

Richter Scale, PH levels +  
Decibel Level (7.2)

\* formulas given

Richter Scale

$y = \log X$   
 ↑ magnitude (Richter Scale)      ↑ amplitude of vibrations

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

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

↑  
decibel  
level of  
sound

↑  
sound  
intensity  
watts/m<sup>2</sup>

pg. 438

#19, Rock concert  $\Rightarrow$  120 dB

Radio  $\Rightarrow$  40 dB

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

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

concert

$$120 = 10(\log I + 12)$$

$$12 = \log I + 12$$

$$12 - 12 = \log I$$

$$0 = \log I$$

$$10^0 = I$$

$$1 = I$$

Radio

$$40 = 10(\log I + 12)$$

$$4 = \log I + 12$$

$$4 - 12 = \log I$$

$$-8 = \log I$$

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

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