PHYS 133
Ch # 12
H.W. Solution

#3. The speed of sound at 20°C is 343 m/s.

$$\lambda = \frac{v}{f}$$

for $f = 20\ Hz$

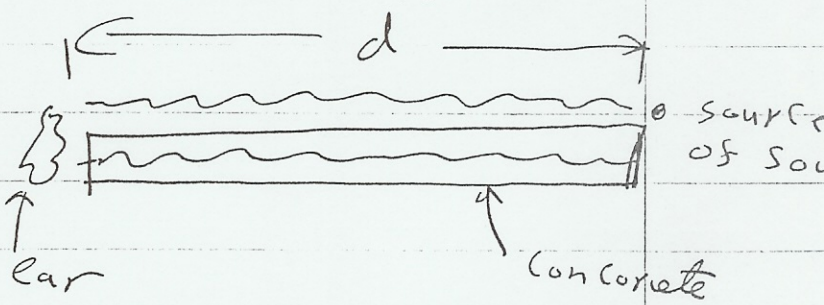
$$\lambda = \frac{343}{20} = 17.15\ m.$$

for $f = 20{,}000\ Hz$

$$\lambda = \frac{343}{20{,}000} = 1.71 \times 10^{-2}\ m$$

$$= 1.71\ cm.$$

#5



There are two waves, one travelling in the concrete and the other on air

$v_a = 343\ m/s$ = speed of sound on air

$v_c \simeq 5000\ m/s$ = speed of sound on Con

#5 Cont

let t_1 = time of travell in air

t_2 = " " " " concorete

$t_1 - t_2 = 1.4\ s$

or $t_1 = 1.4 + t_2$

$t_1 = \frac{d}{343} \Rightarrow t_2 = \frac{d}{343} - 1.4$

$t_2 = \frac{d}{5000}$

$\therefore \frac{d}{343} - 1.4 = \frac{d}{5000}$

$\therefore d = 14.5d - 7000$

or $13.5d = 7000$

$\therefore d = 518.5\ m.$

#9 $\beta = 10 \log \left(\frac{I}{10^{-12}}\right)$

Here $120 = 10 \log \left(\frac{I_1}{10^{-12}}\right)$

or $\frac{I_1}{10^{-12}} = 10^{12}$

or $I_1 = 1 \text{ W/m}^2$.

For 20 dB

$20 = 10 \log \left(\frac{I_2}{10^{-12}}\right)$

or $\frac{I_2}{10^{-12}} = 10^2$

or $I_2 = 10^{-10} \text{ W/m}^2$.

$\therefore \frac{I_2}{I_1} = \frac{10^{-10}}{1}$

$= 10^{-10}$