

Physics 1214, Midterm III: solutions

Answers to multiple choice questions: 1:A; 2:B; 3:B; 4:B.

$$\text{P1 } \frac{1}{s_1} + \frac{1}{s'_1} = \frac{1}{f_1} \quad s'_1 = \frac{1}{\frac{1}{f_1} - \frac{1}{s_1}} = 2 \text{ cm}$$

$$m_1 = -\frac{s'_1}{s_1} = -1 \quad m_2 = \frac{m}{m_1} = -2 \quad m_2 = -\frac{s'_2}{s_2} \quad s'_2 = 2s_2$$

$$\frac{1}{s_2} + \frac{1}{s'_2} = \frac{1}{f_2} \quad \frac{1}{s_2} + \frac{1}{2s_2} = \frac{1}{f_2} \quad \frac{3}{2s_2} = \frac{1}{f_2} \quad s_2 = \frac{3}{2}f_2 = 3 \text{ cm}$$

$$d = 2 \text{ cm} + 3 \text{ cm} = 5 \text{ cm}$$

$$\text{P2 } \frac{1}{f_1} = (n_1 - 1) \left(\frac{1}{\infty} - \frac{1}{R} \right) \quad \frac{1}{f_2} = (n_2 - 1) \left(\frac{1}{R} - \frac{1}{\infty} \right)$$

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} = (n_2 - n_1) \frac{1}{R} \quad f = \frac{R}{n_2 - n_1} = 20 \text{ cm}$$

$$\text{P3 } \Delta y = \frac{Rm}{d}(\lambda_1 - \lambda_2) \quad R = \frac{d\Delta y}{m(\lambda_1 - \lambda_2)} = 0.5 \text{ m}$$

$$\text{P4 } B_{\max} = \frac{E_{\max}}{c} = 3.33 \times 10^{-9} \text{ T}$$

$$u_{\text{av}} = \frac{\varepsilon_0 E_{\max}^2}{2} = 4.425 \times 10^{-12} \text{ J/m}^3$$