

## Worksheet 2

- Calculate the concentration of  $\text{H}^+(\text{aq})$  in
  - a solution in which  $[\text{OH}^-] = 0.010\text{M}$   
 $1.0 \times 10^{-12}$
  - a solution in which  $[\text{OH}^-] = 2.0 \times 10^{-9}\text{M}$   
 $5.0 \times 10^{-6}$
- Calculate the pH of a solution with  $[\text{H}^+] = 5.6 \times 10^{-8}\text{M}$   
  
pH = 7.25
- Calculate the pH of a solution with  $[\text{OH}^-] = 3.2 \times 10^{-4}\text{M}$   
  
pH = 10.5
- Identify the acid, base, conjugate acid, and conjugate base in each of the reactions below:
  - $\text{HCl}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{HCO}_3^-(\text{aq}) + \text{Cl}^-(\text{aq})$   
Acid      base              conj. Acid      conj. base
  - $\text{HNO}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) \leftrightarrow \text{NO}_2^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$   
Acid              base      conj. Base      conj. acid
- Identify the Lewis acid and base in each of the following reactions:
  - $\text{Fe}^{3+}(\text{aq}) + 6\text{CN}^-(\text{aq}) \leftrightarrow [\text{Fe}(\text{CN})_6]^{3-}(\text{aq})$   
Acid              base
  - $\text{NH}_3 + \text{BF}_3 \leftrightarrow \text{NH}_3\text{BF}_3$   
Base      acid

6. A student prepared a 0.10M solution of formic acid,  $\text{HCHO}_2$ , and measured its pH using a pH meter. The pH at  $25^\circ\text{C}$  was found to be 2.38.
- Calculate  $K_a$  for formic acid at this temperature
  - What percentage of the acid is ionized?

$$K_a = 1.8 \times 10^{-4}$$
$$4.2\%$$

7. If I have two acids, one with a  $\text{p}K_a$  of 2.8 and one with a  $\text{p}K_a$  of 8.6 at the same temperature, which one is the strongest and why?

The one with the  $\text{p}K_a$  of 2.8 is stronger. A smaller  $\text{p}K_a$  means a larger  $K_a$ , which is a stronger acid.

8. Calculate the pH of a 0.20M solution of HCN ( $K_a = 4.9 \times 10^{-10}$ )

$$\text{pH} = 5.0$$

9. Calculate the concentration of  $\text{OH}^-$  in a 0.15M solution of  $\text{NH}_3$

$1.6 \times 10^{-3} \text{M}$

10. Arrange the compounds in each of the following series in order of increasing acid strength:

a)  $\text{AsH}_3$ ,  $\text{HI}$ ,  $\text{NaH}$ ,  $\text{H}_2\text{O}$

$\text{NaH}$ ,  $\text{AsH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{HI}$

b)  $\text{H}_2\text{SeO}_3$ ,  $\text{H}_2\text{SeO}_4$ ,  $\text{H}_2\text{O}$

$\text{H}_2\text{O}$ ,  $\text{H}_2\text{SeO}_3$ ,  $\text{H}_2\text{SeO}_4$