

Solutions

Problem 1

0.

Problem 2

$$I = \frac{\Delta V}{R} = \frac{6.0 - 1.5}{1.5 \times 10^3} = 3.0 \times 10^{-3} \text{ A.}$$

Problem 3

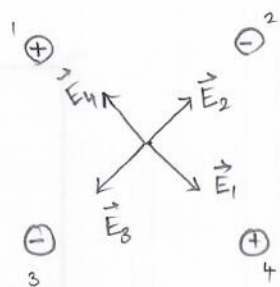
Light rays converge at a real image, and
 diverge from virtual images. Image formed in a
 flat mirror is virtual. Image formed on a projector
 screen is real.

Problem 4

No. $n = \frac{c}{v} < 1 \Rightarrow c < v.$

If $n < 1$, then speed of light in the medium
 would be faster than speed of light in vacuum.

Problem 5



Since the distances and charges are the same, these vectors cancel.

$$\begin{aligned}\vec{E} &= \vec{E}_1 + \vec{E}_2 + \vec{E}_3 + \vec{E}_4 \\ &= 0.\end{aligned}$$

Problem 6

$$\begin{aligned}U &= U_{12} + U_{13} + U_{14} + U_{23} + U_{24} + U_{34} \\ &= -\frac{1}{4\pi\epsilon_0} \frac{q^2}{L} - \frac{1}{4\pi\epsilon_0} \frac{q^2}{L} + \frac{1}{4\pi\epsilon_0} \frac{q^2}{\sqrt{2}L} + \frac{1}{4\pi\epsilon_0} \frac{q^2}{\sqrt{2}L} - \frac{1}{4\pi\epsilon_0} \frac{q^2}{L} - \frac{1}{4\pi\epsilon_0} \frac{q^2}{L} \\ &= \frac{1}{4\pi\epsilon_0} \frac{q^2}{L} \left(-4 + \frac{2}{\sqrt{2}} \right) \\ &= \frac{1}{4\pi\epsilon_0} \frac{q^2}{L} (-4 + \sqrt{2})\end{aligned}$$

Problem 7

$$\begin{aligned}\vec{F} &= I \vec{L} \times \vec{B} \\ &= (2.0) b \hat{j} \times 0.30 \hat{i} \\ &= (2.0)(2.0 \times 10^{-2})(0.30) \hat{j} \times \hat{i} \\ &= 12 \times 10^{-3} (-\hat{k}) \\ &= -\hat{k} 12 \times 10^{-3} \text{ N}\end{aligned}$$

Problem 8

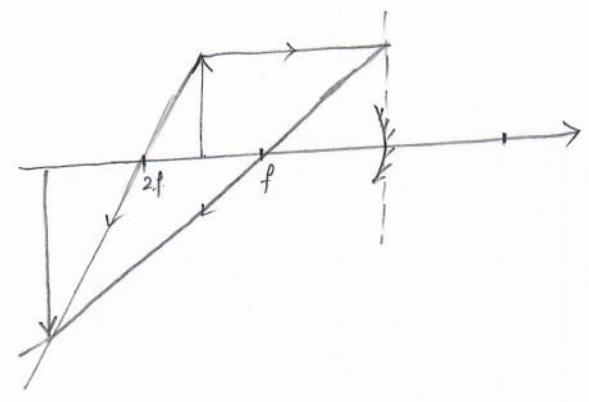
$f = +10.0\text{cm}$
 $p = +15.0\text{cm}$

$$\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$$

$$\frac{1}{15} + \frac{1}{q} = \frac{1}{10}$$

$$\frac{1}{q} = \frac{1}{10} - \frac{1}{15} = \frac{1}{30}$$

$$q = +30.0\text{cm}$$



(a) $+20.0\text{cm}$

(b) $q = +30.0\text{cm}$

(c) $m = -\frac{q}{p} = -\frac{(+30.0\text{cm})}{(+15.0\text{cm})} = -2.0$

(d) real

(e) inverted

(f) $m = \frac{h_i}{h_o}$
 $-2.0 = \frac{h_i}{(1.0\text{cm})}$ $h_i = -2.0\text{cm}$

Problem 9

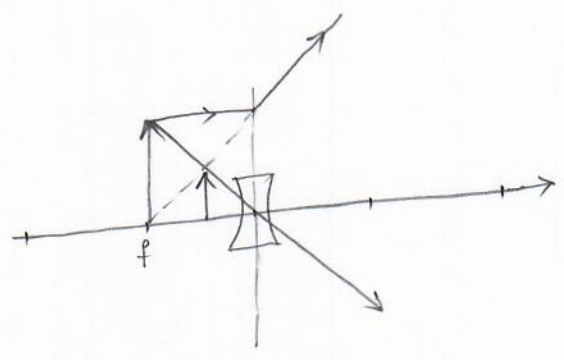
$f = -10.0\text{cm}$
 $p = +10.0\text{cm}$

$$\frac{1}{p} + \frac{1}{q} = \frac{1}{f}$$

$$\frac{1}{10} + \frac{1}{q} = \frac{1}{-10}$$

$$\frac{1}{q} = -\frac{1}{10} - \frac{1}{10} = -\frac{2}{10.0}$$

$$q = -5.0\text{cm}$$



$$m = -\frac{q}{p}$$

$$= -\frac{(-5.0\text{cm})}{(+10.0\text{cm})} = +0.50$$

(a) $q = -5.0\text{cm}$

(b) $m = +0.50$

(c) virtual

(d) upright