

## Physics 1214, Homework #9: solutions

Answers to multiple choice questions: M1: B; M2: C.

$$\text{P1: } \Delta y = R \frac{\lambda}{d} = 10d \quad d = \sqrt{\frac{R\lambda}{10}} = 0.25 \text{ mm}$$

$$\text{P2: } d \sin \theta = m\lambda \quad m < \frac{d}{\lambda} = 4.4$$

There are  $2 \times 4 + 1 = 9$  maxima ( $m = 0, \pm 1, \pm 2, \pm 3, \pm 4$ ).

$$\text{P3: } n_{red} = 1.201 + \frac{0.049}{(700/300)^2} = 1.210$$

$$n_{violet} = 1.201 + \frac{0.049}{(300/300)^2} = 1.250$$

$$\theta_{b \text{ red}} = \arcsin\left(\frac{\sin \theta_a}{n_{red}}\right) = 35.76^\circ$$

$$\theta_{b \text{ violet}} = \arcsin\left(\frac{\sin \theta_a}{n_{violet}}\right) = 34.45^\circ$$

$$d_{red} = h \frac{\sin(\theta_a - \theta_{b \text{ red}})}{\cos \theta_{b \text{ red}}} = 0.198 \text{ cm}$$

$$d_{violet} = h \frac{\sin(\theta_a - \theta_{b \text{ violet}})}{\cos \theta_{b \text{ violet}}} = 0.222 \text{ cm}$$

$$\Delta d = d_{violet} - d_{red} = 0.024 \text{ cm}$$

$$\text{P4: } \frac{1}{f} = (n - 1) \frac{1}{R} \quad R = (n - 1)f = 10 \text{ cm}$$

$$r = \sqrt{\frac{1}{2} R \lambda} = 1.8 \times 10^{-4} \text{ m}$$