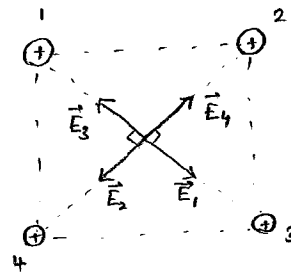


Solutions

Problem 1

$$|\vec{E}_1| = |\vec{E}_2| = |\vec{E}_3| = |\vec{E}_4|$$

$$\Rightarrow \vec{E}_1 + \vec{E}_2 + \vec{E}_3 + \vec{E}_4 = 0$$



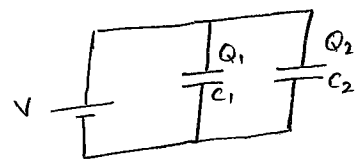
Problem 2

$$\Delta V = \frac{1}{2} m v^2$$

$$\frac{K_0}{K_P} = \frac{\Delta V}{\Delta V} = 1$$

Problem 3

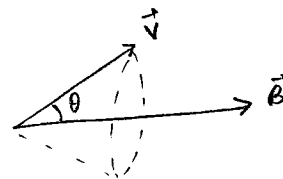
$$\frac{U_1}{U_2} = \frac{\left(\frac{1}{2} C_1 V_1^2\right)}{\left(\frac{1}{2} C_2 V_2^2\right)} = \frac{C_1}{C_2} = 0.5$$



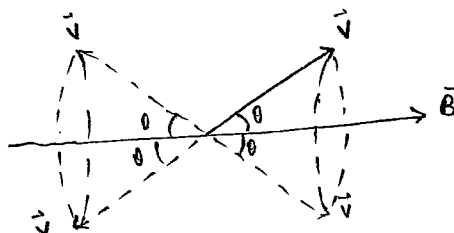
$$V_1 = V_2$$
$$Q_1 + Q_2 = Q$$

Problem 4

(a) $F = q v B \sin \theta$
 $3.60 \times 10^{-13} = 1.6 \times 10^{-19} (4.50 \times 10^6) 1.00 \sin \theta$
 $\sin \theta = 0.5$
 $\theta = 30^\circ \text{ or } 150^\circ$

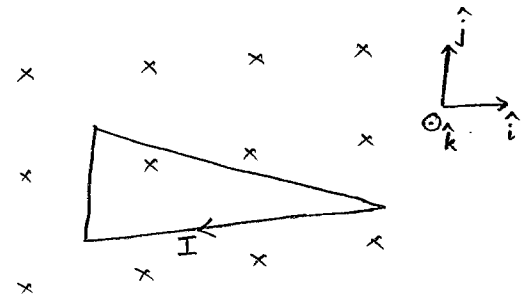


(b) No.

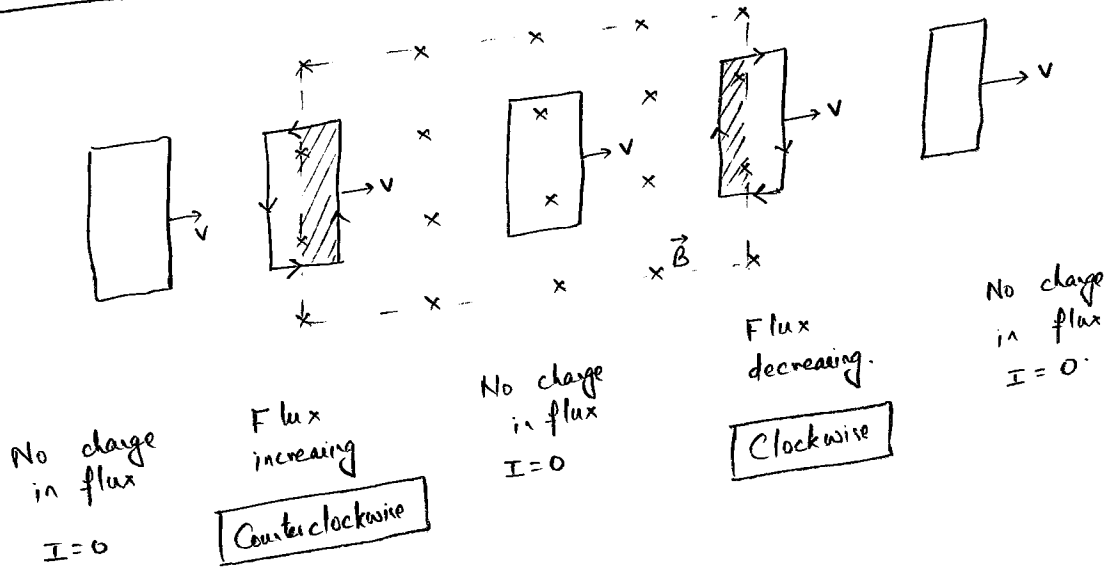


Prob. 5

$$\begin{aligned} \vec{F} &= I \vec{L} \times \vec{B} \\ &= I (-x \hat{i}) \times (-B \hat{k}) \\ &= I \times B (\hat{i} \times \hat{k}) \\ &= x I B (-\hat{j}) \\ &= -\hat{j} \times I B \end{aligned}$$



Prob. 6



Prob. 7

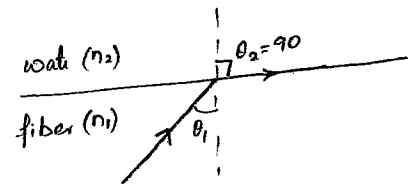
$$\begin{aligned} t &= \frac{d}{c} = \frac{6.44 \times 10^{18} \text{ m}}{3.00 \times 10^8 \frac{\text{m}}{\text{s}}} \\ &= \frac{6.44}{3.00} \times 10^{10} \text{ s} \times \frac{1 \text{ min}}{60 \text{ s}} \times \frac{1 \text{ h}}{60 \text{ min}} \times \frac{1 \text{ day}}{24 \text{ h}} \times \frac{1 \text{ year}}{365 \text{ days}} \\ &= 681 \text{ years} \end{aligned}$$

Prob. 8

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

$$1.50 \sin \theta_c = 1.33 \sin 90$$

$$\theta_c = \sin^{-1} \left(\frac{1.33}{1.50} \right) = 62.5^\circ$$



Prob. 9

(a) $R = 2f = 2 \times (-10 \text{ cm}) = -20.0 \text{ cm}$

(b) $\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} = -\frac{1}{10.0} - \frac{1}{40} = -\frac{5}{40}$

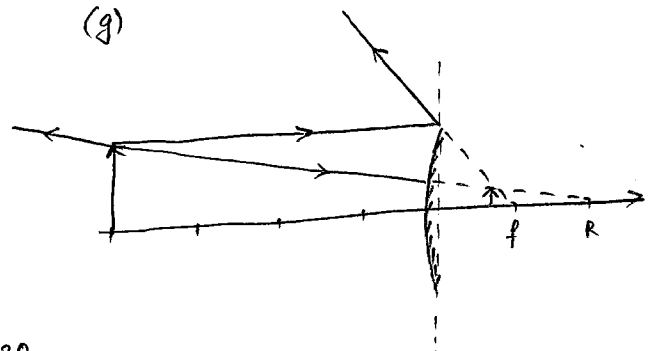
$$d_i = -\frac{40}{5} = -8.0 \text{ cm}$$

(c) $m = -\frac{d_i}{d_o} = -\frac{(-8.0 \text{ cm})}{(+40.0 \text{ cm})} = +0.20$

(d) virtual

(e) upright

(f) $h_i = m h_o = +0.20 \times 1.00 \text{ cm} = +0.20 \text{ cm}$



Prob. 10

(a) $\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} = \frac{1}{10} - \frac{1}{40} = \frac{3}{40}$

$$d_i = \frac{40}{3} = +13.3 \text{ cm}$$

(b) $m = -\frac{d_i}{d_o} = -\frac{(+13.3 \text{ cm})}{(+40.0 \text{ cm})} = -0.33$

(c) real

(d) inverted

(e)

