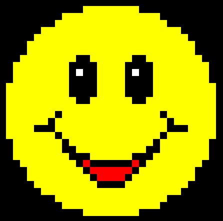


STRONG ACIDS

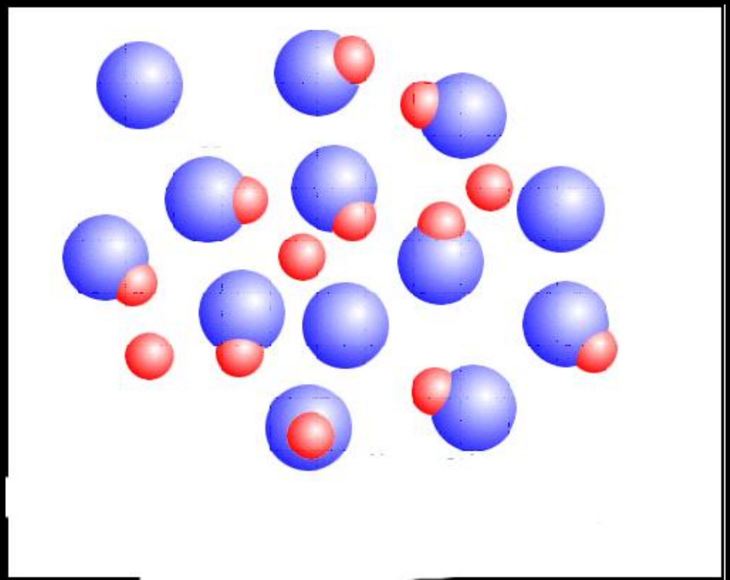
vs.

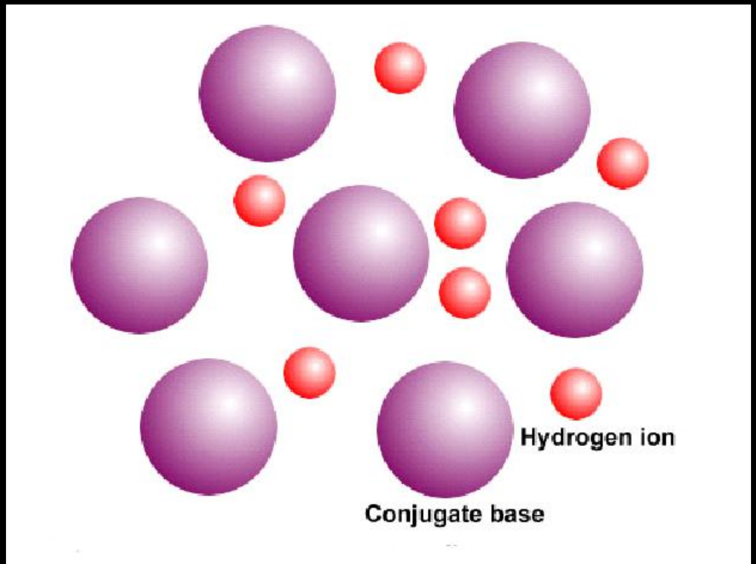
WEAK ACIDS

CREATED BY
SCHWEITZER

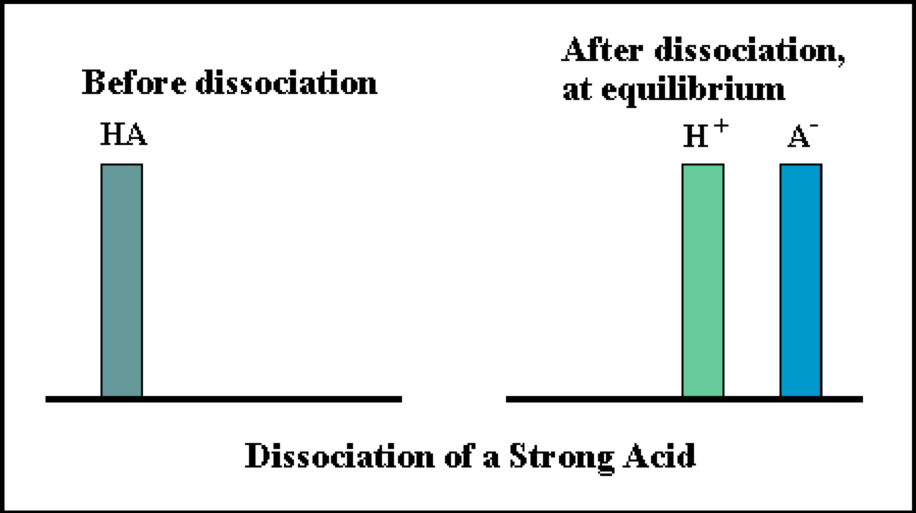
What is the difference between a strong and weak acid?

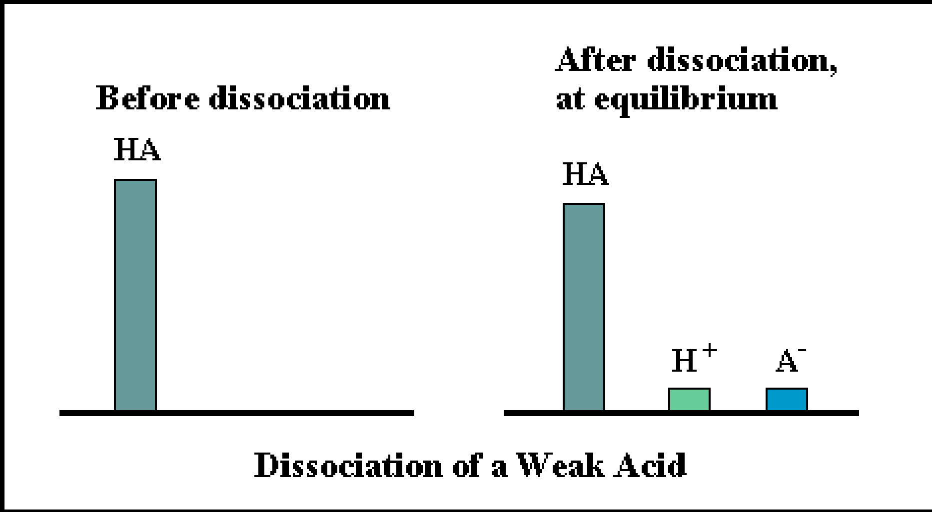
- A strong acid will dissociate 100 % where as a weak acid will only dissociate minimally.





Graphical difference between Strong and weak





Ap Question

Compared to a weak Arrhenius acid, a strong Arrhenius acid.

a. is more soluble in water
b. is a better oxidizing agent
c. is more highly ionized on water solution
d. has more available protons per molecule
e. has stronger bonds between hydrogen and oxygen atoms.

Strong Acid…..WHO??

- 6 strong acids
  - $HCl_{(aq)}$ → Hydrochloric acid
  - $HBr_{(aq)}$ → Hydrobromic acid
  - $HI_{(aq)}$ → Hydroiodic acid
  - $HNO_{3(aq)}$ → Nitric acid
  - $H_2SO_{4(aq)}$ → sulfuric acid
  - $HClO_{4(aq)}$ → Perchloric acid

WEAK ACID……WHO????

- IF IT QUALIFIES AS AN ACID
  - STARTS WITH “H” AND IS IN WATER
- BUT, IS NOT A STRONG ACID THEN IT MUST BE……….

WEAK

STRONG OR WEAK???

- $HCl_{(aq)} \rightarrow$
- $HC_2H_3O_{2(aq)} \rightarrow$
- $HF_{(aq)} \rightarrow$
- $HClO_{(aq)} \rightarrow$

ANSWERS

- $HCl_{(aq)}$ → STRONG
- $HC_2H_3O_{2(aq)}$ →
- $HF_{(aq)}$ →
- $HClO_{(aq)}$ →

ANSWERS

- $HCl_{(aq)}$ → STRONG
- $HC_2H_3O_{2(aq)}$ → WEAK
- $HF_{(aq)}$ →
- $HClO_{(aq)}$ →

ANSWERS

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ANSWERS

- $HCl_{(aq)}$ → STRONG
- $HC_2H_3O_{2(aq)}$ → WEAK
- $HF_{(aq)}$ → WEAK
- $HClO_{(aq)}$ → WEAK

Q: Can a strong Acid neutralize more base then a weak acid?

- A: No.

  HCl vs. HCN

- Both Acids contain the same number of Hydrogen atoms.

1 hydrogen can neutralize 1 OH^- from a base.

$HCl + NaOH = NaCl + H_2O$

STRONG BASES….WHO

- 100% DISSOCIATION

- X – OH

- X = METAL FROM 1^{ST} OR 2^{ND} FAMILY
  - EXCEPT: Be
- MOST METAL-HYDROXIDES ARE NEARLY INSOLUBLE

Strong or weak base?

- $Be(OH)_2$
- KOH
- NaOH
- NH_3

Strong or weak base?

- $Be(OH)_2$ Weak
- KOH strong
- NaOH strong
- NH_3 Weak

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

- For a solution of .05M HCl you simply put the .05M into the $[H^+]$ (very simple)
  - Why can we do this?????
  - $HCl \rightarrow H^+ + Cl^-$
  - 10 0 0
  - 0 10 10
    - The number or concentration of HCl is proportional to the H^+ ions
    - But….
    - $HF \rightarrow H^+ + F^-$
    - 10 ? ?

How do scientist deal with weak acids and bases????

- After many experiments it turns out that an acid or base (at a specific temperature) will always produce the same ratio of original acid to ionized product.
- This ratio is called
  - – Ka: Weak acids
  - – Kb: weak bases

Ka & Kb

- Ka = [P]/[R]
- Notice: a strong acid has no reactant left over. So the fraction above would be undefined or astronomically large.
  - Therefore would not be practical
- $HF \rightarrow H^+ + F^-$
- 10 $\rightarrow$ 0 0 (initial)
- 5 $\rightarrow$ 5 5 in this theoretical problem what is the ka???
- 1

Ka & Kb (cont')

- [P]/[R] = 1
- This means we are directly in the middle.
- Equal amounts of products and reactants.
- $HX \rightarrow H^+ + X^-$
- $K_a > 1$ (increased products, increased acidity)
- Ka < 1 (decreased products, decreased acidity)

Hydrolysis reactions

- ALL equilibrium expressions for weak acid base reactions are based of hydrolysis reactions!

- Examples: HF Hydrofluoric acid

$$HF_{(aq)} + H_2O_{(l)} \rightarrow H_3O^+_{(aq)} + F^-_{(aq)}$$

$$Ka = [H_3O^+][F^-]/[HF]$$

F^- is the conjugate base

- F^- is the conjugate base so it is a weak base and will also under go hydrolysis.
- $F^-_{(aq)} + H_2O_{(l)} \rightarrow HF_{(aq)} + OH^-_{(aq)}$
  - Kb = [HF][OH^-]/[F-]

AP Question

Which equation best illustrates the ionization behavior of liquid ammonia?

a. $NH_3 <= => 3H^+ + N^{-3}$

b. $NH_3 <= => NH_2^- + H^+$

c. $NH_3 + NH_3 <= => NH_4^+ + NH_2^-$

d. $H_2O + NH_3 <= => H_3O^+ + NH_2^-$

e. $H_2O + NH_3 <= => NH_4^+ + OH^-$

AP Question

- Which applies to a concentrated solution (15M) of NH_3 in water?
- Kb = 1.8E-5 for NH_3 in water at 298K
- I. $[OH^-] = [H_3O^+]$
- II. The percent ionization of NH_3 is nearly 100%
- III. Of all ions and molecules present, the greatest number is water molecules
- a. I only d. I and II only
- b. III only e. I, II , and III
- c. II and III only

Equilibrium Expressions

- Ammonia vs. Ammonium
- Write out the hydrolysis equations

Equilibrium Expressions

- Ammonia vs. Ammonium
- $NH_{3\,(aq)} + H_2O_{(l)} \rightarrow NH_4^+{}_{(aq)} + OH^-{}_{(aq)}$
- $NH_4^+{}_{(aq)} + H_2O_{(l)} \rightarrow NH_{3(aq)} + H_3O^+{}_{(aq)}$

- Write out the Equilibrium expressions

Equilibrium Expressions

- Ammonia vs. Ammonium
- $NH_{3\,(aq)} + H_2O_{(l)} \rightarrow NH_4{}^+{}_{(aq)} + OH^-{}_{(aq)}$
- $NH_4{}^+{}_{(aq)} + H_2O_{(l)} \rightarrow NH_{3(aq)} + H_3O^+{}_{(aq)}$

- $Ka = [NH_4{}^+][OH^-]/[NH_3]$
- $Kb = [NH_3][H_3O^+]/[NH_4{}^+]$

AP Question

Which gives the mass action expression for hydrolysis of the CO_3^{2-} ion?

a. $[CO_3^{2-}][H^+]/[HCO_3^-]$
b. $[CO_2][H^+]/[CO_3^{-2}]$
c. $[HCO_3^-][OH^-]/[CO_3^{2-}]$
d. $[CO_3^{2-}][H^+]/[HCO_3^-]$
e. $[CO_2][OH^-]/[CO_3^{2-}]$

What are the factors that affect the pH of Weak Acid or base

1. Ka or Kb

2. Original concentration

Analogy: Monetary investment at 2% return. If you want to get more money you either need to increase % return or increase initial investment.