Chapter 17

Problem 66

$r_1 = 3.0\ m \qquad \beta_1 = 40.0\ dB$

what is the noise level of 1000 flies at the same distance?

The short answer is that each 10x of the Intensity is +10 dB

1000 flies because the intensity to be 1000x larger or 10^3

∴ the ~~sound level~~ intensity will increase by +10+10+10 and the final ~~intensity~~ sound level is

$\beta_f = 40+30 = \boxed{70\ dB}$

The long answer is

$\beta_1 = 10 \log\left(\frac{I}{I_0}\right) \rightarrow \frac{\beta_1}{10} = \log\frac{I}{I_0} \rightarrow I_1 = I_0\, 10^{\beta_1/10}$

Now 1000 flies have an intensity in $\left(\frac{W}{m^2}\right)$ of

$I_f = 1000\, I_0\, 10^{\beta_1/10}$

$= 10^3 I_0\, 10^{\beta_1/10}$

Use law of exponents

$I_f = I_0\, 10^3 \cdot 10^{\beta_1/10} = I_0\, 10^{(3+\beta_1/10)}$

Now $\beta_f = 10 \log\left(\frac{I_f}{I_0}\right) = 10 \log\left(\frac{I_0\, 10^{(3+\beta_1/10)}}{I_0}\right)$

$= 10 \log\left(10^{3+\beta_1/10}\right) = 10\left[3 + \frac{\beta_1}{10}\right] = 30 + \beta_1$

$\beta_f = 30+40 = \boxed{70\ dB}$