

Solutions

PHYS-203B-001

(Final Exam)

Spring 2022

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Problem 1

$$\begin{aligned} 1 \text{ gram of electrons} &= 10^{-3} \text{ kg of } e \frac{1 \text{ electron}}{9.1 \times 10^{-31} \text{ kg of } e} \frac{1.6 \times 10^{-19} \text{ C}}{1 \text{ electron}} \\ &= 1.8 \times 10^8 \text{ C} \end{aligned}$$

Problem 2

Change in flux induces a potential difference.

Problem 3

Virtual image.

Problem 4

$$\frac{1}{R_{\text{tot}}} = \frac{1}{R_1} + \frac{1}{R_2 + R_3} = \frac{1}{R} + \frac{1}{2R} = \frac{3}{2R}$$

$$R_{\text{tot}} = \frac{2}{3} R = \frac{2}{3} 25 = 17 \Omega$$

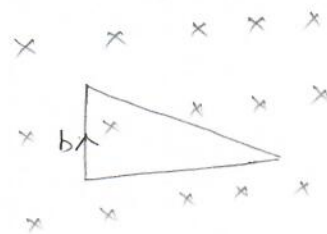
$$R_1 = R_2 = R_3 = R$$

Problem 5

$$\begin{aligned} F &= I L B \sin \theta \\ &= (2.0)(0.020)(0.30) \sin 90 \\ &= 1.2 \text{ mN} \end{aligned}$$

direction: along $-\hat{i}$

$$\vec{F} = -\hat{i} 1.2 \text{ mN}$$



Problem 6

(b) 8.0cm (d)

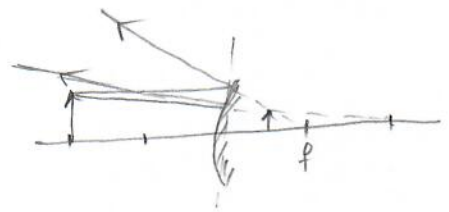
(c) $\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$ $\frac{1}{d_i} = \frac{1}{-4.0} - \frac{1}{8.0} = -\frac{3.0}{8.0}$
 $d_i = -\frac{8.0}{3.0} = -2.7\text{cm}$

(d) $m = -\frac{d_i}{d_o} = -\frac{(-2.7\text{cm})}{(8.0\text{cm})} = +0.33$

(e) virtual

(f) upright

(g) $m = \frac{h_i}{h_o}$ $+0.33 = \frac{h_i}{1.0\text{cm}} \Rightarrow h_i = 0.33\text{cm}$



Problem 7

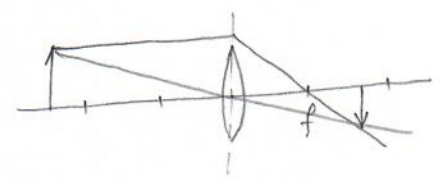
(b) $\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o} = \frac{1}{+4.0} - \frac{1}{10.0} = \frac{6.0}{40.0}$ (a)

$d_i = \frac{40.0}{6.0} = 6.7\text{cm}$

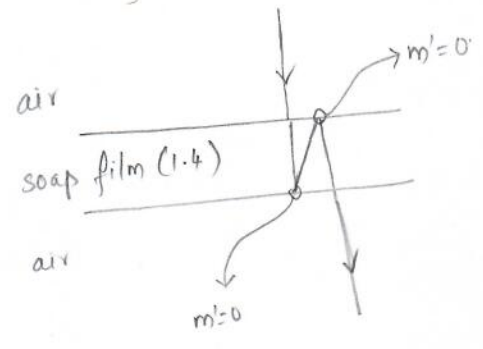
(c) $m = -\frac{d_i}{d_o} = -\frac{(6.7\text{cm})}{(10.0\text{cm})} = -0.67$

(d) real

(e) inverted.



Problem 8



$$\frac{(x_2 - x_1)}{\lambda} n + m' \frac{1}{2} = \begin{cases} m & \text{cons.} \\ m + \frac{1}{2} & \text{des.} \end{cases}$$

$$\frac{2t}{\lambda} n = m + \frac{1}{2}$$

$$t = \left(m + \frac{1}{2}\right) \frac{\lambda}{2n}$$

$$= (2m + 1) \frac{\lambda}{4n}$$

$$= (2m + 1) \frac{480 \text{ nm}}{4(1.4)} = (2m + 1) 86 \text{ nm}$$

- m=0 86 nm
- m=1 260 nm
- m=2 430 nm
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