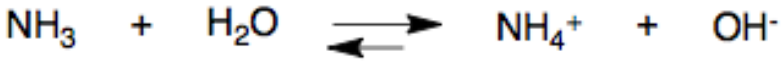
Strength of Acids

strong acid:

weak acid:

strong base:

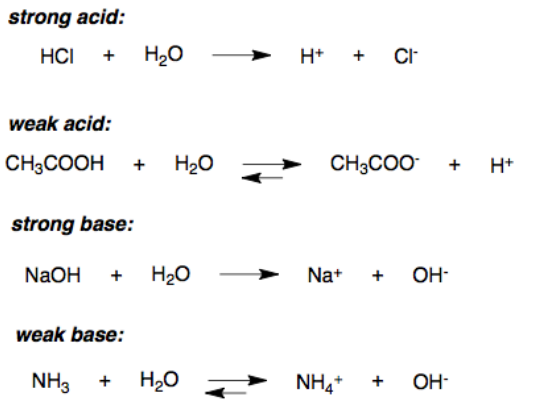
weak base:



- Strong Acids
- Weak Acids
- The Acid Dissociation Constant
- Calculating Percent Dissociation

Strong Acids

- Strong acids can catalyze chemical reactions.
- Strong acids are defined by their pKa.The acid must be stronger in aqueous solution than a hydronium ion, so its pKa must be lower than that of a hydronium ion.Therefore, strong acids are acids with a pKa of <-174.
- Strong acids can be organic or inorganic.
- Strong acids must be handled carefully because they can cause severe chemical burns.
- Strong acids are essential for catalyzing some reactions, including the synthesis and hydrolysis of carbonyl compounds.



Ionization of acids and bases in water

Weak Acids

- The dissociation of weak acids, which constitute the majority of acids, can be calculated mathematically and applied in experimental work.
- If the concentration and Ka of the weak acid are known, the pH of the entire solution can be calculated.The exact method of calculation varies according to what assumptions and simplifications can be made.
- Weak acids and weak bases are essential for the preparation of buffer solutions, which have important experimental uses.

Vinegars

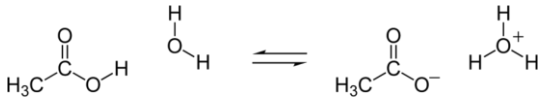
The Acid Dissociation Constant

- The acid dissociation constant is derived by multiplying the equilibrium constant of the acid in solution by the concentration of water, which is constant.
- Understanding Ka is essential for biochemistry, analytical chemistry, physiology, and many other branches of science.
- A logarithmic measure of the acid dissociation constant, known as pKa, is more commonly used in practice than Ka, since acid dissociation constants can span many orders of magnitude.

Acetic Acid Dissociation

Calculating Percent Dissociation

- The percent dissociation is symbolized as α (alpha) and represents the ratio of total conjugate base (A-) to total acid (HA).
- Unlike Ka, the percent dissociation varies with the concentration of HA; more dilute acids dissociate more than concentrated ones.
- The percent dissociation is related to the concentration of both the conjugate base and the initial concentration of acid.It can therefore be calculated if the pH of the solution and the pKa of the acid are known.



Acetic Acid Dissociation

Key terms

- **acid** an electron pair acceptor; generally capable of donating hydrogen ions
- **acid ionization constant** a quantitative measure of the strength of one in solution
- **carbonyl** A divalent functional group, (-CO-), characteristic of aldehydes, ketones, carboxylic acids, amides, carboxylic acid anhydrides, carbonyl halides, esters and others.
- **conjugate acid** The species created when a base accepts a proton.
- **conjugate base** The species that is created after the donation of a proton.
- **dissociation** Referring to the process by which compounds split into smaller constituent molecules, usually in a reversible manner.
- **electrolyte** a substance that, in solution or when molten, ionizes and conducts electricity
- **ester** A compound most often formed by the condensation of an alcohol and an acid, with elimination of water.It contains the functional group carbon-oxygen double bond joined via carbon to another oxygen atom.
- **hydrolysis** A chemical process of decomposition involving the splitting of a bond and the addition of the hydrogen cation and the hydroxide anion of water.
- **percent ionization** the fraction of an acid that undergoes dissociation
- **pH** the negative of the logarithm to base 10 of the concentration of hydrogen ions, measured in moles per liter; a measure of acidity or alkalinity of a substance, which takes numerical values from 0 (maximum acidity) through 7 (neutral) to 14 (maximum alkalinity)
- **weak acid** one that dissociates incompletely, releasing only some of its hydrogen atoms into solution

Vinegars

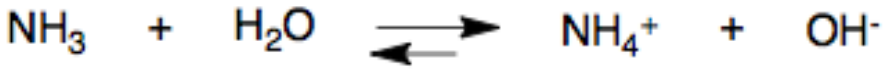
All vinegars contain acetic acid, a common weak acid.

strong acid:

weak acid:

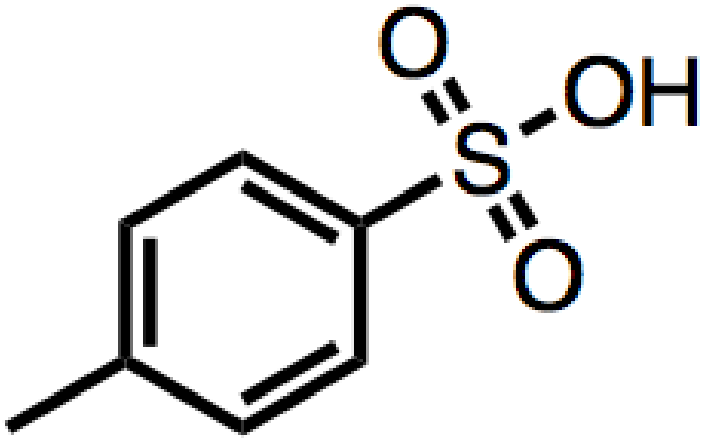
strong base:

weak base:



Ionization of acids and bases in water

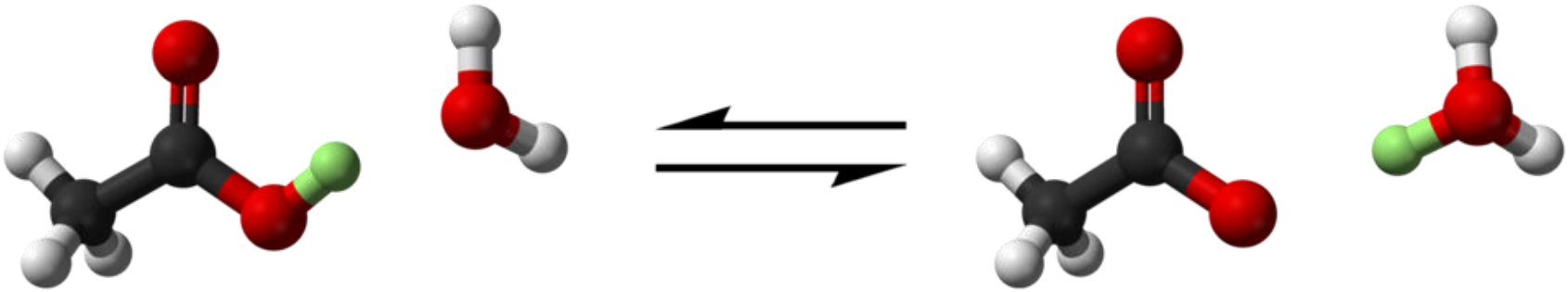
A strong acid ionizes completely in an aqueous solution by losing one proton (H+).



p-Toluenesulfonic acid

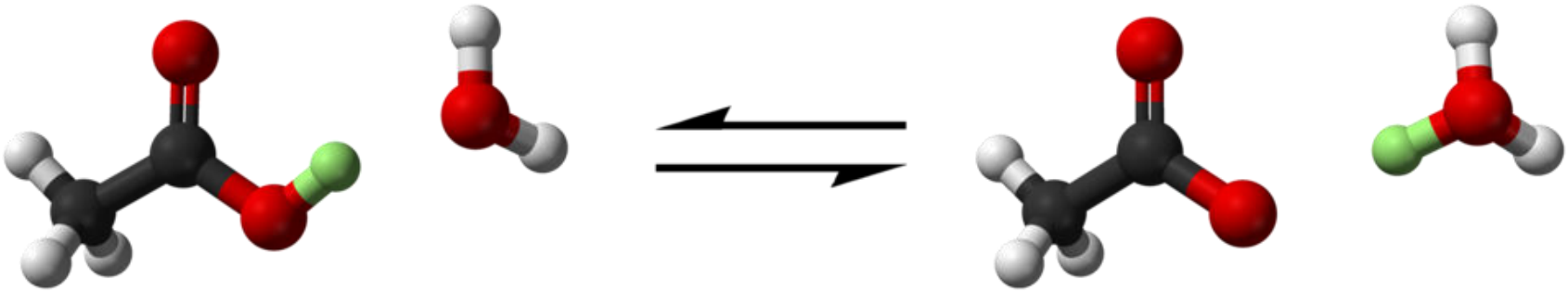
p-Toluenesolfonic acid

p-Toluenesulfonic acid is an example of an organic soluble strong acid, with a pKa of -2.8.



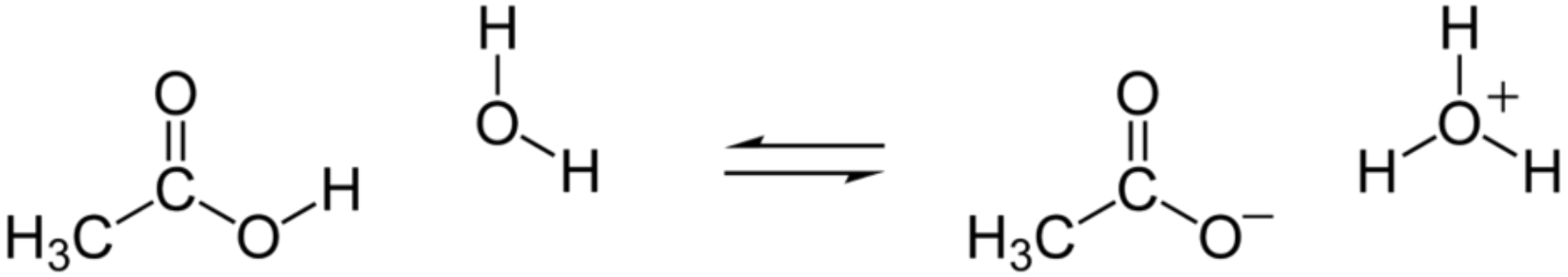
Acetic Acid Dissociation

Acetic acid, a weak acid, dissociates from its protonated state to its conjugate base and hydronium ion.



Acetic Acid Dissociation

A ball-and-stick model of the dissociation of acetic acid to acetate.A water molecule is protonated to form a hydronium ion in the process.The acidic proton that is transferred from acetic acid to water is labelled in green.



Acetic Acid Dissociation

The percent dissociation that acetic acid undergoes compares the concentration of conjugate base (on the right hand side of the equation) and the acid (on the left hand side of the equation).