

32. (a) The first minimum of the diffraction pattern is at  $5.00^\circ$ , so

$$a = \frac{\lambda}{\sin \theta} = \frac{0.440 \mu\text{m}}{\sin 5.00^\circ} = 5.05 \mu\text{m} .$$

(b) Since the fourth bright fringe is missing,  $d = 4a = 4(5.05 \mu\text{m}) = 20.2 \mu\text{m}$ .

(c) For the  $m = 1$  bright fringe,

$$\alpha = \frac{\pi a \sin \theta}{\lambda} = \frac{\pi(5.05 \mu\text{m}) \sin 1.25^\circ}{0.440 \mu\text{m}} = 0.787 \text{ rad} .$$

Consequently, the intensity of the  $m = 1$  fringe is

$$I = I_m \left( \frac{\sin \alpha}{\alpha} \right)^2 = (7.0 \text{ mW/cm}^2) \left( \frac{\sin 0.787 \text{ rad}}{0.787} \right)^2 = 5.7 \text{ mW/cm}^2 ,$$

which agrees with Fig. 37-36. Similarly for  $m = 2$ , the intensity is  $I = 2.9 \text{ mW/cm}^2$ , also in agreement with Fig. 37-36.