

71. (a) We use Eq. 37-12:

$$\begin{aligned}\theta &= \sin^{-1} \left( \frac{1.22\lambda}{d} \right) = \sin^{-1} \left[ \frac{1.22(v_s/f)}{d} \right] \\ &= \sin^{-1} \left[ \frac{(1.22)(1450 \text{ m/s})}{(25 \times 10^3 \text{ Hz})(0.60 \text{ m})} \right] = 6.8^\circ .\end{aligned}$$

(b) Now  $f = 1.0 \times 10^3 \text{ Hz}$  so

$$\frac{1.22\lambda}{d} = \frac{(1.22)(1450 \text{ m/s})}{(1.0 \times 10^3 \text{ Hz})(0.60 \text{ m})} = 2.9 > 1 .$$

Since  $\sin \theta$  cannot exceed 1 there is no minimum.