Richter Scale, PH levels + Decibel Level (7.2)

* formulas given

Richter Scale

$y = \log x$

amplitude of vibrations

magnitude (Richter Scale)

pg. 427 table

Richter Scale of 0
What was the amplitude?

$0 = \log_{10} x$

$10^0 = x$

$1 = x$

ex 1) How much more intense is the Chile Earthquake with magnitude of 9.5 than the Grand Banks Earthquake with a magnitude of 7.2

Chile

$9.5 = \log x$

$10^{9.5} = x$

Grand Banks

$7.2 = \log x$

$10^{7.2} = x$

* How much more intense does not mean subtraction. Its a scale factor, so divide.

$$\frac{10^{9.5}}{10^{7.2}} = 10^{9.5-7.2} = 10^{2.3} = 200$$

times more intense

PH-level pg. 433

$p(x) = -\log x$

PH level

hydrogen ions mol/L

a) 0.0001 mol/L
what is PH level?

$p(x) = -\log(0.0001)$
$= 4$

b) PH = 2
What is the concentration of hydrogen ions?

$2 = -\log x$
$-2 = \log x$
$10^{-2} = x$
$\frac{1}{100} = x$

c) Solution A — PH of 1.6

Solution B — PH of 2.5

How much more acidic is solution A than B?

$p(x) = -\log x$

$1.6 = -\log x$
$-1.6 = \log x$
$10^{-1.6} = x$

$2.5 = -\log x$
$-2.5 = \log x$
$10^{-2.5} = x$

$\frac{10^{-1.6}}{10^{-2.5}} = 10^{-1.6-(-2.5)} = 10^{0.9}$
$= 7.943$
times more acidic

Decibel Level

$$\beta = 10(\log I + 12)$$

β: decibel level of sound

I: sound intensity watts/m^2

pg. 438

#19 Rock Concert ⇒ 120 dB

Radio ⇒ 40 dB

How many more times louder is the concert than the radio?

$$\beta = 10(\log I + 12)$$

concert

$$\frac{120}{10} = \frac{\cancel{10}(\log I + 12)}{\cancel{10}}$$

$$12 = \log I + 12$$

$$12 - 12 = \log I$$

$$0 = \log_{10} I$$

$$10^0 = I$$

$$1 = I$$

Radio

$$\frac{40}{10} = \frac{\cancel{10}(\log I + 12)}{\cancel{10}}$$

$$4 = \log I + 12$$

$$4 - 12 = \log I$$

$$-8 = \log I$$

$$10^{-8} = I$$

$$\frac{1}{10^{-8}} = 10^8 = 100\,000\,000$$