145.

Problem 20.27 (RHK)

Suppose that a rustling leaf generates 8.4 dB of sound. We have to find the sound level from a tree with 2.71×10^5 rustling leaves.

Solution:

Decibel definition of sound level is

$$\text{sound level} = 10\log\frac{I}{I_0},$$

where

$$I_0 = 10^{-12}\ \text{W m}^{-2}.$$

Sound level 8.4 dB corresponds to intensity I_1,

$$8.4 = 10\log\frac{I_1}{I_0}.$$

Sound level due to 2.71×10^5 rustling leaves will be

$$SL = 10\log\left(\frac{2.71\times10^5 I_1}{I_0}\right) = 10\left(\log\left(2.71\times10^5\right) + \log\frac{I_1}{I_0}\right),$$

$$= 10\left(0.433 + 5\right) + 8.4,$$

$$= 63\ \text{dB}.$$