**Calculating Ka and pKa with**

**Equilibrium.**

**Ka: acid – dissociation constant. The equilibrium constant for a specific acid’s dissociation in water.**

**pKa: the negative log of the acid – dissociation constant.**

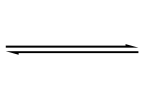
**The following steps can be used to calculate Ka and pKa:**

1. **Write the Balanced chemical equation.**
2. **Under the balanced equation make a table that lists values needed (a, b and c)for each substance involved in the reaction:**
3. **Initial Concentration.**
4. **The change in Concentration when going to equilibrium.**
5. **The equilibrium Concentration.**

**In making the table define “X” as the Concentration (mole / L) of one of the substances that reacts going to equilibrium and then use the stoichiometry of the reaction to determine the concentrations of the other substances in terms of “X”.**

**Example:**

**The pH of .250 M HF is 2.036. What are the values of Ka and pKa for Hydroflouric acid?**

**HF (aq) + H2O** **H3O + (aq) + F- (aq)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **HF (aq)** | **H3O+ (aq)** | **F- (aq)** |
| **Initial (M)** | **.25** | **Close to 0\*** | **0** |
| **Change in (M)** | **-X** | **+X** | **+X** |
| **Equilibrium(M)** | **(.25-X)** | **X** | **X** |

**\*Means very small concentration of H3O+ are present because of the dissociation of water.**

**Value of “X” using pH:**

**X= [H3O+] = antilog (-pH) = 10-pH = 10-2.036 =**

**9.2 x 10-3 M.**

**The other equilibrium concentrations can be found using:**

**[F-] = X = 9.2 x 10-3 M**

**[HF] = .250 – X = .250 - .0092 = .241 M.**

**Substituting these concentrations into the equilibrium equation gives the value of Ka.**

**Ka = [H3O+] [F-] (X)(X)**

**[HF] = .25 – S =**

**(9.2 x 10-3)(9.2 x 10-3)**

**.241 = 3.51 x 10-4**

**pKa = - log Ka = -log (3.51 x 10-4) = 3.455**