AP Chemistry
Ms. Ye

Name ___________________________________
Date ________________________Block ______

Strong Acids vs. Weak Acids

Strong Acids

- Ionize completely: ____
- So, the [_________________________] is _______________________________________
- Can easily calculate the pH

Example: Find the pH of 0.10 M HNO_3.

What if you have a very dilute amount of acid in water?

Example – Find the pH of 1.0×10^{-10} M HBr (an acid can't have a pH greater than 7!)

Weak Acids

- Don't ionize completely (only partially), so they make an EQUILIBRIUM when dissolved in water ________________________________
- They'll have an equilibrium acid dissociation constant value, K_a, associated with them.
- A few things about K_a
  - The ____ compared to each other can be found by ____ for the acids
  - Strong acids have a __________________________________ (very large)
  - Weak acids have known K_a values (they'll be given or you can calculate it)
  - You can also find the K_b of its conjugate base:

    ______________________ (same as $[H^+][OH^-] = 1.00 \times 10^{-14}$)

Calculating the pH of a weak acid

Example – find the pH of 1.0 M HF. K_a for HF is 7.2×10^{-4}

Example- Find the molarity of acetic acid if the pH of the solution is 4.15.

Strong and Weak Acids Worksheet. Show all work!

1. Calculate the pH of a 0.389 M solution of $HClO_3$.

2. What are the major species present in a 0.250 M solution of each of the following acids? Calculate the pH of these solutions.
   a. $HClO_4$
   b. HNO_3

3. Calculate the pH of each of the following solutions of a strong acid in water:
   a. 1.0×10^{-11} M HCl
   b. 1.0×10^{-8} M HCl

4. Using the table of weak acids and weak bases, order the following from the weakest to the strongest acid: H_2O, HNO_3, HOCl, NH_4^+

5. Find the pH of a 0.25 M solution of lactic acid, $HC_3H_5O_3$ ($K_a = 8.3 \times 10^{-4}$).

6. The pH of a 0.0100 M solution of cyanic acid (HOCN) is 2.77 at 25°C. Calculate its K_a.

7. What are the major species present in each of the following solutions? Calculate the pH of 0.1 M of each of these solutions (use the table for K_a values)
   a. HNO_2

   b. $HC_2H_3O_2$

8. Monochloroacetic acid, $HC_2H_2ClO_2$, is a skin irritant that is used in "chemical peels" intended to remove the top layer of dead skin from the face and ultimately improve the complexion. The value for the K_a of monochloroacetic acid is 1.35×10^{-3}. Calculate the pH of a 0.10 M solution.

9. A solution of formic acid (HCOOH, $K_a = 1.8 \times 10^{-4}$) has a pH of 2.70. Calculate the initial concentration of formic acid in this solution.

Weak Acids and Bases Reference Sheet

Name of Acid	Formula	Value of K_a
Hydrogen sulfate ion	HSO_4^-	1.2×10^{-2}
Chlorous acid	$HClO_2$	1.2×10^{-2}
Monochloroacetic acid	$HC_2H_2ClO_2$	1.35×10^{-3}
Hydrofluoric acid	HF	7.2×10^{-4}
Nitrous acid	HNO_2	4.0×10^{-4}
Formic acid	HCO_2H	1.8×10^{-4}
Lactic acid	$HC_3H_5O_3$	1.38×10^{-4}
Benzoic acid	$HC_7H_5O_2$	6.4×10^{-5}
Acetic acid	$HC_2H_3O_2$	1.8×10^{-5}
Hydrated aluminum ion	$[Al(H_2O)_6]^{3+}$	1.4×10^{-5}
Propanoic acid	$HC_3H_5O_2$	1.3×10^{-5}
Hypochlorous acid	HOCl	3.5×10^{-8}
Hypobromous acid	HOBr	2×10^{-9}
Hydrocyanic acid	HCN	6.2×10^{-10}
Boric acid	H_3BO_3	5.8×10^{-10}
Ammonium ion	NH_4^+	5.6×10^{-10}
Phenol	HOC_6H_5	1.6×10^{-10}
Hypoiodus acid	HOI	2×10^{-11}

Name of Polyprotic acid	Formula	K_{a1}	K_{a2}	K_{a3}
Phosphoric acid	H_3PO_4	7.5×10^{-3}	6.2×10^{-8}	4.8×10^{-13}
Arsenic acid	H_3AsO_4	5×10^{-3}	8×10^{-8}	6×10^{-10}
Carbonic acid	H_2CO_3	4.3×10^{-7}	5.6×10^{-11}	
Sulfuric acid	H_2SO_4	very large	1.2×10^{-2}	
Sulfurous acid	H_2SO_3	1.5×10^{-2}	1.0×10^{-7}	
Hydrosulfuric acid	H_2S	1.0×10^{-7}	1.0×10^{-19}	
Oxalic acid	$H_2C_2O_4$	6.5×10^{-2}	6.1×10^{-5}	
Ascorbic acid	$H_2C_6H_6O_6$	7.9×10^{-5}	1.6×10^{-12}	
Citric acid	$H_3C_6H_5O_7$	8.4×10^{-4}	1.8×10^{-5}	4.0×10^{-6}

Name of Base	Formula	Value of K_b
Ammonia	NH_3	1.8×10^{-5}
Methylamine	CH_3NH_2	4.38×10^{-4}
Ethylamine	$C_2H_5NH_2$	5.6×10^{-4}
Diethylamine	$(C_2H_5)_2NH_2$	1.3×10^{-3}
Triethylamine	$(C_2H_5)_3NH_2$	4.0×10^{-4}
Hydroxylamine	$HONH_2$	1.1×10^{-8}
Hydrazine	H_2NNH_2	3.0×10^{-6}
Aniline	$C_6H_5NH_2$	3.8×10^{-10}
Pyridine	C_5H_5N	1.7×10^{-9}