Acids and Bases 14.5

pH for Weak Acids
Polyprotic Acids

Ex1) Calculating pH for a Weak Acid Solution

Ex1) Find the pH of a 2.5 *M* solution of HF.

$HF_{(aq)} \rightleftharpoons H^+_{(aq)} + F^-_{(aq)}$ ($K_a = 7.2 \times 10^{-4}$)

Step 1. Find [H⁺] by using an ICE chart.

	[HF]	[H⁺]	[F⁻]
I			
C			
E			

Ex1) Calculating pH for a Weak Acid Solution (cont.)

Ex1) Calculating pH for a Weak Acid Solution (cont.)

Step 2. Find the pH using your calculated value for [H⁺].

Ex2) Calculating pH for a Weak Acid Solution

Ex2) Find the pH of a 1.5 *M* HCN solution.

$HCN_{(aq)} \rightleftharpoons H^+_{(aq)} + CN^-_{(aq)}$ ($K_a = 4.9 \times 10^{-10}$)

Step 1. Find [H⁺] with an ICE chart

	[HCN]	[H⁺]	[CN⁻]
I			
C			
E			

Ex2) Calculating pH for a Weak Acid Solution (cont.)

Step 2. Find the pH with [H⁺]

Ex3) K_a and pH with % Dissociation

Ex 3) Acetic acid, $HC_2H_3O_2$, experiences 0.767% dissociation in a 0.300 *M* solution at 25°C. Find K_a for acetic acid at 25°C and the pH of the solution.

Step 1. Find K_a

	$[HC_2H_3O_2]$	$[H^+]$	$[C_2H_3O_2^-]$
I			
C			
E			

Ex3) K_a and pH with % (cont.)

$HC_2H_3O_2 \rightleftharpoons H^+ + C_2H_3O_2^-$

Step 2. Find pH

Polyprotic Acids

Polyprotic acids can donate more than one H^+ in a solution.

e.g. H_2SO_4 and H_2CO_3

Sulfuric acid Carbonic Acid

Polyprotic Acids

Polyprotic acids have a different K_a value for each possible dissociation.

$H_2CO_{3(aq)} \rightleftharpoons H^+_{(aq)} + HCO_3^-{}_{(aq)}$ ($K_{a1} = 4.3 \times 10^{-7}$)

$HCO_3^-{}_{(aq)} \rightleftharpoons H^+_{(aq)} + CO_3^{2-}{}_{(aq)}$ ($K_{a2} = 5.6 \times 10^{-11}$)

Polyprotic Acids

($K_{a1} = 4.3 \times 10^{-7}$) >> ($K_{a2} = 5.6 \times 10^{-11}$)

Always use K_{a1} to calculate $[H^+]$ and pH.

- Most of the H^+ ions come from the first dissociation.
- The H^+ ions from the first dissociation drive the equilibrium(s) for the other dissociations to the left.