Logarithms Applications

Real uses of logarithms

pH scale

- A value of 1-14
  - 14 is the most alkaline (base)
  - 1 is the most acidic
  - 7 is considered "neutral" as in distilled water

Look at the pH scale image…

- For every one linear movement on the pH scale, what happens to the hydrogen ion (H^+) concentration?
  - For example, if you move from 11 to 10
  - What about 3 to 4?
  - What about 5 to 8?

To find pH given H^+

- $pH = -\log H^+$
  - The pH scale value is the opposite of the logarithm (base 10) of the hydrogen ion concentration.

http://www.yakimablueberries.com/

Blueberries have an H+ concentration of 0.000794 moles/liter. What is the pH value?

Are blueberries more acidic or alkaline?

http://manbir-online.com/nutrition/banana.htm

Bananas have a pH value of 5.2. What is the concentration of H+?

Comparing Intensities

- Each jump on the "linear scale" relates to a multiple of ten (it increases ten-fold)
- By how many times more acidic are blueberries than bananas?

The Richter Scale

- Linear value used to describe an earthquake's destruction
- Scale from 0 to 10 – nothing has been recorded over 9.5
  - Belief that the Yucatan Peninsula comet collision was 12.55

Comparing Intensities

- Each jump on the "linear scale" relates to a multiple of ten (it increases ten-fold)
- By how many times more acidic are blueberries than bananas?

Comparing Intensities

- How many times more intense was the Haiti earthquake of 2010 (7.0) than the Sept 2012 Dallas earthquake (3.5)?

Decibels

- A value from 0 to 140+ that tells you how loud a sound is
  - It is a measure of the number of watts per square meter of sound waves
  - The higher the number of watts per square meter, the louder the sound (and the higher the decibel level)

How to find a decibel given watts/square meter

$$dB = 10 \cdot \log \frac{I}{10^{-12}}$$

Where $I = intensity\ of\ sound\ in\ {}^{w}/_{m^2}$ and 10^{-12} is the intensity of sound at zero decibels.

Find the decibel value of a sound with an intensity of $10^{-2.5}$. What sound on our scale most closely matches this decibel?

Comparing Intensities

- Because the decibel scale counts by tens instead of ones like the pH scale or Richter scale, we must look at decibel "jumps" in groups of ten. This relates to an increase in intensity by tenfold.
- For example, a sound of 56 dB is 100 times more intense than a sound of 36 dB. (56 is two tens more than 36, and $10 \cdot 10 = 100$)