3.5 Day 2

Obj: 1. Solve application problems.

1 m to 1 km

$1 \rightarrow \log 1 = 0$ because 10^0

$1000 \rightarrow \log 1000 = 3$ because 10^3

Nov 27-9:31 AM

Richter Scale: measures earthquakes

uses logarithms → order of magnitude

$$R = \log \frac{a}{T} + B$$

a: amplitude

T: period of seismic wave

B: dampening constant

Nov 27-9:46 AM

How many times more severe is an earthquake with Richter 7.9 than an earthquake with Richter 5.9?

$R_1 = \log \frac{a_1}{T} + B = 7.9$

$R_2 = \log \frac{a_2}{T} + B = 5.9$

looking for: $\frac{a_1}{a_2}$

$R_1 - R_2 = 7.9 - 5.9 = \left(\log \frac{a_1}{T} + B\right) - \left(\log \frac{a_2}{T} + B\right)$

$2 = \log \frac{a_1}{T} - \log \frac{a_2}{T}$

$2 = \log \left(\frac{a_1}{T} \cdot \frac{T}{a_2}\right)$

$2 = \log \frac{a_1}{a_2}$

$10^2 = \frac{a_1}{a_2}$

100 times greater

Nov 27-9:53 AM

pH levels: measures acidity

$pH = -\log [H^+]$

H^+ : hydrogen ions

Vinegar has pH 2.4
Baking soda pH 8.4

What are their H^+ concentrations?

Vinegar: $pH = -\log [H^+]$

$2.4 = -\log [H^+]$

$-2.4 = \log [H^+]$

$10^{-2.4} = [H^+]$

$[H^+] \approx 3.98 \times 10^{-3}$

Baking Soda:

$8.4 = -\log [H^+]$

$-8.4 = \log [H^+]$

$10^{-8.4} = [H^+]$

$\approx 3.98 \times 10^{-9}$

Nov 27-9:59 AM

Newton's Law of Cooling

$$T(t) = T_m + (T_0 - T_m)e^{-kt}$$

T_0 : initial temp.

T_m : temp of surroundings

t : time

K : cooling constant

Nov 27-10:07 AM

A hard boiled egg at 96°C is placed in 16°C water to cool. Four minutes later the egg is 45°C. Determine when it will be 20°C.

$T(t) = T_m + (T_0 - T_m)e^{-kt}$

$T(t) = 16 + 80e^{-kt}$

$45 = 16 + 80e^{-4k}$

$-16 \quad -16$

$\frac{29}{80} = \frac{80e^{-4k}}{80}$

$\ln\frac{29}{80} = \ln e^{-4k}$

$\frac{\ln\frac{29}{80}}{-4} = \frac{-4k}{-4}$

$k = \frac{\ln\frac{29}{80}}{-4} \approx .2536\ldots$

$T(t) = 16 + 80e^{-.2536t}$

$20 = 16 + 80e^{-.2536t}$

$-16 \quad -16$

$\frac{4}{80} = \frac{80e^{-.2536t}}{80}$

$\ln\frac{4}{80} = \ln e^{-.2536t}$

$\frac{\ln\frac{4}{80}}{-.2536} = \frac{-.2536t}{-.2536}$

$t \approx 11.809$

Nov 27-10:17 AM