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**.

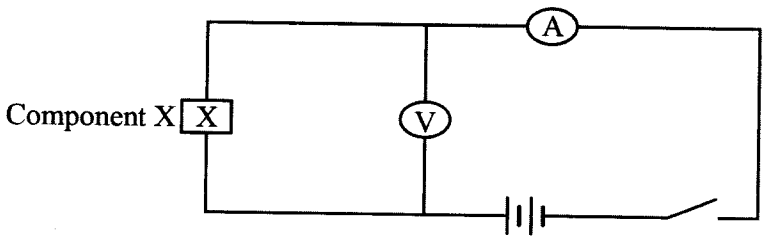


Figure 1

(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.

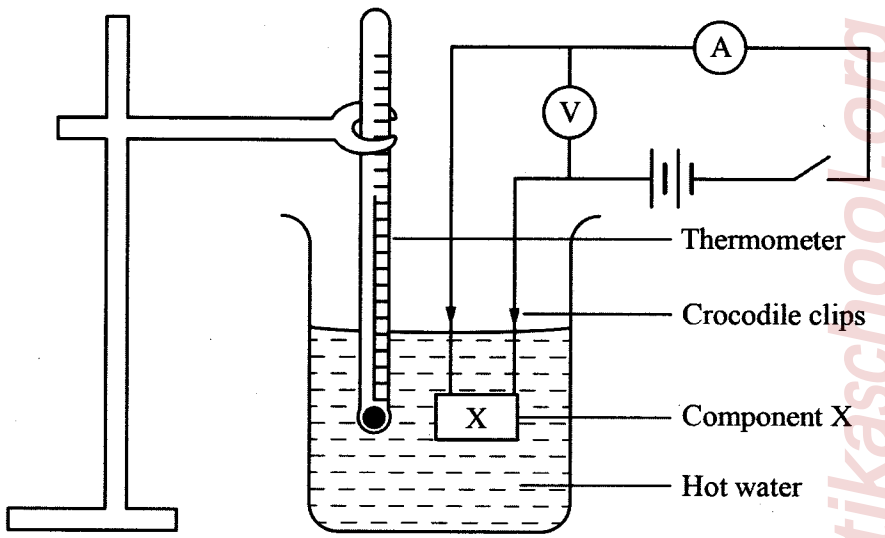


Figure 2

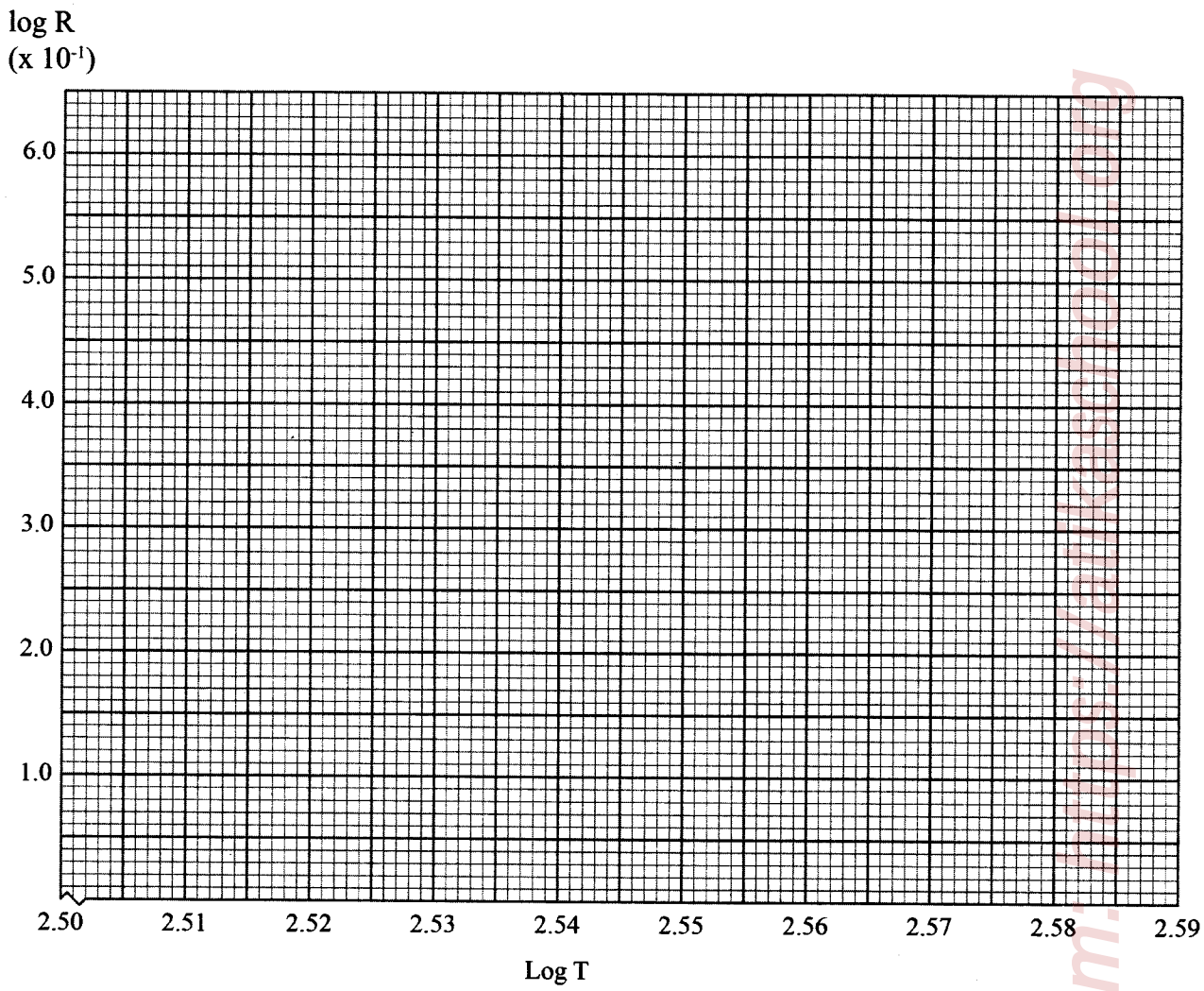
(c) Stir the water from time to time, when the temperature falls to 80°, switch on the circuit, read and record the current I and the potential difference V in **table 1**. **Then open the switch.**

(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 (°)	**80**	**75**	**70**	**65**	**60**	**55**
T (K)						
Current I (A)						
Potential difference V (V)						
Resistance R = $\frac{V}{I}$ (Ω)						
Log R (***3 decimal places***)						
Log T (***3 decimal places***)						

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



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

(f) Given that R and T are related by the equation Log R = Log K + n 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.**

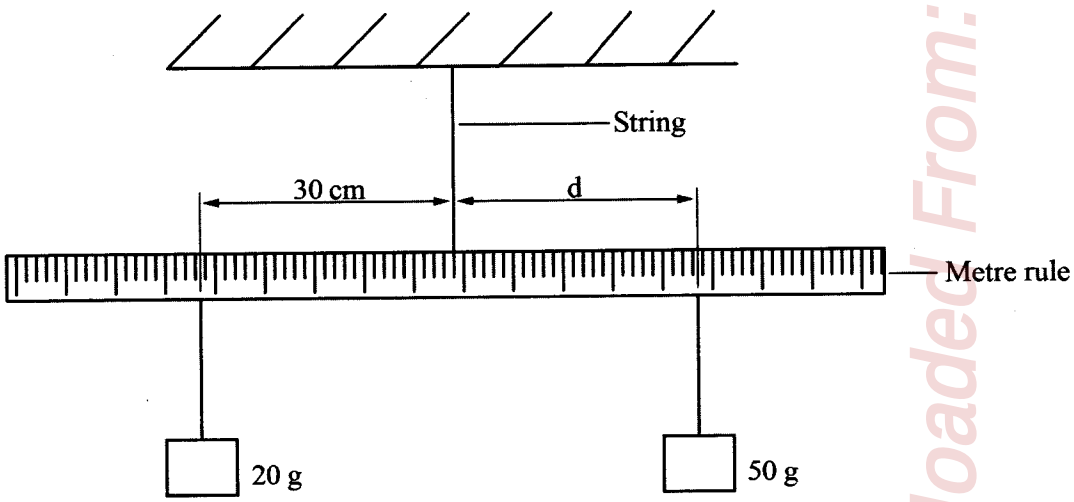


Figure 3

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)

.....

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

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

(ii) Calculate the weight of the 20 g mass in air ($g = 10\ Nkg^{-1}$) (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.**

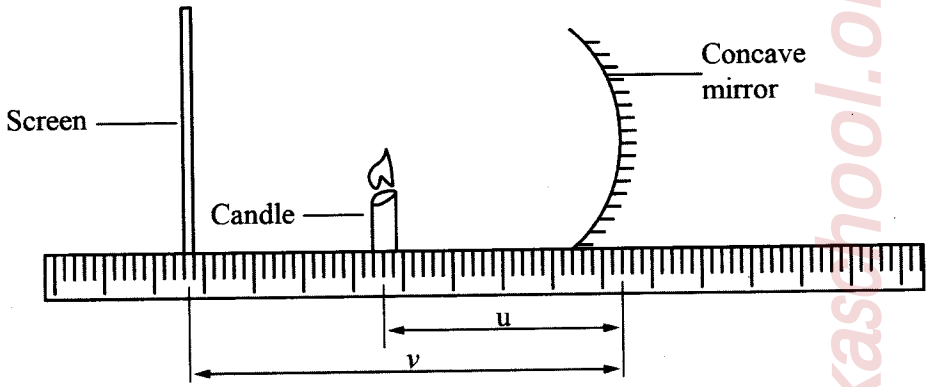


Figure 4

(i) Read and record the distance v between the screen and the mirror.

v = ... (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 = ... (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)