WKST: 18 b -key

For each of the problems below, assume 100% dissociation.

1. A. Write the equation for the dissociation of hydrochloric acid.

$$HCl(aq) \rightarrow H^{1+}(aq) + Cl^{1-}(aq)$$

B. Find the pH of a 0.00476 M hydrochloric acid solution.

$$\underset{0.00476\ M}{HCl(aq)} \rightarrow \underset{0.00476\ M}{H^{1+}(aq)} + Cl^{1-}(aq)$$

$$pH = -\log[H^+]$$
$$pH = -\log[0.00476\ M]$$
$$pH = 2.32$$

2. A. Write the equation for the dissociation of sulfuric acid.

$$H_2SO_4(aq) \rightarrow 2\,H^{1+}(aq) + SO_4^{2-}(aq)$$

B. Find the pH of a solution that contains 3.25 g of H_2SO_4 dissolved in 2.75 liters of solution.

$$\text{Step 1: } x\,\text{mol}\,H_2SO_4 = 3.25\,\text{g}\,H_2SO_4\left(\frac{1\,\text{mol}\,H_2SO_4}{98\,\text{g}\,H_2SO_4}\right) = 0.033\,\text{mol}\,H_2SO_4$$

$$\text{Step 2: } M = \frac{\text{mol}}{L} \Rightarrow M = \frac{0.033\,\text{mol}\,H_2SO_4}{2.75\,L} \Rightarrow M = 0.0121\,M\,H_2SO_4$$

$$\text{Step 3: } H_2SO_4(aq) \rightarrow 2H^+ + SO_4^{2-}(aq)$$
$$0.0121\,M \quad \therefore 0.0242M$$

$$\text{Step 4: } pH = -\log[H^+] \Rightarrow pH = -\log[0.0242\ M] \Rightarrow pH = 1.62$$

3. A. Write the equation for the dissociation of sodium hydroxide.

$$\underset{0.000841\ M}{NaOH(aq)} \rightarrow Na^{1+}(aq) + \underset{0.000841\ M}{OH^{1-}(aq)}$$

B. Find the pH of a 0.000841 M solution of sodium hydroxide.

$$pOH = -\log[OH^-]$$
$$pOH = -\log[0.000841\ M]$$
$$pOH = 3.08$$

$$pH + pOH = 14$$
$$pH + 3.08 = 14$$
$$pH = 10.92$$

or

$$K_w = [H^+][OH^-]$$
$$1\times10^{-14} = [H^+][0.000841\ M]$$
$$[H^+] = [1.19\times10^{-11}\ M]$$

$$pH = -\log[H^+]$$
$$pH = -\log[1.19\times10^{-11}\ M]$$
$$pH = 10.92$$

Wkst: 18D -Key

continued

4. A. Write the equation for the dissociation of aluminum hydroxide.

$$\underset{2.36\times10^{-5}\ M}{Al(OH)_3(aq)} \rightarrow Al^{3+}(aq) + 3\ \underset{7.08\times10^{-5}\ M}{OH^{1-}(aq)}$$

B. If the pH is 9.85, what is the concentration of the aluminum hydroxide solution?

$pH + pOH = 14$
$9.85 + pOH = 14$
$pOH = 4.15$

$pOH = -\log[OH^-]$
$4.15 = -\log[OH^-]$
$2^{nd}\ \boxed{log}\ -4.15 = [OH^-]$
$[OH^-] = 7.08\times10^{-5}\ M$

$$\frac{7.08\times10^{-5}\ M}{3} = 2.36\times10^{-5}\ M$$

5. A. Write the equation for the dissociation of calcium hydroxide.

$$\underset{2.18\times10^{-3}\ M}{Ca(OH)_2(aq)} \rightarrow Ca^{2+}(aq) + 2\ \underset{4.37\times10^{-5}\ M}{OH^{1-}(aq)}$$

B. If the pH is 11.64 and you have 2.55 L of solution, how many grams of calcium hydroxide are in the solution?

$pH + pOH = 14$
$11.64 + pOH = 14$
$pOH = 2.36$

$pOH = -\log[OH^-]$
$2.36 = -\log[OH^-]$
$2^{nd}\ \boxed{log}\ -2.36 = [OH^-]$
$[OH^-] = 4.37\times10^{-3}\ M$

$$2\overline{)4.37\times10^{-3}\ M}\ \ 2.18\times10^{-3}\ M$$

$$M = \frac{mol}{L} \Rightarrow 2.18\times10^{-3}\ M \Rightarrow \frac{x\ mol\ Ca(OH)_2}{L} \Rightarrow x = 5.57\times10^{-3}\ mol\ Ca(OH)_2$$

$$x\ g\ Ca(OH)_2 = 5.57\times10^{-3}\ M\left(\frac{74\ g\ Ca(OH)_2}{1\ mol\ Ca(OH)_2}\right) = 0.412\ g\ Ca(OH)_2$$