

## PH212 - Chapter 35 Homework Solutions

$$2) m\lambda = d\sin\theta \quad \lambda = \frac{d\sin\theta}{m} = \frac{(0.0160 \times 10^{-3})(\sin 9.8^\circ)}{5}$$

$$\lambda = 5.45 \times 10^{-7} \text{ m} = 545 \times 10^{-9} \text{ m} = 545 \text{ nm}$$

5)



$$\sin\theta \approx \tan\theta = \frac{\text{opp}}{\text{adj}} = \frac{x}{L}$$

$$m\lambda = d\sin\theta \approx d\left(\frac{x}{L}\right) \quad m=1$$

$$x \approx \frac{L\lambda}{d} = \frac{(3.60)(656 \times 10^{-9})}{(0.0600 \times 10^{-3})} = 0.0394 \text{ m} = 3.94 \text{ cm}$$

$$9) \left. \begin{array}{l} m_1\lambda_1 = d_1\sin\theta_1 \quad m_1=2 \quad \lambda_1=460 \text{ nm} \\ (m_2 + \frac{1}{2})\lambda_2 = d_2\sin\theta_2 \quad \lambda_2=? \end{array} \right\} \begin{array}{l} d_1=d_2 \quad \theta_1=\theta_2 \\ d_1\sin\theta_1 = d_2\sin\theta_2 \end{array}$$

$$m_1\lambda_1 = (m_2 + \frac{1}{2})\lambda_2 = \left(\frac{2m_2+1}{2}\right)\lambda_2$$

$$\lambda_2 = \frac{2m_1\lambda_1}{2m_2+1} = \frac{4\lambda_1}{2m_2+1}$$

$$\text{If } m_2=0, \text{ then } \lambda_2 = 4\lambda_1 = 4(460) = 1840 \text{ nm} \quad (\text{not visible})$$

$$\text{If } m_2=1, \text{ then } \lambda_2 = \frac{4}{3}\lambda_1 = \frac{4}{3}(460) = 613 \text{ nm} \quad (\text{visible})$$

$$\text{If } m_2=2, \text{ then } \lambda_2 = \frac{4}{5}\lambda_1 = \frac{4}{5}(460) = 368 \text{ nm} \quad (\text{not visible})$$

$$\lambda_2 = 613 \text{ nm.}$$