Equilibrium Practice Questions

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Weak acid pH - Ka and the Approximation Method**

To calculate the precise pH of weak acid & bases you can use Ka (or Kb) values (see your Chemistry Data Booklet's acid-base table) and the quadratic method. If the weak acid/base concentration is more than 1000 times the Ka/Kb value an approximate answer very close to the true value can be calculated as shown in the worked example below.

Generally speaking, for any equilibrium system, if the smallest [reactant] >1000 K(a,b,c,p,etc) then the change in concentration, x, is so small as to be negligible. More appropriately ±x, or a multiple thereof, is negligible. *Any concentration you add to or subtract it from is unaffected.*

Example 1. What is the pH of a 0.10 mol/L ethanoic acid solution?

CH3COOH(aq) + H2O(g) H3O+(aq) + CH3COO–(aq)

Initially 0.10 mol/L — — —

Equilibrium 0.10 - x — x x

So

Therefore

= 1.3 × l0-3 mol/L

and pH = –log(1.3 × l0-3 mol/L) = 2.88

% Ionization = 1.3 % 

1. What is the [H3O+(aq)], % Ionization, and the pH of 1.0 mol/L ethanoic acid?

2. What is the [H3O+(aq)], % Ionization, and the pH of 0.25 mol/L hypochlorous acid?

3. What is the [H3O+(aq)], % Ionization, and the pH of 0.50 mol/L oxalic acid?

4. What is the [H3O+(aq)], % Ionization, and the pH of 1.2 mol/L hydrofluoric acid?

5. What is the [H3O+(aq)], % Ionization, and the pH of 0.20 mol/L aqueous ammonium chloride?

6. What is the [H3O+(aq)], % Ionization, and the pH of 3.0 mol/L sulfurous acid?