Answer on Question #67405, Chemistry, General Chemistry

Why is the equilibrium between the acid NaH_2PO_4 and its conjugate base Na_2HPO_4, a suitable buffer for maintaining intracellular pH (pH 6.9-7.3)?

Solution:

This buffer solution is a mixture of a weak acid H_3PO_4 and a salt of its conjugate base (NaOH) - Na_2HPO_4. So, the acid for this buffer is NaH_2PO_4, and the salt is Na_2HPO_4.

The pH value of acidic buffer system we can calculate, using formula:

$pH = pKa + \lg\frac{C(Na2HPO4)}{C(NaH2PO4)}$, where pKa = - lg Ka (Ka is acid constant dissociation).

$Ka(H_3PO_4) = 6.2 \cdot 10^{-8}$

We can determine the pKa value:

$pKa = -\lg 6.2 \cdot 10^{-8} = 7.21$

If the ratio $\frac{C(Na2HPO4)}{C(NaH2PO4)} = 1$, it means, that:

$\lg\frac{C(Na2HPO4)}{C(NaH2PO4)} = \lg 1 = 0$

Thus:

$pH = 7.21 + 0 = 7.21$

Answer: pH = 7.21.