Chp 14 Acids + Bases

Definitions

Arrhenius

Acid: donates H^+

Base: donates OH^-

Bronsted

Acid: donates H^+

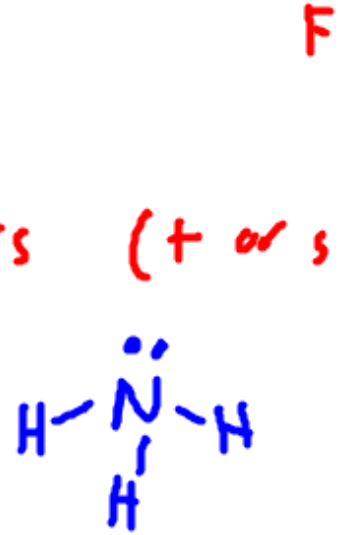
Base: accepts H^+

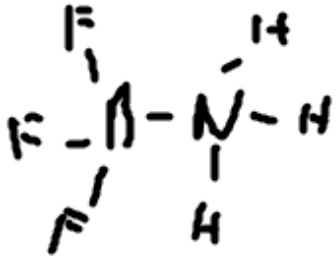
Acid must have H^+

Lewis

Acid: e^- pr acceptors (+ or shortage of e^-)

Base: surplus of e^-





hydronium ion (H_3O^+) same as H^+

$HA_{(aq)}$ + $H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + A^-_{(aq)}$

acid — base — C.A. — C.B.

Conjugate pairs

acid → conjugate base

base → conjugate acid

HA/A^-

H_2O/H_3O^+

Acid dissociation constant K_a

strong acid: $HCl, HBr, HI, HNO_3, HClO_4, H_2SO_4$

$$HCl_{(aq)} \rightleftharpoons H^+_{(aq)} + Cl^-_{(aq)}$$

$$K_a = \frac{[H^+][Cl^-]}{[HCl]}$$

very large — 100% products — 10,000 +

$$HC_2H_3O_2(aq) \rightleftharpoons H^+_{(aq)} + C_2H_3O_2^-(aq)$$

weak acid

$$K_a = \frac{[H^+][C_2H_3O_2^-]}{[HC_2H_3O_2]} = 1.8 \times 10^{-5}$$

small — 5% or less products

Acid Strength

Strong Acids - completely dissociate

$HA_{(aq)} \rightarrow H^+_{(aq)} + A^-_{(aq)}$

.10M .10M .10M

$[HA] \approx [H^+]$

weak acids

$HA_{(aq)} \rightleftharpoons H^+_{(aq)} + A^-_{(aq)}$

.10

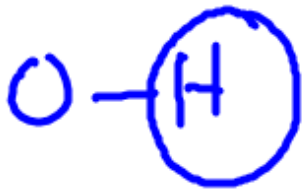
$-x$ [HA] does not really change

x is almost $\emptyset$

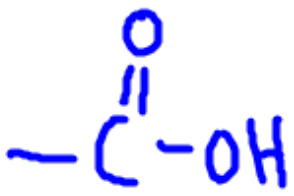
Diprotic $H_2SO_{4(aq)} \rightarrow H^+_{(aq)} + HSO_4^-{}_{(aq)}$

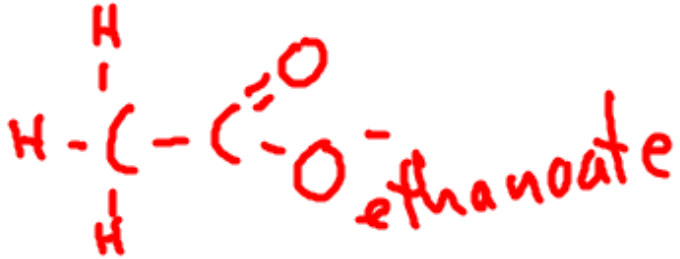
2 acidic H's $HSO_4^- \rightleftharpoons H^+ + SO_4^{2-}$

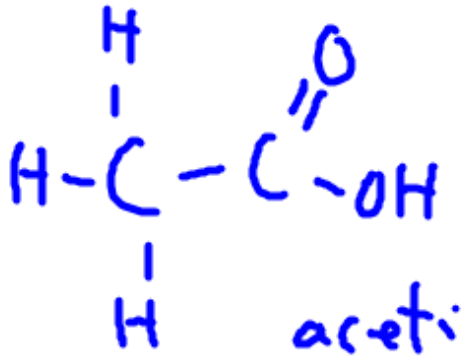
Oxyacids - contains Oxygen

usually it is an 

organic acids







ethanoic acid

acetic acid

CH_3CO_2H or CH_3COOH

water

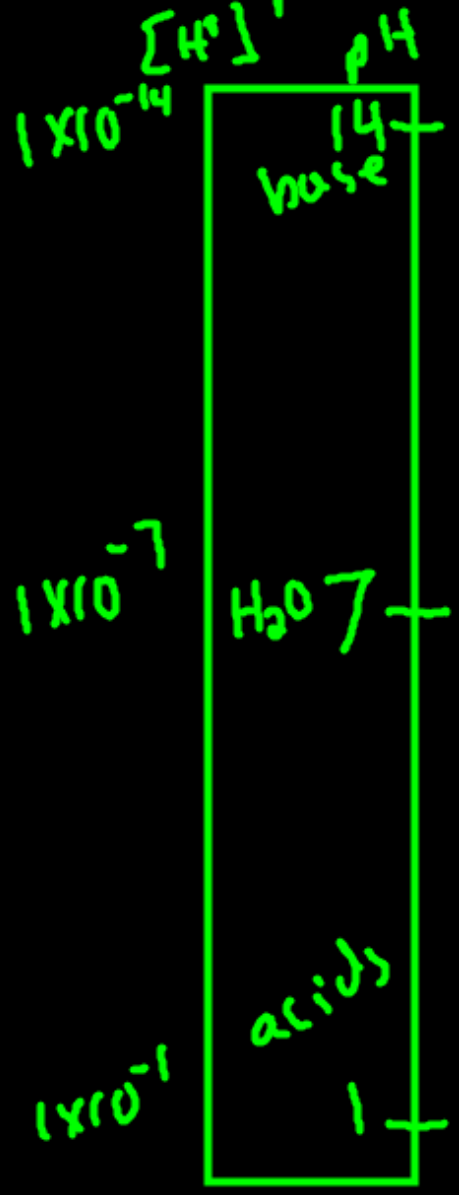
amphoteric - can be a base or acid

$$H_2O(l) + H_2O(l) \rightleftharpoons H_3O^+(aq) + OH^-(aq)$$

K_w - dissociation constant for water

$$K_w = [H_3O^+][OH^-] = 1.0 \times 10^{-14}$$

pH scale - how acidic a solution is



come from [H+]'s

$pH = -\log[H^+]$

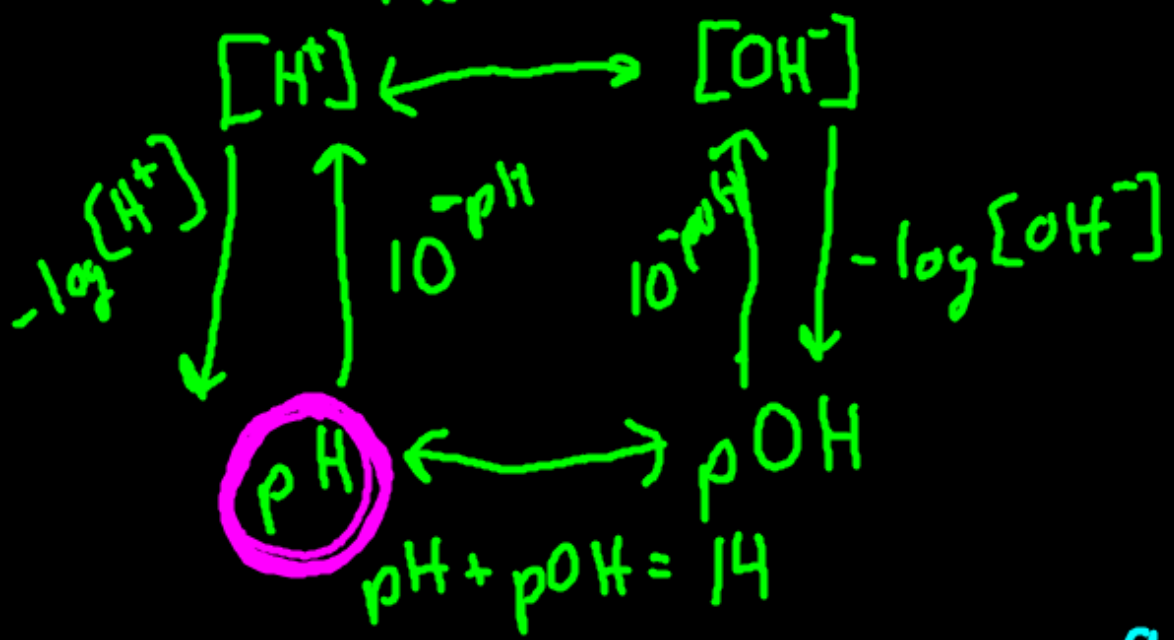
$[H^+] = 3.7 \times 10^{-4}$ M

pH 3.43

(acidic) or basic

pH Problems

$K_w = [H^+][OH^-] = 1 \times 10^{-14}$



$pH = 9.62$ $\quad [H^+] = 10^{-9.62}$ $\quad [OH^-] = 10^{-4.38}$

$pOH = 14 - 9.62$ $\quad 2.4 \times 10^{-10}\ M$ $\quad 4.2 \times 10^{-5}\ M$

4.38