Chem 321

Module 14: Calculation of the Buffer pH Using Concentrations

Buffer solution: mix 100 mL of 0.030 M KH_2PO_4 + 100 mL of 0.050 M K_2HPO_4

Solution

Since equal volumes of the solutions are mixed, the resulting concentration of each salt is just one-half of its starting concentration.

$[H_2PO_4^-] = 0.015$ M and $[HPO_4^{2-}] = 0.025$ M

	$H_2PO_4^-$	+ H_2O	⇆	H_3O^+	+	HPO_4^{2-}
init	0.015 M			$\sim 10^{-7}$ M		0.025 M
equil	~0.015			x		~0.025

$$K_a = 6.3\,x\,10^{-8} = \frac{[H_3O^+][HPO_4^{2-}]}{[H_2PO_4^-]} = \frac{[H_3O^+](0.025)}{(0.015)}$$

$$[H_3O^+] = 3.7_8 \times 10^{-8} \quad \Rightarrow \quad \text{pH} = -\log([H_3O^+]) = \mathbf{7.42}$$