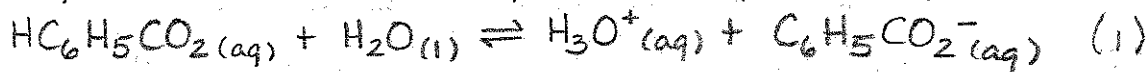


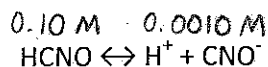


4. Benzoic acid, $\text{HC}_6\text{H}_5\text{CO}_2$, is an organic acid whose sodium salt, $\text{NaC}_6\text{H}_5\text{CO}_2$, has long been used as a safe food additive to protect beverages and many foods against harmful yeasts and bacteria. The acid is monoprotic. Write the equation for its K_a .



$$K_a = \frac{[\text{H}_3\text{O}^+][\text{C}_6\text{H}_5\text{CO}_2^-]}{[\text{HC}_6\text{H}_5\text{CO}_2]} \quad (1)$$

5. The $[\text{H}^+]$ of a 0.10 M solution of cyanic acid (HCNO) is found to be 0.0010 M. Calculate the K_a for cyanic acid.

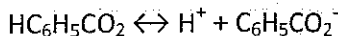
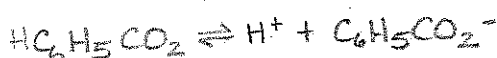


$$K_a = \frac{[\text{H}^+][\text{CNO}^-]}{[\text{HCNO}]} \quad (1)$$

$$= \frac{[0.0010 \text{ M}][0.0010 \text{ M}]}{[0.10 \text{ M}]} \quad (1)$$

$$= 1.0 \times 10^{-5} \quad (1)$$

6. If 1.22 grams of benzoic acid, $\text{HC}_6\text{H}_5\text{CO}_2$, is dissolved in 1.0 L of water, the $[\text{H}^+]$ is found to be 8.0×10^{-4} M. Calculate the K_a for benzoic acid.

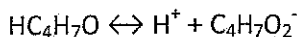


$$\frac{1.22 \text{ g} \cdot \text{mol} \times \frac{1}{122.32 \text{ g}}}{1.0 \text{ L}} = 1.0 \times 10^{-2} \text{ mol/L} \quad (1)$$

$$K_a = \frac{[\text{H}^+][\text{C}_6\text{H}_5\text{CO}_2^-]}{[\text{HC}_6\text{H}_5\text{CO}_2]} \quad (1)$$

$$(1) = \frac{[8.0 \times 10^{-4} \text{ M}]^2}{[1.0 \times 10^{-2} \text{ M}]} = 6.4 \times 10^{-5} \quad (1)$$

7. A 0.0050 M solution of butyric acid, HC_4H_7 , has a $\text{pH} = 4.0$, calculate K_a .

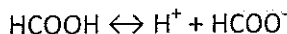


$$\begin{array}{l} \text{pH} = 4.0 \\ [\text{H}^+] = 1 \times 10^{-4} \text{ mol/L} \end{array} \quad (1)$$

$$K_a = \frac{[\text{H}^+][\text{C}_4\text{H}_7\text{O}_2^-]}{[\text{HC}_4\text{H}_7\text{O}]} \quad (1)$$

$$= \frac{[1.0 \times 10^{-4} \text{ M}]^2}{[0.0050 \text{ M}]} = 2.0 \times 10^{-6} \quad (1)$$

8. Determine the $[\text{OH}^-]$ and the $[\text{H}^+]$ of a 0.20 M solution of formic acid. The $K_a = 1.8 \times 10^{-4}$



$$K_a = \frac{[\text{H}^+][\text{HCOO}^-]}{[\text{HCOOH}]} \quad (1)$$

$$1.8 \times 10^{-4} = \frac{[x][x]}{[0.20 \text{ M}]} \quad (1)$$

$$[\text{H}^+] = 6.0 \times 10^{-3} \text{ mol/L} \quad (1)$$

$$[\text{H}^+][\text{OH}^-] = 1.0 \times 10^{-14}$$

$$[\text{OH}^-] = \frac{1.0 \times 10^{-14}}{6.0 \times 10^{-3} \text{ mol/L}}$$

$$(1) = 1.7 \times 10^{-12} \text{ mol/L}$$