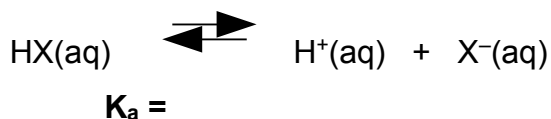


Ch. 16.6 Weak Acids

-- most acids are weak

-- For a weak acid HX...

-- acid-dissociation constant



large K_{a} :

small K_{a} :

The % of a weak acid that is ionized is given by the equation:

For organic acids (containing only C, H, and O) the “donated” H was connected to...

EX. A 0.020 M niacin solution has pH 3.26.

(a) What % of the acid is ionized?

(b) What is K_{a} ?

EX. If K_{a} for niacin is 1.6×10^{-5} , find the pH of a 0.010 M niacin solution.

(READ: Strengths of Acids printout)

% ionization of a weak acid at a given temperature...does what?

Rationale:

Recall that

$$\% \text{ ion.} = \frac{[\text{H}^{\text{+}}]_{\text{at eq.}}}{[\text{HX}]_{\text{orig.}}} \times 100$$

for the weak acid $\text{HX(aq)} \rightleftharpoons \text{H}^{\text{+}}(\text{aq}) + \text{X}^{-}(\text{aq})$

If we increase [HX], particle [] increases. System doesn't “want” higher [] of particles, so it shifts LEFT to reduce the number of particles (one vs. two). [$\text{H}^{\text{+}}$] will increase, but not as much as [HX]. Therefore, % ionization decreases.

-- The opposite is true if we dilute the solution.

REVIEW: pH of a mixture of Weak Acids

***Which is the dominant equilibrium?** (When that is solved, the problem reduces to a pH of what

is effectively 1 species in solution)

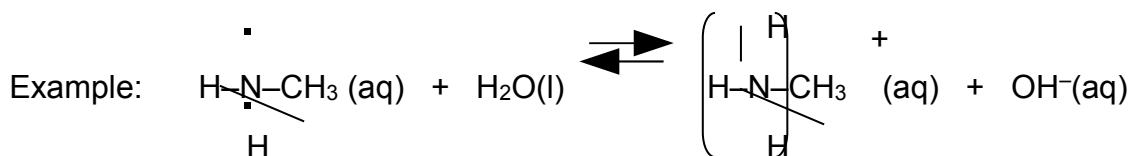
EX. Calculate the % of HF molecules ionized in a 0.10 M HF solution. ($K_a = 6.8 \times 10^{-4}$)

Ch. 16 Sec 7 Bases:

Weak Bases



*Weak bases are often nitrogen-containing molecules (“amines”) or anions.



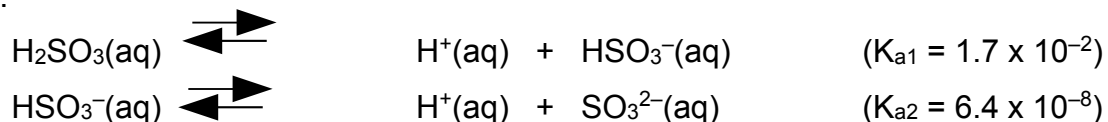
Review of SB: Totally dissociate in solution; What are the strong bases?

pH of a WB

ICE diagram (use them!!!)

EX. What is the $[\text{NH}_3]$ in a solution having pH 9.35?

Ch.16 sec 6-p. 688 Polyprotic acids – like sulfurous acid, H_2SO_3 – have more than one ionizable H^+ .



-- Usually, K_{a2} is at least 1000X smaller than K_{a1} . In such cases, one can calculate $[\text{H}^+]$ and pH based only on K_{a1} (i.e., ignore K_{a2} and pretend you have a monoprotic acid).

Monoprotic versus Polyprotic acids

- **MONOPROTIC** with a single H^+ ion to donate.

In general, acids with more than one H^+ ion available to be donated are called **POLYPROTIC** acids

- **DIPROTIC** acids have two H^+ ions which it can donate.
 - e.g. H_2SO_4 and H_2CO_3

- **TRIPROTIC** acids have three H^+ ions which it can donate.
 - e.g. H_3PO_4

Polyprotic acids undergo a **stepwise-dissociation** in water, in which one H^+ ion is lost at a time.

EX. Find the pH of a 0.0037 M carbonic acid solution. ($K_{a1} = 4.3 \times 10^{-7}$, $K_{a2} = 5.6 \times 10^{-11}$)