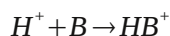


Question:

The pKa of one of the hydrogens that is attached to one of the nitrogens of the purine guanine is 9.7. If guanine is in a solution that has a pH of 10.2, then what fraction of the guanine molecules would be in the protonated form at this pH?

Answer:

For reaction:



$$pK_a = -\log\left(\frac{[H^+][B]}{[HB^+]}\right)$$

$$pK_a = pH + \log\left(\frac{[HB^+]}{[B]}\right)$$

So, we have relation between protonated and unprotonated forms.

$$\frac{[HB^+]}{[B]} = 10^{(pK_a - pH)} = 10^{(9.7 - 10.2)} = 0.316$$

we need an expression:

$$\frac{[HB^+]}{[HB^+] + [B]} = \frac{[HB^+]}{[HB^+] + \frac{[HB^+]}{0.316}} = \frac{1}{1 + 1/0.316} = 0.24 = 24\%$$