

Solutions

PHYS-203B (Final Exam)

Fall 2025

①

Problem 1

$$\vec{F} = q \vec{E} = -\hat{j} q E$$

direction of force = $-\hat{j}$ = vertically down.

Problem 2

Negative

Problem 3

There is no induced current because magnetic flux is not changing.

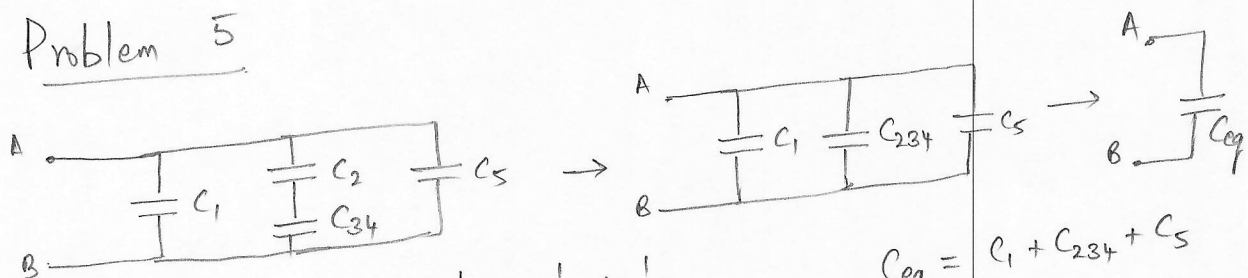
Problem 4

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

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

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

Problem 5



$$\begin{aligned} C_{34} &= C_3 + C_4 \\ &= 30. + 40. \\ &= 70. \text{ nF} \end{aligned}$$

$$\begin{aligned} \frac{1}{C_{234}} &= \frac{1}{C_2} + \frac{1}{C_{34}} \\ &= \frac{1}{20.} + \frac{1}{70.} = \frac{9}{140} \end{aligned}$$

$$C_{234} = \frac{140}{9} = 16 \text{ nF}$$

$$\begin{aligned} C_{eq} &= C_1 + C_{234} + C_5 \\ &= 10. + 16 + 50. \\ &= 76 \text{ nF} \end{aligned}$$

Problem 6

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

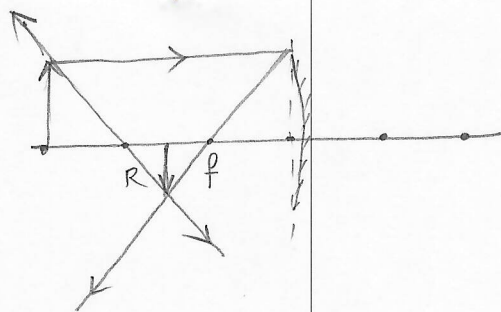
$$(b) \frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$

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

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

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

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



(d) real

(e) inverted

$$(f) m = \frac{h_i}{h_o}$$

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

Problem 7

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

$$\frac{1}{+20.} + \frac{1}{d_i} = \frac{1}{-10.}$$

$$\frac{1}{d_i} = -\frac{1}{10.} - \frac{1}{20.} = -\frac{3}{20.}$$

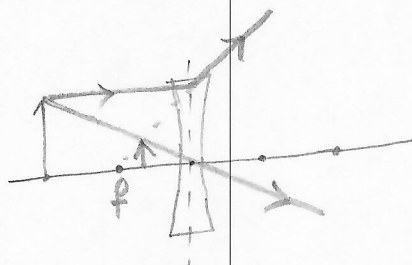
$$d_i = -\frac{20.}{3} = -6.7\text{cm}$$

$$(b) m = -\frac{d_i}{d_o}$$

$$= -\frac{(-6.7\text{cm})}{(+20.\text{cm})}$$

$$= +0.33$$

(e)



(c) virtual

(d) upright