Name: _____ Date: _____

# AP Chemistry: 14.5-14.6 Classwork

**Directions:** Calculate the following on your own paper. Write you final answer on the line and staple your work to the back.

1. What is the pH of a 0.25 M solution of HF if the $K_a = 6.8 \times 10^{-4}$?

   1.89

2. If the pH of $HC_3H_5O_2$ is 4.2 and the $K_a = 1.34 \times 10^{-5}$
   a. What is the equilibrium concentration of $HC_3H_5O_2$?

      $2.97 \times 10^{-4}$ M

   b. What was the initial concentration of $HC_3H_5O_2$ before dissociation?

      $[H^+] = 10^{-4.2} + (2.97 \times 10^{-4}) =$ → $3.6 \times 10^{-4}$ M

3. If the pH is 12.2 what was the initial concentration of the base?

   ~~/~~

4. 0.50 M $NH_3$ has a $K_b = 1.8 \times 10^{-5}$

   a. What is the concentration of $OH^-$ at equilibrium?

      .0030 M

   b. What is the pOH of this solution?

      2.52

   c. What is the pH of this solution?

      11.48

5. If the pH of a weak base solution is 9.5 and the original concentration of base was 0.30 M

   a. What is the pOH?

      4.5

   b. What is the concentration of $OH^-$?

      $3.16 \times 10^{-5}$ M

   c. What is the equilibrium concentration of the base?

      0.30 M

   d. What is the $K_b$ of the base?

      $3.3 \times 10^{-9}$

6. If the pH is equal to 8.7 and the $K_b = 9.6 \times 10^{-7}$.
   What was the original concentration of the base?

   $3.1 \times 10^{-5}$

pOH = 5.3

$[OH^-] = 5.0 \times 10^{-6}$ M

$9.6 \times 10^{-7} = \frac{(5.0 \times 10^{-6})^2}{x}$ add

$x = 2.6 \times 10^{-5}$ M

# AP Chemistry: Acid-Base Properties of Salts Classwork

1. A salt is basic if the anion is the conjugate base of a weak acid.

2. A salt is acidic if the cation is the conjugate acid of a weak base, highly charged (+2 or +3).

3. A salt is neutral if cation of strong base + anion of strong acid.

4. Are solutions of the following salts acidic, basic, or neutral?

   a. KCl — neutral

   b. $NH_4C_2H_3O_2$ — neutral

   $NH_4^+$ → $K_a = 5.6\times10^{-10}$

   $K_b = \frac{1.0\times10^{-14}}{1.8\times10^{-5}} = 5.6\times10^{-10}$

   $K_a = K_b$

   c. KF — basic

   d. $NH_4F$ — acidic

   $NH_4^+$ → $5.6\times10^{-10}$

   $K_b = \frac{1.0\times10^{-14}}{3.5\times10^{-4}} = 2.86\times10^{-11}$

   $K_a > K_b$

5. Calculate the pH of 0.12M $KNO_2$ — 8.21

$NO_2^- + H_2O \rightleftharpoons HNO_2 + OH^-$

| | $NO_2^-$ | | $HNO_2$ | $OH^-$ |
|---|---|---|---|---|
| I | .12 | / | 0 | 0 |
| C | $-x$ | / | $+x$ | $+x$ |
| E | $.12-x$ | / | $x$ | $x$ |

$K_a = 4.6\times10^{-4}$

$K_b = \frac{1.0\times10^{-14}}{4.6\times10^{-4}} = 2.17\times10^{-11} = \frac{x^2}{.12}$

$x = 1.62\times10^{-6}\ M = [OH^-]$

$pOH = 5.79$

$pH = 8.21$

6. Calculate the pH of a 0.45M NaOCl — 10.59

$OCl^- + H_2O \rightleftharpoons HOCl + OH^-$

| | $OCl^-$ | | $HOCl$ | $OH^-$ |
|---|---|---|---|---|
| I | .45 | / | 0 | 0 |
| C | $-x$ | / | $+x$ | $+x$ |
| E | $.45-x$ | / | $x$ | $x$ |

$K_a = 3.0\times10^{-8}$

$K_b = \frac{1.0\times10^{-14}}{3.0\times10^{-8}} = 3.3\times10^{-7}$

$3.3\times10^{-7} = \frac{x^2}{.45}$

$x = 3.87\times10^{-4}\ M = [OH^-]$

$pOH = 3.41$

$pH = 10.59$

## 14.9 Classwork: Effect of Structure on the Properties of Acids & Bases

1. State which of following in each pair is the stronger acid. Justify your answer.

a) HCl, HBr more polar bond

(b) HCl, $H_2S$ more polar bond

(c) $HClO_3$, $HBrO_3$ more polar bond

(d) $H_3PO_4$, $H_3PO_3$ more oxygens

(e) $HNO_2$, $HNO_3$ more oxygens

(f) (g) HOBr, HOI more polar bond

(g) $H_2CO_3$, $H_2SiO_3$ more polar bond

(h) $H_3AsO_4$, $H_3AsO_3$ more oxygens

(i) $H_3AsO_4$, $H_3PO_4$ more polar bond

(j) $H_2Te$, $H_2Se$ more polar bond

2. Will the following oxides give acidic or basic solutions?

a) $Li_2O$ basic

b) $CO_2$ acidic

c) SrO basic

d) $SO_2$ acidic

e) $NO_2$ acidic

f) BaO basic

1.5

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67 $HC_3H_5O_2$ $K_a = 1.3 \times 10^{-5}$

$HC_3H_5O_2 \rightleftharpoons H^+ + C_3H_5O_2^-$

| | $HC_3H_5O_2$ | $H^+$ | $C_3H_5O_2^-$ |
|---|---|---|---|
| I | .10 | 0 | 0 |
| C | $-x$ | $+x$ | $+y$ |
| E | $.10-x$ | $x$ | $x$ |

$1.3 \times 10^{-5} = \frac{x^2}{.10}$

$x = .0011\ M = [H^+]$

$pH = -\log(.0011) = 2.94$

$\frac{.0011}{.1} \times 100 = 1.1\%$

68 $HClO_2 \rightleftharpoons H^+ + ClO_2^-$

| | $HClO_2$ | $H^+$ | $ClO_2^-$ |
|---|---|---|---|
| I | .22 | 0 | 0 |
| C | $-x$ | $+x$ | $+y$ |
| E | $.22-x$ | $x$ | $x$ |

$1.2 \times 10^{-2} = \frac{x^2}{.22}$

$x = .0514\ M = [H^+]$

$pH = -\log(.0514) = 1.29$

$\frac{.0514}{.22} \times 100 = 2.33\%$

69 $K_a = ?$

3.0% dissociated

.15 M solution

$\frac{x}{.15} \times 100 = 3.0$

$x = .0045\ M$

$K_a = \frac{(.0045)^2}{.15}$ $K_a = 1.35 \times 10^{-4}$