

Ch. 4 Prob. 42

$$\lambda = 580 \text{ nm}$$

$$\text{Grating } \frac{1500 \text{ lines}}{\text{cm}}$$

Find the angle of the 3rd-order maximum

~~convert the grating~~

Find the distance between lines in the grating.

$$d = \frac{1}{\frac{1500 \text{ lines}}{\text{cm}}} = 6.67 \times 10^{-4} \frac{\text{cm}}{\text{line}}$$

convert to meters

$$d = 6.67 \times 10^{-6} \frac{\text{m}}{\text{line}}$$

Now use the formula for a double-slit maximum

$$d \sin \theta = m \lambda$$

$$\sin \theta = \frac{m \lambda}{d}$$

$$\theta = \sin^{-1} \left( \frac{m \lambda}{d} \right) = \sin^{-1} \left( \frac{(3)(580 \times 10^{-9} \text{ m})}{6.67 \times 10^{-6} \text{ m}} \right)$$

$$\theta = \sin^{-1} (0.261)$$

$$\theta = \boxed{15.1^\circ}$$