

Physics 301 Homework 7

April 12, 2008

1.

$$I = \frac{P}{4\pi r^2} = 1.99 \times 10^{-4} W/m^2 \quad (1)$$

$$SIL = 10 \log \frac{I}{I_0} = 83dB \quad (2)$$

2. $p \propto \frac{1}{r}$ so that:

$$p_6 = \frac{p_3}{2} \quad (3)$$

$$SPL_6 = 20 \log \frac{p_3}{2p_0} = SPL_3 - 20 \log 2 = 34dB \quad (4)$$

3. In this case we can sum up the intensity because different waves don't interfere here.

$$I_{total} = 20I \quad (5)$$

$$\begin{aligned} SPL_{total} &= 10 \log I_{total} + const. = 10 \log I + 10 \log 20 + const. \\ &= SPL_{indiv} + 10 \log 20 = 93dB \end{aligned} \quad (6)$$

4.

$$L_L = SPL - 10phons \quad (7)$$

in this case, so it is 70 and 83 phons respectively.

5.

$$S = 2^{\frac{phons-40}{10}} \quad (8)$$

so it is 8 and 20 sones respectively.

6. It would be dBC, since at high sound pressures, the frequency response of the ear is rather flat, compensated by the C-weighting. (At low sound pressures, you would use A-weighting to compensate for the frequency response of the ear.)