Question #79143

what is the percentage change in [H+] if pH of the blood changes from pH 7.4 to 7.2

The percentage change of $[H^+]$ is 58.49%.

Solution:

In chemistry, pH is a logarithmic scale used to specify the acidity or basicity of an aqueous solution. It is approximately the negative of the base 10 logarithm of the molar concentration, measured in units of moles per liter, of hydrogen ions. [1]

So, a formula for pH is:

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

For blood this formula will change, because blood is a buffer solution (For example, the bicarbonate buffering system is used to regulate the pH of blood. [2]):

$$pH = -logK_{\alpha,H_2CO_3} + \log(\frac{[HCO_3^-]}{[H_2CO_3]})$$

$-logK_{\alpha,H2CO3}$ will not change, if pH changes, because it has constant meaning – 6.1.

So, the ΔpH is equal to:

$$\Delta pH = pH_1 - pH_2 = -\log[H^+]_1 + \log[H^+]_2 = log\frac{[H^+]_2}{[H^+]_1}$$

$[H^+]_2/[H^+]_1$ is equal to:

$$\frac{[H^+]_2}{[H^+]_1} = 10^{\Delta pH} = 10^{0.2} = 1.5849$$

$$\Delta[H^+] = \frac{[H^+]_2}{[H^+]_1} - \frac{[H^+]_1}{[H^+]_1} = \frac{[H^+]_2}{[H^+]_1} - 1 = 1.5849 - 1 = 0.5849 = 58.49\%$$

So, the percentage change of $[H^+]$ is 58.49%.

References:

[1] https://en.wikipedia.org/wiki/PH

[2] https://en.wikipedia.org/wiki/Bicarbonate_buffer_system