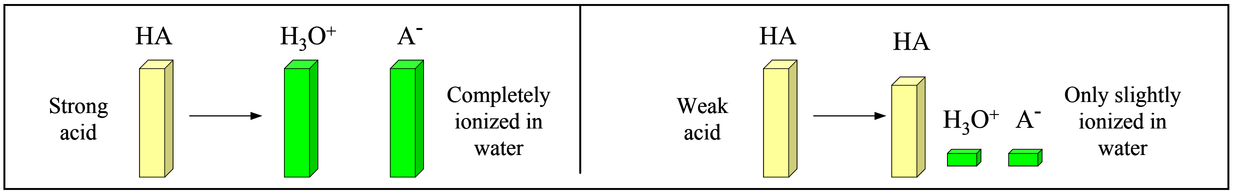
Jaeger **Need to know Chapter 14 + 15 Acids and Bases** (Part 2) CP Chemistry C

Name ______________________________ **Period** __________ **Date** __________

Second sheet

Strong and Weak Acids and Bases

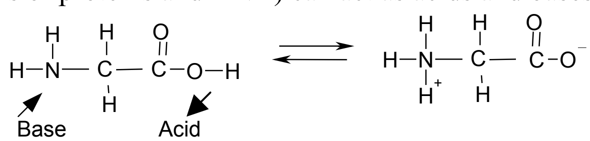


Type	Properties	Examples acids	Examples Bases
Strong	A **strong acid or base** is completely (or almost completely) ionized in water.	HCl, NBr, HI, HNO_3 nitric acid, H_2SO_4 sulfuric acid, $HClO_4$ perchloric acid	All group 1 and 2 hydroxides LiOH, NaOH, KOH, $Mg(OH)_2$, $Ca(OH)_2$, $Sr(OH)_2$
Weak	A **weak acid or base** is only slightly ionized in water, forming only few ions. **Most** acids and bases are weak.	Acetic acid (in vinegar), H_3PO_4 phosphoric acid, H_2CO_3 carbonic acid (both in soft drinks)	NH_3 ammonia, $Al(OH)_3$ $Fe(OH)_3$

(The structure of acids and covalent bases determine their strength.)

Although most acids and bases are classified as **weak**, their behavior is **still significant**. Most acid-base chemistry in living systems occurs through interaction between weak acids and bases.
Amino acids (the building blocks of proteins and DNA) can act as acids and bases (even at the same time).

Example Amino acid Glycine



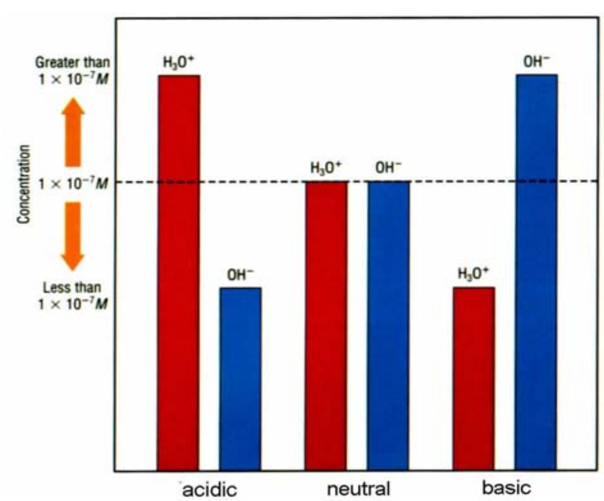
Bronstedt Theory
Acid = H^+ donor
Base = H^+ acceptor

Careful:
Weak and strong acids can **both** be concentrated **or** diluted. **Strength plus concentration** determine the hydronium ion concentration!

The pH Scale

The pH scale is a convenient way to compare the acidity and basicity of solutions. The hydronium ion concentration $[H^+]$ in a solution can be expressed in molarity and typically ranges from 10^0 to 10^{-14}. The pH value is equals the power of ten without the negative, or **pH = -log $[H^+]$**. Example: if $[H^+] = 10^{-6}$, pH = 6

The hydroxide concentration $[OH^-]$ in water also ranges about the same and can be expressed in pOH.
pOH = -log $[OH^-]$ Example: if $[OH^-] = 10^{-8}$, pOH = 8.
It turns out that the sum of (pH + pOH) in water is always 14, thus we need only one scale to determine acidity or bacidity of the solution: the pH



$[H^+] = [OH^-]$	**neutral**		**pH = pOH = 7**
$[H^+] > [OH^-]$	**acidic**	**(more H_3O^+)**	**pH < 7.0**
$[H^+] < [OH^-]$	**basic**	**(more OH^-)**	**pH > 7.0**

pH + pOH = 14

pOH = 14 – pH pH = 14 – pOH

What is the hydrogen concentration $[H^+]$

at pH = 4.00 ? $[H^+]$ = … at pH = 11.00 ? $[H^+]$ = …

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What is the pH value…

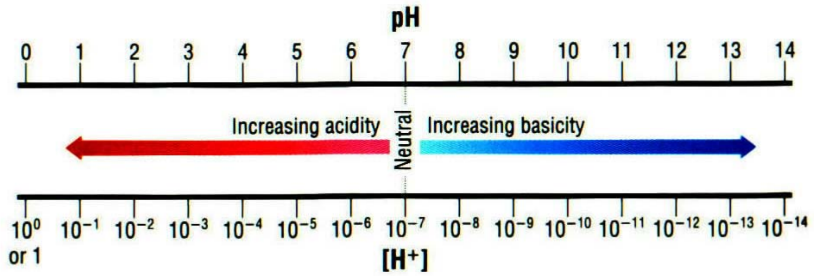
at $[H^+] = 10^{-7}$ M ? pH = ….

at $[H^+] = 10^{-3}$ M ? pH = ….

What is the pOH

at pH = 4.00 ? pOH = ….

at pH = 11.00 ? pOH = ….



pH smaller than 7 (acidic); equal 7 (neutral); bigger than 7 (basic)

pH < 7.0 **pH = 7.0** **pH > 7.0**

Shampoo and cosmetics (read p. 501 and describe in the table when to use higher or lower pH products)

Shampoo with low pH	
Shampoo with high pH	
Skin products with high pH	
Skin products with low pH	

Section 15.1 Neutralization reactions

The reaction of an acid with a base is called neutralization reaction, because the properties of both are diminished or neutralized. In most cases water and a salt is formed (combining H^+ with OH^- to H_2O).

M**OH** + **H**A → MA + $\mathbf{H_2O}$ example NaOH + HCl → NaCl + H_2O

The resulting products are only truly neutral if both, acid and base, are strong. Otherwise the resulting solution or the salt formed will still have basic or acid properties.

Acid (example)	Base (Example)	Properties of solution or salt
Strong: HCl	Strong: NaOH	Neutral: NaCl
Strong: HBr	Weak: $Al(OH)_3$	Acidic: $AlBr_3$
Weak: H_2CO_3 (carbonic acid)	Strong: $Ca(OH)_2$	Basic: $CaCO_3$ (in Tums®, limestone etc.)
Weak: vinegar	Weak: $Al(OH)_3$	Uncertain outcome, often no reaction

"The stronger wins"

15.2 Buffer

A buffer is a solution that resists changes in pH if small amounts of acids or bases are added. It is prepared form a combination of a weak base and one of its salts or a weak acid and one of its salts.

Blood Buffer: Blood must be constant at a pH of 7.4 and has several buffer systems to maintain that pH.

Limestone (mostly $CaCO_3$, a salt from a strong base and weak acid is basic) can neutralize or buffer acid rain.

Antacids (anti acid = base) are carbonates ($CaCO_3$) or insoluble hydroxides ($Mg(OH)_2$) used to reduce stomach acidity.