

Applications of Logarithms

Learning Objectives

- Applied logarithmic models
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Applied logarithmic models

1. Decibels are measured using the equation $D = 20 \log\left(\frac{P_2}{P_1}\right)$ where pressure is measured in Pascals, and the reference sound pressure $P_1 = 0.02 \text{ mPa}$ (millipascals). Damage to human hearing can occur at 85 decibels. Find the sound pressure P_2 that produces that level of sound. Report your answer in pascals.

2. pH is measured using the formula $pH = -\log_{10}[H^+]$, where H^+ is the concentration of positive hydrogen ions. What is the concentration of H^+ ions when the pH is 4.5?

3. The Richter scale can be measured by the formula $R = \log\left(\frac{I}{I_0}\right)$, where I_0 is the intensity of a reference earthquake. The strongest earthquake to strike Oklahoma in 2016 was a 5.8 on the Richter scale. In 2018, a 7.9 earthquake struck off the coast of Alaska. How much more powerful was the Alaska earthquake as compared to the Oklahoma quake?

ANSWER KEY

1. $P_2 \cong 356 \text{ mPa}$ or 0.356 Pa
2. $H^+ = 3.16 \times 10^{-5}$
3. approximately 126 times more powerful