

88. The source being a “point source” means $A_{\text{sphere}} = 4\pi r^2$ is used in the intensity definition $I = P/A$, which further implies

$$\frac{I_2}{I_1} = \frac{P/4\pi r_2^2}{P/4\pi r_1^2} = \left(\frac{r_1}{r_2}\right)^2 .$$

From the discussion in §18-5, we know that the intensity ratio between “barely audible” and the “painful threshold” is $10^{-12} = I_2/I_1$. Thus, with $r_2 = 10000$ m, we find $r_1 = r_2\sqrt{10^{-12}} = 0.01$ m.