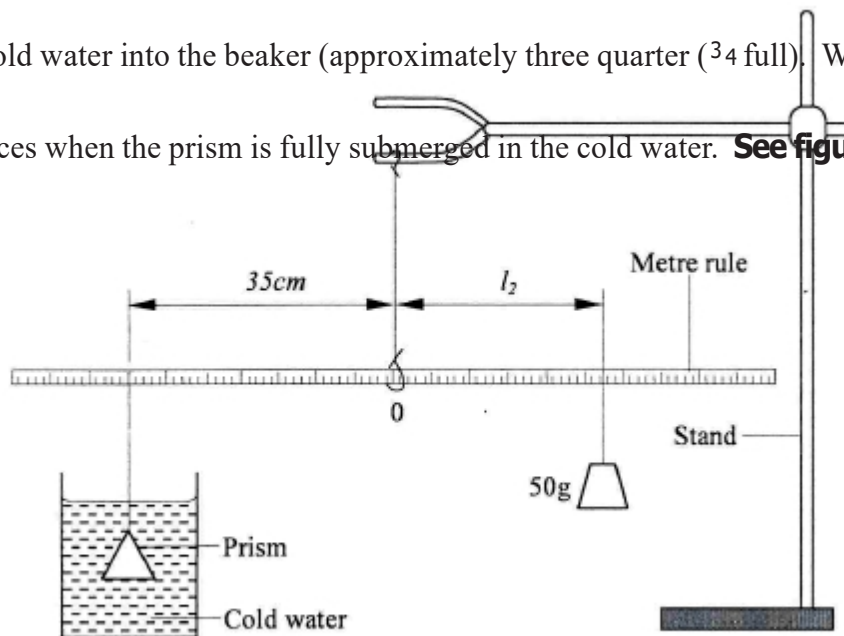


Figure 5

- (I) $l_2 = \dots\dots\dots$ cm (1 mark)
- (II) Determine the weight W_2 of the prism in the cold water. (1 mark)
- (j) Measure and record the temperature T_1 of the cold water when the system is balanced. with the prism fully submerged in hot water. **Ensure that the prism is still supported**
 $T_1 = \dots\dots\dots$ °C (1 mark)
- (k) (i) Determine the distance l_3 of the point of support of the 50 g mass when the prism is submerged in hot water. Now pour out the cold water and replace it with hot water. Balance the metre rule **at 35 cm from 0.**

is submerged in hot water.

$l_3 = \dots\dots\dots$ cm. (1 mark)

- (ii) Measure and record the temperature T_2 of the hot water.

$T_2 = \dots\dots\dots$ °C (1 mark)

- (iii) Determine the weight W_3 of the prism in hot water. (1 mark)

- (l) Determine the constant k for the water given that:

$k = \frac{(W_1 - W_2) - (W_1 - W_3)}{T_2 - T_1}$

