

pH: Log relationship

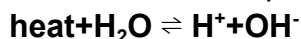
One of the challenges in preparing these is guessing what the ABA was asking on a given ITE. Insight is always appreciated (in a manner consistent with the ABA's policy on question and answer reproduction) from those who took the test. However, here is my best guess for what the ABA is looking for in this keyword. This writeup will not address the Stewart approach to acid-base management and strong ion difference.

pH is defined as the negative logarithm of the concentration of hydrogen ions. That is:

$$\text{pH} = -\log_{10}([\text{H}^+])$$

Therefore, for every **1 unit decrease in pH**, the concentration of **H⁺ is increased by 10-fold** and vice versa. A **2 point increase in pH** means the **[H⁺] has dropped 100-fold**. Burn this into your memory and don't get tripped up: questions of this ilk are relatively simple and depend on carelessness rather than complex math.

I believe that is the sum of knowledge needed for this keyword, the below is important background information to understand pH-stat vs. alpha-stat and is included for interested parties. A pH of 7 is often cited as neutral, that is equal [H⁺] and [OH⁻] but this is not strictly accurate. The dissociation of water requires heat and can be described:



Therefore, following Le Chatelier's principle, the addition of heat to water will drive the equation to the right and increase [H⁺] and [OH⁻]. The solution is still neutral since [H⁺] and [OH⁻] are equal, but since pH only looks at [H⁺] the pH drops. A pH of 7 is neutral only at standard ambient temperature and pressure (25C and 100kPa) and in fact, the actual pH of neutral in our bodies (37C) is slightly below 7.

If the last bit confused you, bury in the deep recesses of your memory as it largely is only applicable when discussing pH-stat. Then, when ready for a tidal wave of nerdiness, come find me in the hallway.

Further reading:

<https://web.mst.edu/~gbert/logs/pH.html>

<https://derangedphysiology.com/main/cicm-primary-exam/required-reading/acid-base-physiology/Chapter%20114/neutrality-and-influence-temperature-and-pressure-ph>

I welcome all chemistry nerds to "um actually" me about this summary as I intentionally skimmed and "rounded" some nuance and other points for the sake of clarity