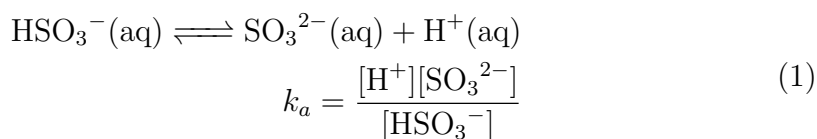# Chapter 13 − Problems 34, 48, 54, 72

Michael Brodskiy
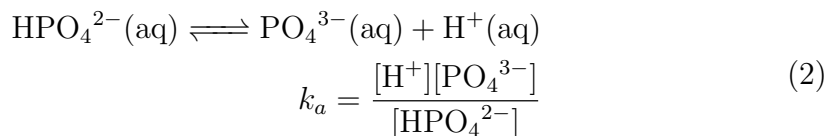
Instructor: Mr. Morgan

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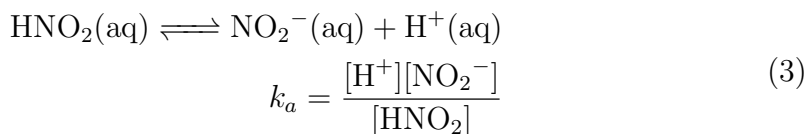
34. (a)

$$HSO_3^-(aq) \rightleftharpoons SO_3^{2-}(aq) + H^+(aq)$$
$$k_a = \frac{[H^+][SO_3^{2-}]}{[HSO_3^-]} \tag{1}$$

(b)

$$HPO_4^{2-}(aq) \rightleftharpoons PO_4^{3-}(aq) + H^+(aq)$$
$$k_a = \frac{[H^+][PO_4^{3-}]}{[HPO_4^{2-}]} \tag{2}$$

(c)

$$HNO_2(aq) \rightleftharpoons NO_2^-(aq) + H^+(aq)$$
$$k_a = \frac{[H^+][NO_2^-]}{[HNO_2]} \tag{3}$$

48.

$$HC_4H_3N_2O_3(aq) \rightleftharpoons C_4H_3N_2O_3^-(aq) + H^+(aq)$$
$$k_a = \frac{[C_4H_3N_2O_3^-][H^+]}{[HC_4H_3N_2O_3]}$$
$$2.34 = -\log_{10}\left([H^+]\right)$$
$$[H^+] = .0046\,[M]$$
$$\frac{9}{128} = .07[mol_{HC_4H_3N_2O_3}]$$
$$\frac{.07}{.325} = .216[M] \tag{4}$$

	$[HC_4H_3N_2O_3]$	$[C_4H_3N_2O_3^-]$	$[H^+]$
I	.216	0	0
C	−.0046	.0046	.0046
E	.2114	.0046	.0046

$$\frac{.0046^2}{.2114} = 1 \cdot 10^{-4}$$

54. (a)
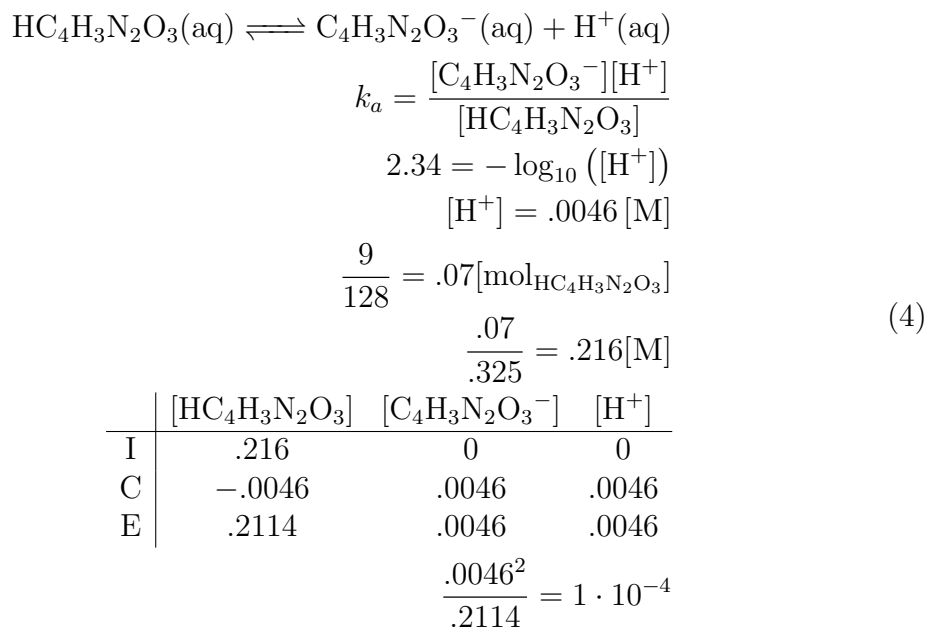
$$\frac{x^2}{.279} = 3.38 \cdot 10^{-5} \tag{5}$$
$$x = .00307 \,[\text{M}]$$

(b)

$$\frac{10^{-14}}{.00307} = 3.26 \cdot 10^{-12} \tag{6}$$

(c)

$$-\log_{10}(.00307) = 2.52 \tag{7}$$

(d)

$$\frac{.00307}{.279} \cdot 100 = 1.1\% \tag{8}$$

72.

	$[\text{NaHCO}_3]$	$[\text{NaCO}_3^-]$	$[\text{H}^+]$
I	.72	0	0
C	$-x$	x	x
E	$.72 - x$	x	x

$$k_a = 8.369 \cdot 10^{-21}$$
$$\frac{x^2}{.72 - x} = 8.369 \cdot 10^{-21} \tag{9}$$
$$x = 7.7625 \cdot 10^{-11}$$
$$\text{pH} = -\log_{10}(x) = 10.11$$
$$[\text{OH}^-] = 10^{-(14-10.11)} = 1.3 \cdot 10^{-4}$$