# 232/3 PHYSICS PAPER 3 - MARKING SCHEME



## PART A

1. **You are provided with the following apparatus.**
   - Two optical pins mounted on corks.
   - Candle.
   - Metre rule.
   - Screen
   - White sheet of paper.
   - Lens
   - Lens holder.
   - Plane mirror.
   - Clamp stand.
   - Boss and a clamp
   - Piece of cellotape.

(a) Set up your apparatus as in figure 2 such that the time of the cork is vertically above the centre of the lens.

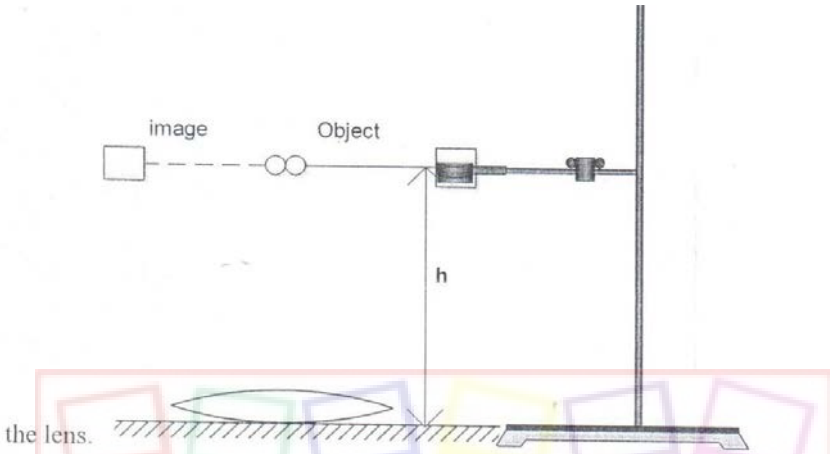



**Figure 2**

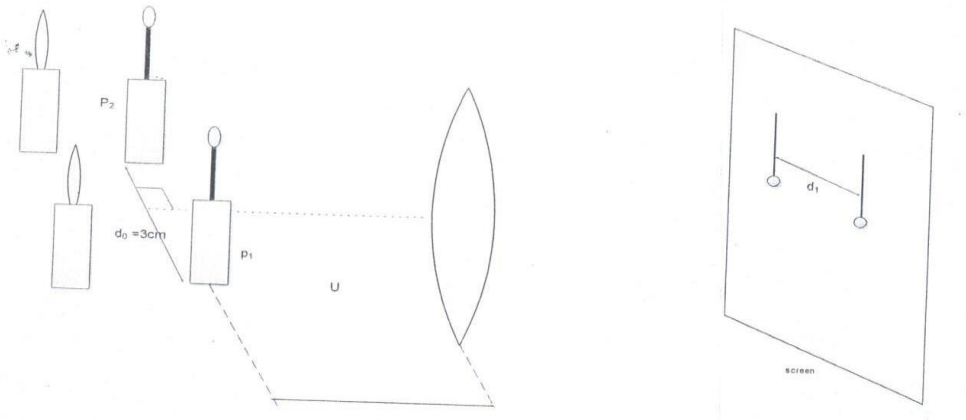
(b) Raise the cork until it coincides with its image without any parallax.

(c) Measure the height h — h = 17.2 cm. — 2mks

(d) Measure the thickness of the lens t — t = 0.47 cm — 1mks

(e) Calculate the focal length from $f = \frac{2h - t}{2}$ — f = 17.0 cm — 1mk

## PART B




(a) Place pin P1 and pin P2 3cm apart and at right angle to the principal axis of the convex lens.

(b) Place the candle behind P1 to illuminate it.

(c) Fix the white sheet of paper on the screen using a cellotape.

(d) Place the screen in front of the lens and move it until a sharp image of pin appear on the screen.

(e) Draw a line against image of P1.

(f) Without moving the screen, move the candle behind $P_2$ so that a sharp image of P2 appears on the screen.

(g) Draw a line against the image of P2 and measure the distance d1 between the two images.

(h) Calculate the magnification from $M = \frac{d_1}{d_o}$



(i) Complete the table using other values of the objects distances (U) in the table.

| | Object distance U(cm) | $d_1$(cm) | Magnification (M) | $\frac{1}{M}$ |
|---|---|---|---|---|
| 1 | 23.5 | 6.0 | 2.0 | 0.5 |
| 2 | 26.5 | 4.0 | 1.33 | 0.75 |
| 3 | 30.0 | 3.5 | 1.17 | 0.85 |
| 4 | 35.0 | 2.5 | 0.83 | 1.20 |
| 5 | 40.0 | 2.0 | 0.67 | 1.49 |
| 6 | 45.5 | 1.5 | 0.50 | 2.0 |
| 7 | 50.0 | 1.4 | 0.47 | 2.1 |

(j) Plot a graph of U(cm) against $\frac{1}{M}$



(k) Determine the gradient of the graph.
Consider (0.15) and (1.2, 35)

gradient = $\frac{rise}{run}\ \frac{35-15}{1.2-0} = \frac{20}{1.2}$ = 16.67cm 3mks

(l) Uses the graph to determine the focal length of the lens given that $\frac{U}{f} = \frac{1}{M} + 1$ 2mks

$$U = \frac{f}{m} + f$$

Gradient = f = vertical intercept..

$$f = \frac{16.67 + 15}{2} = \frac{31.67}{2} = 15.8cm$$

(m) Calculate the average value of focal length use result in part A and part B. 1mk

$$\frac{17.0 + 15.8}{2} = \frac{32.8}{2} = 16.4cm$$

2. (a) (i) Ammeter, I = 0.25 A

(ii) Voltmeter, V = 1.35 V

(iii) K = $\frac{V}{I} \Rightarrow K = \frac{1.35}{0.25}$ 5.4 Ω

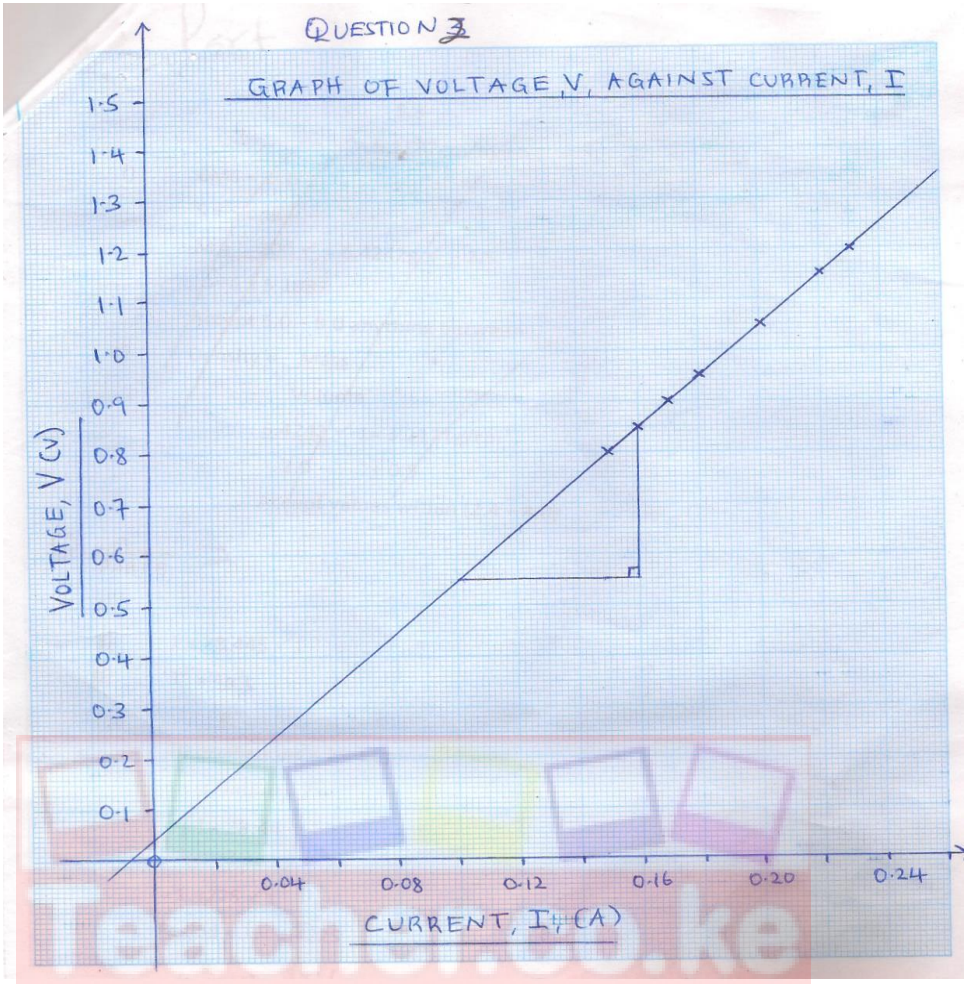




(b) (iii) Table 2.0

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| L(cm) | 10 | 20 | 30 | 40 | 50 | 60 | 70 |
| V(V) | 1.20 | 1.15 | 1.05 | 0.95 | 0.90 | 0.85 | 0.80 |
| I(A) | 0.23 | 0.22 | 0.20 | 0.18 | 0.17 | 0.16 | 0.15 |

(iv)




(v) Slope

$$\frac{\Delta V}{\Delta I} = \frac{0.85 - 0.55}{0.16 - 0.10} = \frac{0.30V}{0.06A} = 5.0\Omega$$

(vi) Quantity representing slope

(b) t = 28.445

$$T^2 = \frac{4\pi^2 L}{g}$$

20 oscillations = 28.44S

1 oscillation =?

$$= \left(\frac{1 \times 28.44}{20}\right)$$

= 1.422S

Period = T = 1.422S

$$(1.422)2 = r = \frac{4\pi^2 L}{g}$$

L = 50 cm = 0.5 m

$$\Rightarrow (1.422)2 \quad \frac{4\pi^2 \times 0.5}{(1.422)^2}$$

g = 4π2x 0.5

(1.422)2

= 9.76/kg ✓1