

4.4.3 Physics Paper 3 (232/3)

Question 1

You are provided with the following:

- A stirrer
- A stand, a boss and a clamp
- A thermometer
- An ammeter
- A voltmeter
- A beaker
- A source of boiling water
- Two dry cells in a cell holder
- A switch
- Seven connecting wires
- A component labelled X

Proceed as follows:

- (a) Set up the circuit as shown in **figure 1**.

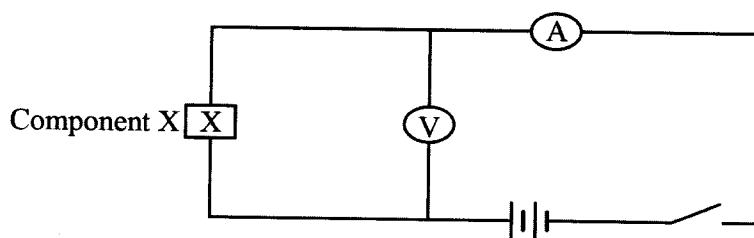


Figure 1

- (i) Close the switch, read and record the current I through component X and the potential difference V across it. (1 mark)

$I =$

$V =$

Open the switch.

- (ii) Determine the resistance R of component X given that: $R = \frac{V}{I}$ (1 mark)

- (b) Pour hot water into the beaker and set up the apparatus as in **figure 2**, so that component X and the thermometer bulb are fully immersed.

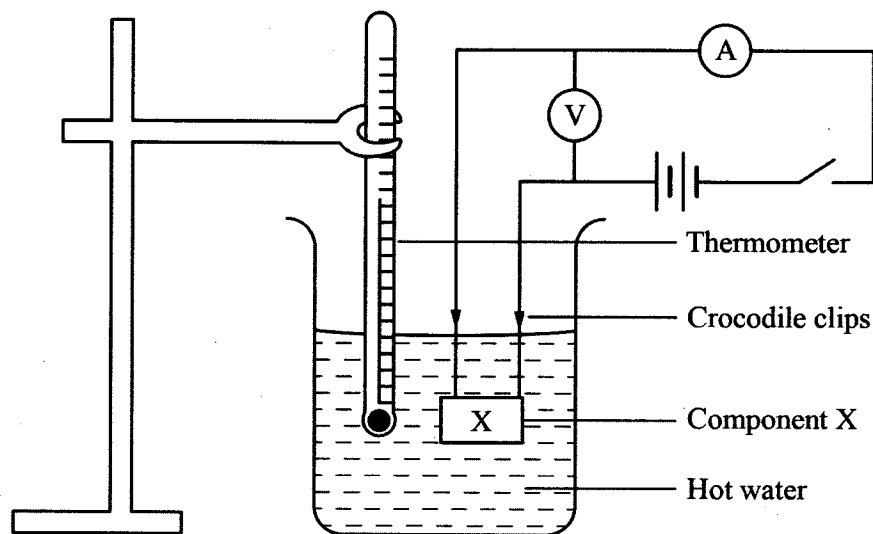


Figure 2

- (c) Stir the water from time to time, when the temperature falls to 80° , switch on the circuit, read and record the current I and the potential difference V in **table 1**. **Then open the switch.**
- (d) Repeat (c) as the temperature falls to the other values shown in **table 1**. Complete the table.

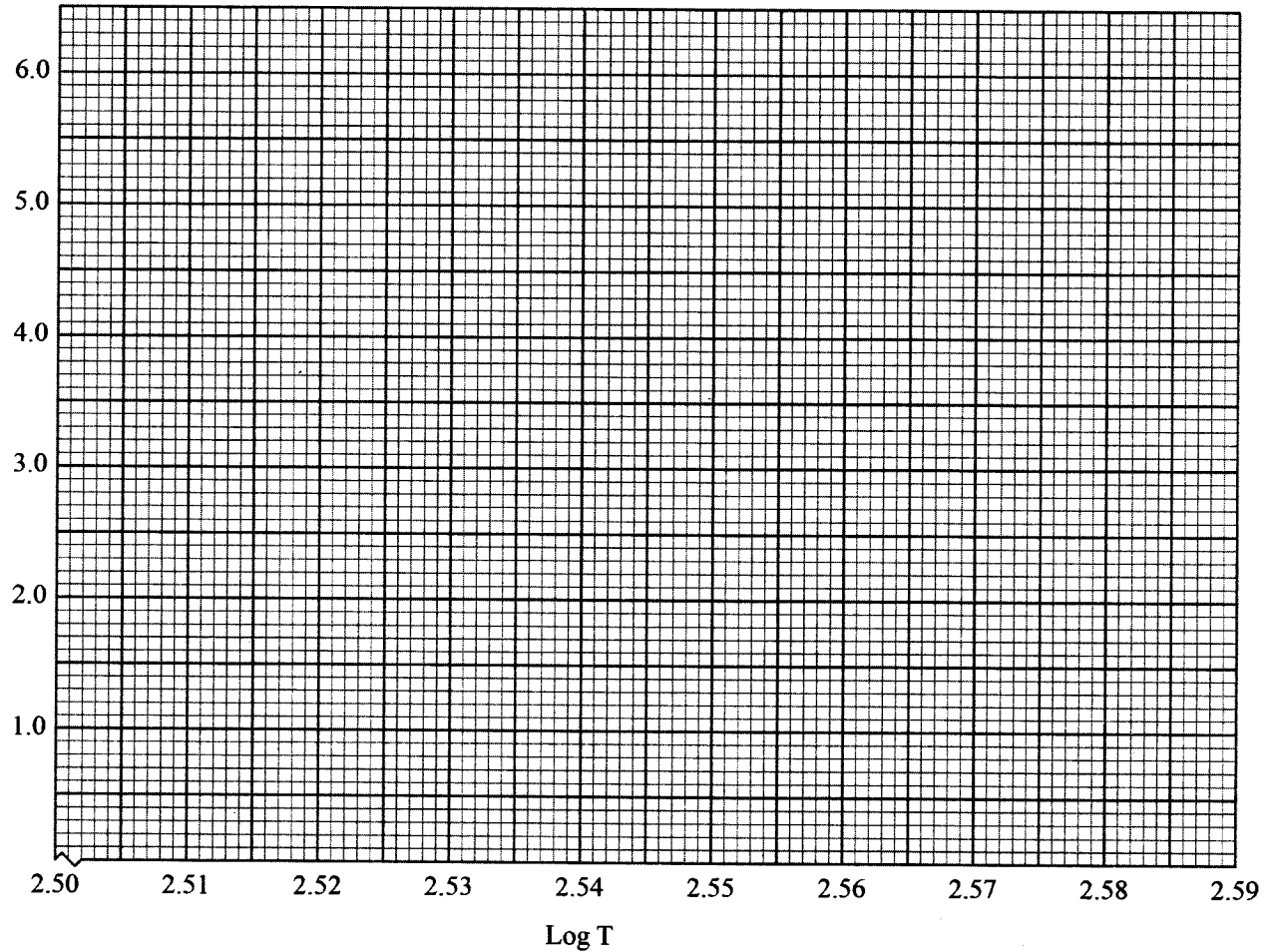
Table 1

(8 marks)

| | | | | | | |
|---|-----------|-----------|-----------|-----------|-----------|-----------|
| Temperature of hot water ($^{\circ}$) | 80 | 75 | 70 | 65 | 60 | 55 |
| T (K) | | | | | | |
| Current I (A) | | | | | | |
| Potential difference V (V) | | | | | | |
| Resistance $R = \frac{V}{I}$ (Ω) | | | | | | |
| Log R (<i>3 decimal places</i>) | | | | | | |
| Log T (<i>3 decimal places</i>) | | | | | | |

- (e) (i) On the axis provided, plot a graph of Log R against log T. (4 marks)

log R
($\times 10^{-1}$)



- (ii) Determine the slope S of the graph. (3 marks)

- (f) Given that R and T are related by the equation $\text{Log } R = \text{Log } K + n \text{Log } T$, determine the value of;

(i) n (1 mark)

(ii) K (2 marks)

Question 2

You are provided with the following:

- A metre rule
- A stand, boss and clamp
- A piece of string
- A 20 g mass
- A 50 g mass
- A measuring cylinder containing water
- A concave mirror
- A screen
- A candle
- Pieces of sewing threads
- A mirror holder (Lens holder)

Proceed as follows:

PART A

- (a) Using a string, suspend the metre rule on the stand so that it balances horizontally at its center of gravity. Record the centimetre mark at which the metre rule balances.

Centimetre mark = cm (1 mark)

- (b) With the metre rule balanced at its centre of gravity, suspend a 20 g mass at a distance of 30 cm from the centre of gravity. Suspend the 50 g mass on the other side of the centre of gravity and adjust its position until the rule is balanced. See figure 3.

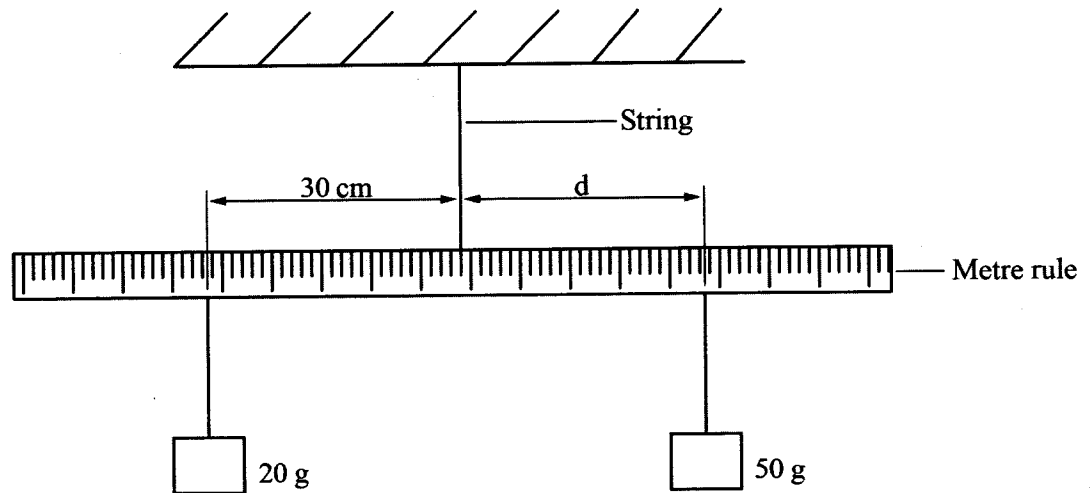


Figure 3

Record the distance d of the 50 g mass from the centre of gravity.

d = cm

d = m

(1 mark)

- (c) (i) Record the volume of the water in the measuring cylinder provided.

$V =$ (1 mark)

- (ii) Immerse the 20 g mass fully into the water and adjust the position of the 50 g mass so that the rule balances horizontally.
Record the volume V_1 of the water plus 20 g mass and the distance d_1 of the 50 g mass from the centre of gravity.

$V_1 =$ (1 mark)

$d_1 =$ (1 mark)

- (iii) (I) Determine the volume of the water displaced (1 mark)

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(II) Determine the weight of the water displaced.
(*density of water = 1 g cm^{-3}*) (3 marks)

- (d) (i) Use the principle of moments to determine the apparent weight of the 20 g mass when fully immersed in water. ($g = 10 \text{ N kg}^{-1}$) (2 marks)

(ii) Calculate the weight of the 20 g mass in air ($g = 10 \text{ N kg}^{-1}$) (1 mark)

(iii) Determine the apparent loss in weight of the 20 g mass. (1 mark)

PART B

- (e) Light the candle and place it at distance $u = 20$ cm in front of the concave mirror. Adjust the position of the screen until a sharp image of the candle flame is obtained. See figure 4.

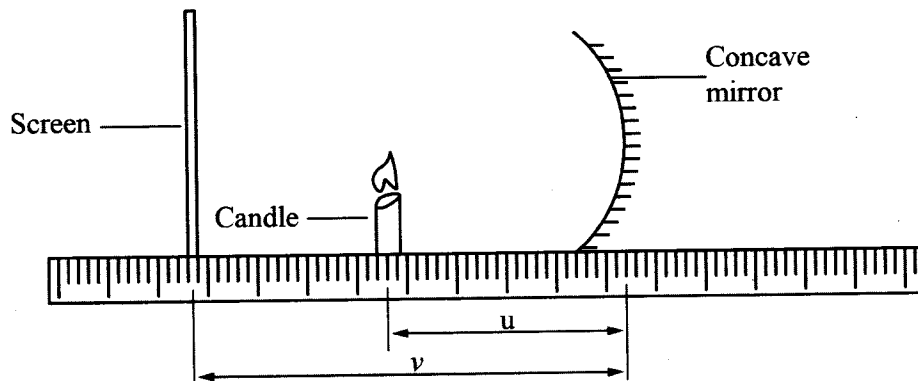


Figure 4

- (i) Read and record the distance v between the screen and the mirror.
- $v = \dots\dots\dots$ (1 mark)
- (ii) Determine:
- I. the magnification m of the mirror given that: $m = \frac{v}{u}$, (1 mark)
- II. the value f_1 given that: $f_1 = \frac{mu}{m+1}$ (1 mark)
- (f) Repeat part (e) for distance $u_1 = 18$ cm
- (i) Read and record the distance v_1 between the screen and the mirror.
- $v_1 = \dots\dots\dots$ (1 mark)
- (ii) Determine the magnification m_1 of the mirror. (1 mark)
- (iii) Hence determine f_2 . (1 mark)
- (g) Determine the average value of f . (1 mark)