

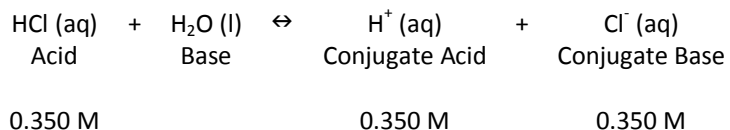
Pre-AP Chemistry/AP Chemistry  
Unit #12—Acids and Bases

Solving for pH, pOH, [H<sup>+</sup>], [OH<sup>-</sup>], and Ka/Kb for a Strong Acid or Strong Base

- Step 1: Write the Ionization Reaction and Identify Acid, Base, Conjugate Acid, and Conjugate Base.  
 Step 2: Solve for pH, pOH, [H<sup>+</sup>], and [OH<sup>-</sup>] at Equilibrium.  
 Step 3: Solve for K<sub>a</sub> or K<sub>b</sub>  
 Step 4: Solve for Percent Ionization

In an experiment, a student is given 0.350 M hydrochloric acid, which is considered a strong acid. Calculate pH, pOH, [H<sup>+</sup>], and [OH<sup>-</sup>] at Equilibrium, as well as, the K<sub>a</sub> and Percent Ionization.

- Step 1: Write the Ionization Reaction and Identify Acid, Base, Conjugate Acid, and Conjugate Base.



- Step 2: Solve for pH, pOH, [H<sup>+</sup>], and [OH<sup>-</sup>] at Equilibrium.

$$\begin{aligned} [\text{H}^+]_{\text{eq}} &= 0.350 \text{ M} \\ \text{pH} &= -\log [0.350] = 0.456 \\ \text{pOH} &= 14 - 0.456 = 13.544 \\ [\text{OH}^-]_{\text{eq}} &= 10^{-(13.544)} = 2.857 \times 10^{-14} \text{ M} \end{aligned}$$

- Step 3: Write Acid Equilibrium Expression and Solve for K<sub>a</sub>.

$$K_a = \frac{[\text{H}^+][\text{Cl}^-]}{[\text{HCl}]}$$

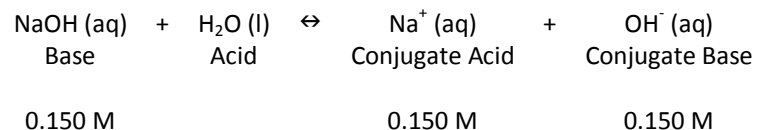
$$K_a = \frac{[0.350][0.350]}{[0.350]} = 3.5 \times 10^{-1}$$

- Step 4: Solve for Percent Ionization of the [OH<sup>-</sup>].

$$\frac{0.350 \text{ M}}{0.350 \text{ M}} \times 100 = 100 \% \text{ H}^+$$

In an experiment, a student is given 0.150 M sodium hydroxide, which is considered a strong base. Calculate pH, pOH, [H<sup>+</sup>], and [OH<sup>-</sup>] at Equilibrium, as well as, the K<sub>b</sub> and Percent Ionization.

- Step 1: Write the Ionization Reaction and Identify Acid, Base, Conjugate Acid, and Conjugate Base.



- Step 2: Solve for pH, pOH, [H<sup>+</sup>], and [OH<sup>-</sup>] at Equilibrium.

$$\begin{aligned} [\text{H}^+]_{\text{eq}} &= 10^{-(13.544)} = 6.667 \times 10^{-14} \text{ M} \\ \text{pH} &= 14 - 0.827 = 13.176 \\ \text{pOH} &= -\log [0.150] = 0.827 \\ [\text{OH}^-]_{\text{eq}} &= 0.150 \text{ M} \end{aligned}$$

- Step 3: Write Acid Equilibrium Expression and Solve for K<sub>a</sub>.

$$K_b = \frac{[\text{Na}^+][\text{OH}^-]}{[\text{NaOH}]}$$

$$K_a = \frac{[0.150][0.150]}{[0.150]} = 1.5 \times 10^{-1}$$

- Step 4: Solve for Percent Ionization of the [OH<sup>-</sup>].

$$\frac{0.150 \text{ M}}{0.150 \text{ M}} \times 100 = 100 \% \text{ H}^+$$

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- Step 1: Write the Ionization Reaction and Identify Acid, Base, Conjugate Acid, and Conjugate Base.  
Step 2: Solve for pH, pOH,  $[H^+]$ , and  $[OH^-]$  at Equilibrium.  
Step 3: Solve for  $K_a$  or  $K_b$   
Step 4: Solve for Percent Ionization