

1. Acidity is defined by the formula $\text{pH} = -\log[\text{H}^+]$, where $[\text{H}^+]$ is the hydrogen ion concentration measured in moles per liter. If the pH is less than 7, then it's considered acidic. If greater than 7, its basic and if it measures 7, then its neutral. If a solution was tested and the hydrogen ion concentration given by $[\text{H}^+] = .0003$, find the pH value and determine if it is basic or acidic.

Evaluating pH when $[\text{H}^+]$ is .003, we have $\text{pH} = -\log[\text{H}^+]$

$$\begin{aligned}\text{pH} &= -\log(.003) \\ \text{pH} &\approx 3.523\end{aligned}$$

That's less than 7, so the solution is acidic.

2. Using acidity as defined by the formula $\text{pH} = -\log[\text{H}^+]$, where $[\text{H}^+]$ is the hydrogen ion concentration measured in moles per liter, testing a solution of ammonia with $[\text{H}^+] = 1.3 \times 10^{-9}$, determine if it's acidic or basic.

$$\begin{aligned}\text{pH} &= -\log(1.3 \times 10^{-9}) \\ &= -\log 1.3 + \log 10^{-9} \\ &= -(\log 1.3 - 9\log 10) \\ &\approx + 8.8861\end{aligned}$$

Since that pH is greater than 7, it's basic.

3. The formula for loudness is given by $\text{dB} = 10\log(I/I_0)$. dB is decibels, I_0 is sound that can be barely heard and I is how more times intense than the initial sound being barely heard. If a cat's purr is 316 times as intense as a threshold sound, find the decibel rating.

$$\begin{aligned}\text{dB} &= 10 \log(I/I_0) \\ &= 10 \log(316 I_0 \div I_0) \\ &= 10 \log(316) \\ &\approx 24.9969\end{aligned}$$