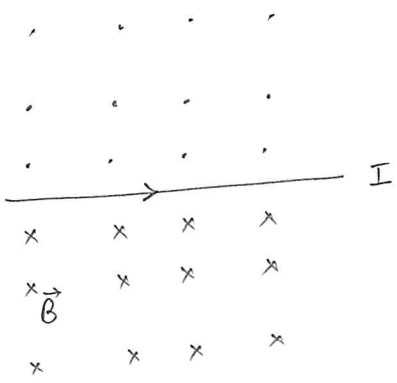
Solutions

PHYS-205B-001 (Final Exam) Spring 2023

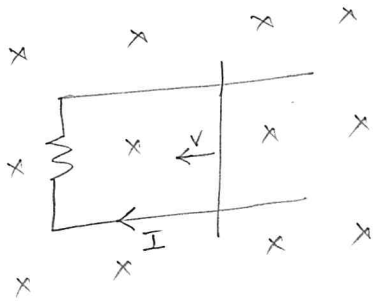
Prob. 1

In a uniform electric field an electric dipole experiences zero force and non-zero torque. In particular, the dipole moment tries to align with the electric field.

Prob. 2



Problem 3



- magnetic flux is decreasing
$\Rightarrow$ induced $\vec{B}$ is along external $\vec{B}$
$\Rightarrow$ induced current is clockwise.

Problem 4

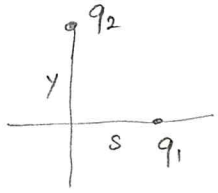
$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$

$$\frac{1}{\infty} + \frac{1}{d_i} = \frac{1}{f}$$

$$\Rightarrow d_i = f$$

Thus, the image is formed at the focal point of the mirror.

Problem 5



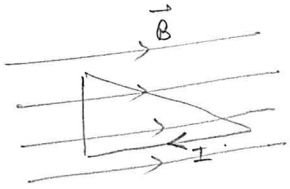
$$V = V_1 + V_2$$

$$= \frac{kq_1}{s} + \frac{kq_2}{y}$$

$$= \frac{(9.0\times10^{9})(-1.0\times10^{-9})}{2\,(1.8\times10^{-2})} + \frac{(9.0\times10^{9})(+2.0\times10^{-9})}{4\,(1.8\times10^{-2})}$$

$$= -\frac{10^3}{4.0} + \frac{10^3}{4.0} = 0 \text{ Volts.}$$

Problem 6



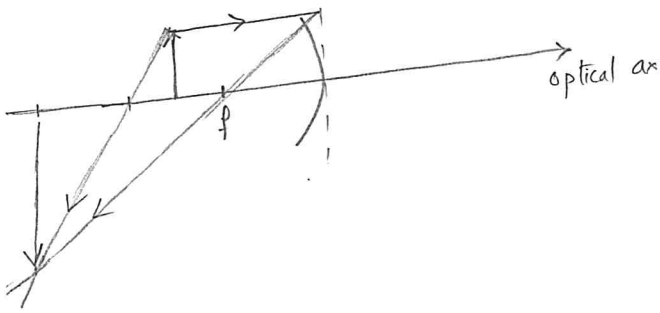
$$\vec{F} = I\vec{L} \times \vec{B}$$

$$= I L B \sin 180$$

$$= 0$$

Problem 7

(a) $R = 2f = +20.0\,cm.$



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

$$\frac{1}{15} + \frac{1}{d_i} = \frac{1}{10.0}$$

$$\frac{1}{d_i} = \frac{1\times3}{10.0\times3} - \frac{1\times2}{15\times2} = \frac{1}{30}$$

$$d_i = +30.\,cm.$$

Real image.

(c) $m = -\frac{d_i}{d_o} = -\frac{(+30.\,cm)}{(15\,cm)} = -2.0$

inverted

$$\frac{h_i}{h_o} = -2.0 \Rightarrow h_i = -2.0\,cm.$$