# CHEMISTRY 12
## ACID BASES UNIT
### Lesson #12
### Calculations Involving $K_a$ and pH

IMPT: The pH scale is NOT LINEAR!!! When the pH is increased by 1, the [ $H_3O^+$ ] is _____ by 10!!!

Recall that Strong Acids IONIZE 100 %, therefore the concentration of the strong acid will eqaul the concentration of $H_3O^+$ in solution!!

HOWEVER, Weak acids DO NOT IONIZE 100% in water, thereforewe must use an _____ to determine the [ $H_3O^+$ ] that is actually present in solution!

Generic Equation for a WEAK ACID in water:
$$HA + H_2O \longleftrightarrow A^- + H_3O^+$$
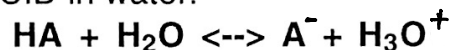
There are THREE types of problems that you can solve associated with a weak acid:

**Type 1**. Given the $K_a$ and the concentration of the weak acid, solve for the pH
**Example 1**. What is the pH for a 0.500 M solution of $CH_3COOH$?
Step 1 . Write out the ionization equation with water

Step 2. Write out the $K_a$ expression, identify the Ka value

Step 3. Set up an ICE TABLE for acetice acid

Step 4. Plug values into $K_a$ and solve for x

Step 5. Use x to solve for pH

**Type 2.** Given the pH and the initial concentration of the weak acid, solve for the $K_a$ value.

**Example 2.** If the pH of a 0.100 M solution of an unknown weak acid is 1.70, determine the $K_a$ and identify the weak acid.

Step 1 . Write out the generic ionization with water

Step 2. Set up an ICE TABLE for the weak acid

Step 3. Use the pH to fill in the values of the ICE TABLE

Step4. Use the equilibrium values to calculate the $K_a$

**Type 3.** Given pH and $K_a$, determine the initial concentration of the weak acid.
**Example 3.** What concentration of $H_2CO_3$ is required to produce a pH of 4.18?
Step 1 . Write out the ionization with water

Step 2. Write out the $K_a$ expression, look up $K_a$ value

Step 3. Set up an ICE TABLE for $H_2CO_3$

Step 4. Use pH to fill in the table

Step 5. Use $K_a$ to solve for initial concentration

**Seatwork/Homework:** Exercises 74-78, 80, 82-83
**PLO's:** Part of M3 and M5 for $K_a$