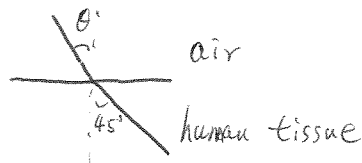


Physics 301 Homework Set 4

1) According to Snell's Law



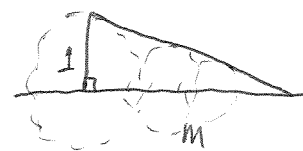
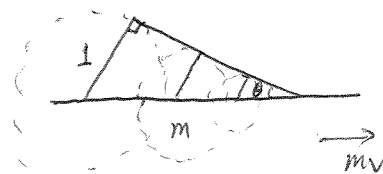
$$\frac{\sin \theta}{\sin 45^\circ} = \frac{v_{\text{air}}}{v_{\text{tissue}}} = \frac{340}{1540}$$

$$\text{so } \theta = \arcsin\left(\frac{1}{\sqrt{2}} \times \frac{340}{1540}\right) \approx 9^\circ \quad \#$$

2) In a time interval Δt , the wave propagates $v\Delta t$ perpendicular to the cone, while the source moves $mv\Delta t$:

$$\text{so } \sin \theta = \frac{1}{m}, \quad \theta = \arcsin \frac{1}{m}$$

Note that the cone should not look like:



#

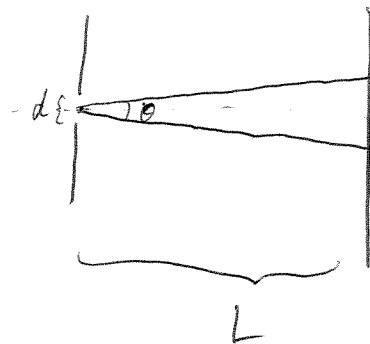
3) Recall that in single slit diffraction, the first minimum occurs when:

$$d \sin \theta = \lambda \quad (d \ll L)$$

θ small so that $\sin \theta \sim \theta$,

Now $\lambda \rightarrow \lambda/2$, (because $f \rightarrow 2f$)

$$\text{so } \theta \rightarrow \frac{\theta}{2} \sim 5^\circ \quad \#$$



$$4) \quad f_n = \frac{(2n+1)v}{L} \quad \text{so } \frac{f_{n+1}}{f_n} = \frac{2n+3}{2n+1} = \text{ratio of two odd integers.}$$

$$\text{so } \frac{f_{n+1}}{f_n} \text{ cannot be } \frac{6}{5}.$$