

Solutions

PHYS-205B

(Final Exam)

Fall 2025

①

Problem 1

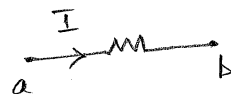
Electric field does not change. It is independent of the radius of charge.

Problem 2

$$V_a - V_b = IR$$

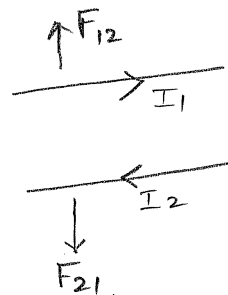
$$6.0 - 1.5 = I(1.5 \times 10^3)$$

$$I = 3.0 \times 10^{-3} \text{ A} = 3.0 \text{ mA}$$



Problem 3

'unlike' currents repel.



Problem 4

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

$$2.4 \sin \theta_c = 1.0 \sin 90$$

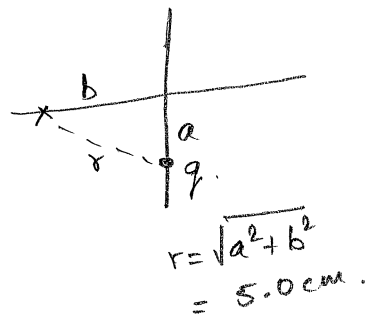
$$\theta_c = \sin^{-1}\left(\frac{1}{2.4}\right) = 25^\circ$$

Problem 5

$$\Delta V = \frac{kq}{r} - \frac{kq}{\infty}$$

$$= \frac{(9.0 \times 10^9)(8.0 \times 10^{-9})}{(5.0 \times 10^{-2})} - 0$$

$$= 1400 \text{ Volts}$$



Problem 6

(a) $R = 2f = 2(-10.) = -20. \text{ cm}$

(b) $\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$

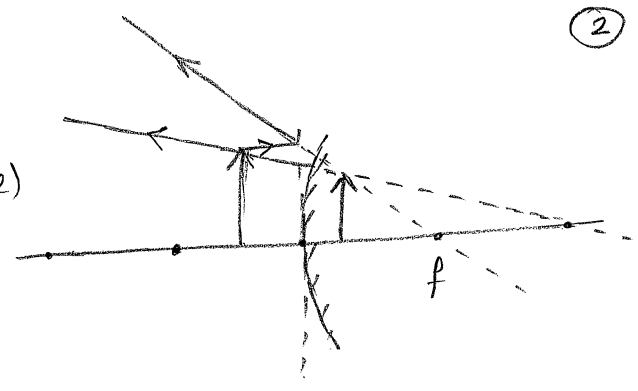
$$\frac{1}{+5.0} + \frac{1}{d_i} = \frac{1}{-10.}$$

$$\frac{1}{d_i} = -\frac{1}{10.} - \frac{1}{5.0} = -\frac{3}{10.}$$

$$d_i = -3.3 \text{ cm.}$$

virtual image.

(e)



(c) $m = -\frac{d_i}{d_o} = -\frac{(-3.3 \text{ cm})}{(+5.0 \text{ cm})}$
 $= +0.67$

$$\frac{h_i}{1.0} = +0.67 \Rightarrow h_i = +0.67 \text{ cm}$$

(d) upright

Problem 7

(a) $\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$

$$\frac{1}{+30.} + \frac{1}{d_i} = \frac{1}{+10.}$$

$$\frac{1}{d_i} = +\frac{1}{10.} - \frac{1}{30.} = \frac{2}{30.}$$

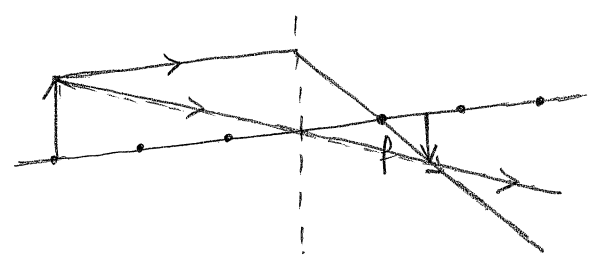
$$d_i = 15 \text{ cm.}$$

(b) $m = -\frac{d_i}{d_o} = -\frac{(+15 \text{ cm})}{(+30 \text{ cm})}$
 $= -0.50$

$$m = \frac{h_i}{h_o}$$

$$-0.50 = \frac{h_i}{1.0 \text{ cm}} \Rightarrow h_i = -0.50 \text{ cm}$$

(d)



(c) inverted.