

Acids and Bases

Unit objectives

Q: What makes a solution acidic or basic?

Q: What about an acid/base makes it acidic/basic?

Q: How does an acid/base produce H^+/OH^-

- In other words: What are the ways in which a reaction can produce H^+ or OH^-

Q: How do I quantify the amount of H^+/OH^- in solution?

Q: Can you indicate the difference between a strong acid and a weak acid.

Q: What does it mean for a reaction not to go to completion or equilibrium?

DO: Be able to write Hydrolysis and K_a expressions

DO: Calculate the pH of a strong acid.

DO: Calculate the pH of a weak acid.

Q: What happens when you mix an acid into a base?

Q: How do you determine the pH of an unknown acid/base?

Q: What is a salt?

Q: Can you determine the general acidity of a salt?

Q: Can you complete a titration and interpret a titration curve.

What makes something acidic or basic?

Acids

all need to be in water (aq)

electrolytes

turn litmus **red**

caustic

ex: vinegar, milk,
soda, apples, citrus fruits

react with metals to
form H_2 gas

have "H" in 1st part of formula

(always) produces H_3O^{+1}
consumes OH^{-1}

Proton (H^+) donor

acids have
sour taste

Bases

alkaline (another name)

electrolytes

turn litmus **blue**

corrosive, caustic

ex: ammonia, lye,
antacid, baking soda

formula often ends with "OH"

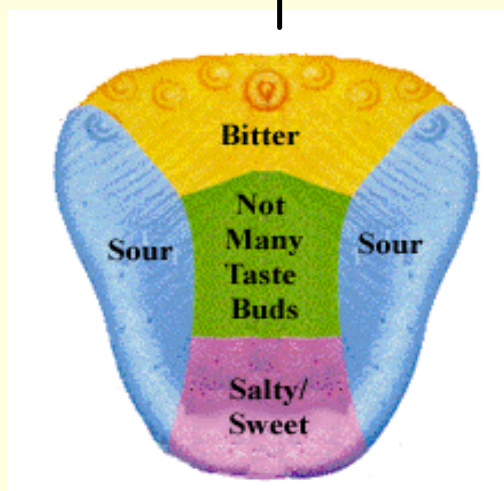
produce OH^{-1}

consumes H^+ or H_3O^{+1}

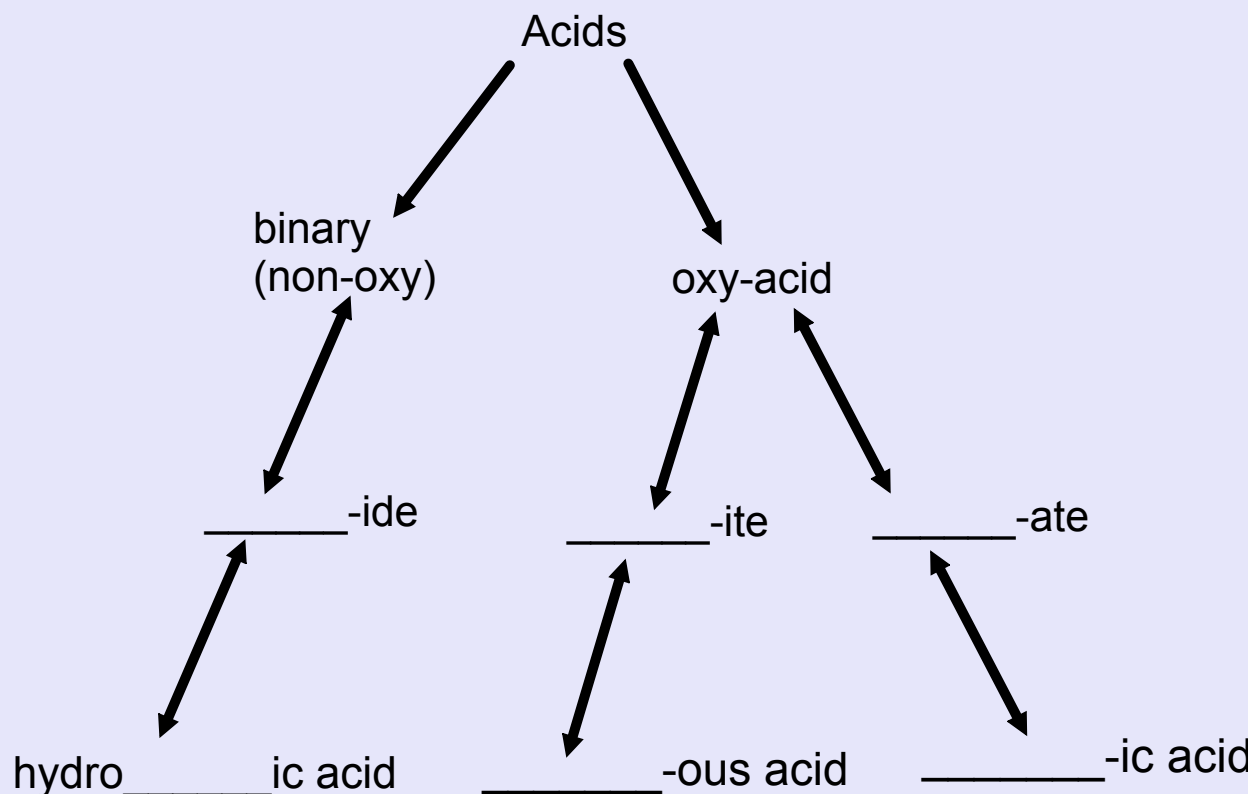
Proton (H^+) acceptor

slippery feel

bases have
bitter taste



acid nomenclature: (review)



Hydrogens will balance the overall charge to zero...

(like ionic)



What makes something **acidic**?

Anything that can
-produce **H₃O⁺** ions

hydrolysis only (react with water)



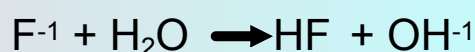
acids

-must be aqueous
-need water to
produce hydronium ion

What makes something **basic**?

Anything that can
-produce **OH⁻** ions

hydrolysis:



ionization:

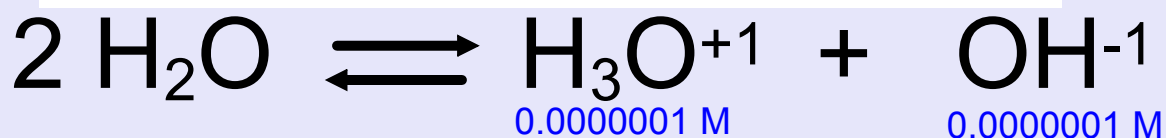
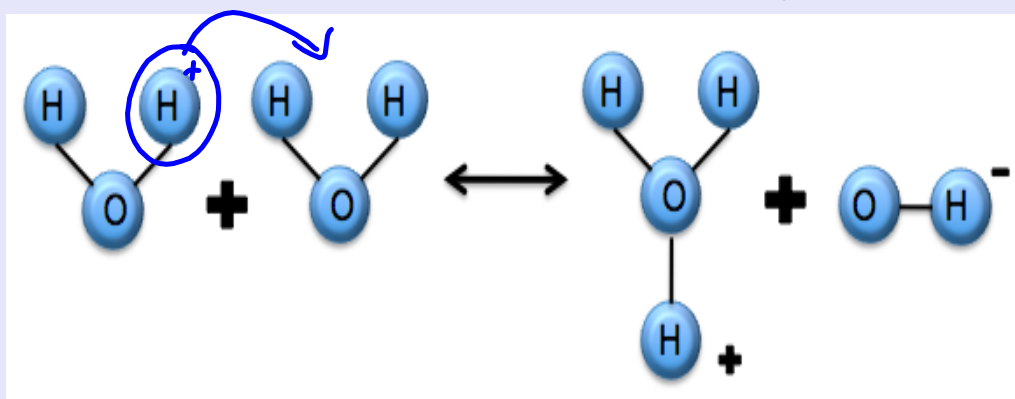


hydronium ion

the concentration of **H₃O⁺** and/or concentration of **OH⁻**
determines the **pH (measure of acidity)**

Can OH^{-1} and H_3O^{+1} exist together?

auto-ionization of water - is always happening



in pure water at 25°C : $[\text{H}_3\text{O}^{+1}] = [\text{OH}^{-1}] = 1 \times 10^{-7}$

brackets mean concentration

a very small amount ionizes

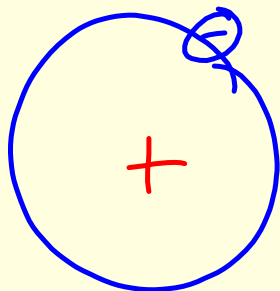
Ionization constant of Water, $K_w = [\text{H}_3\text{O}^{+1}] [\text{OH}^{-1}] = 1 \times 10^{-14}$

$$(10^{-7}) (10^{-7}) = 10^{-14}$$

pure neutral water

Why is the H^+ so important?

Draw a hydrogen atom:
one proton and one electron



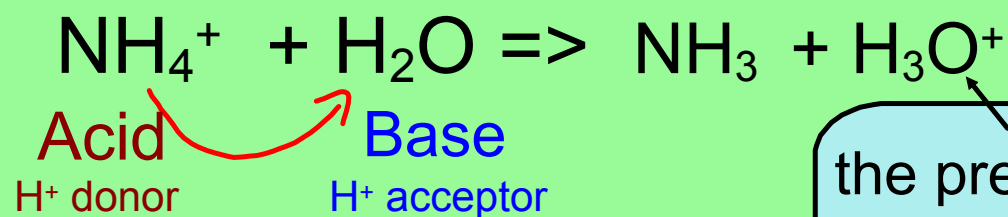
Draw an hydrogen ion:



A Hydrogen ion is just a proton!

Every acid base reaction is an exchange of an H^+ (a proton)

So each reaction contains an acid and a base.



the presence of H_3O^+ makes it acidic

Which reactant is the acid?

NH_4^+ (the one donating H^+)

Which reactant is the base?

H_2O (the one accepting the H^+)

What makes something acidic or basic?

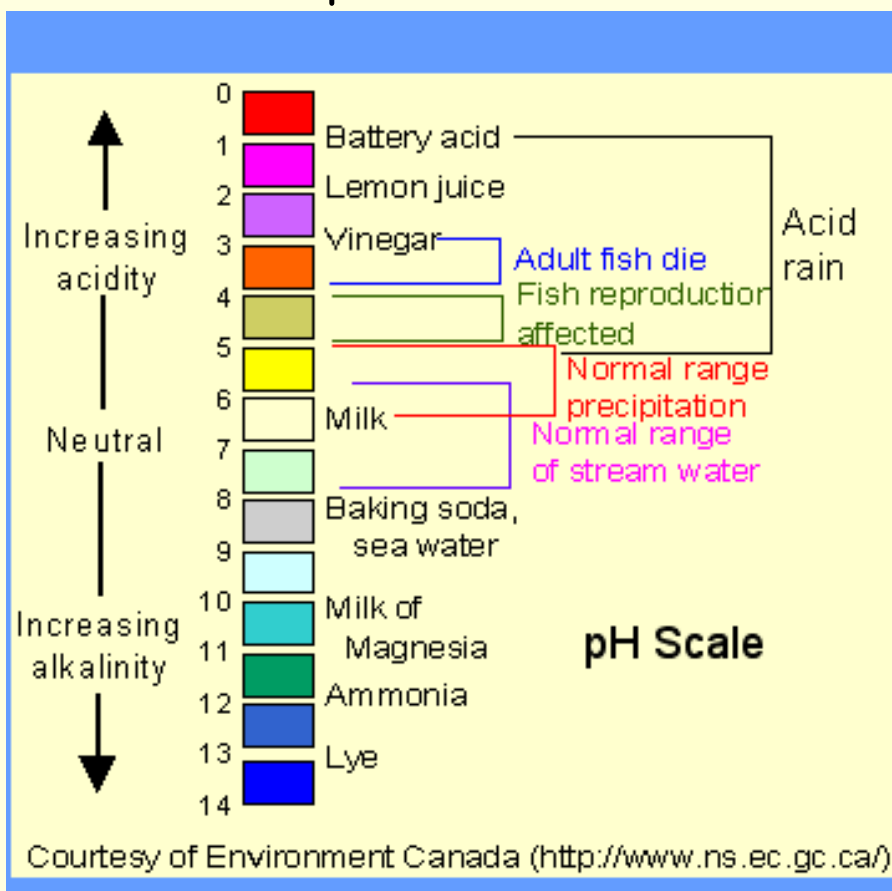
amount of:

H_3O^{+1} hydronium ion (H^{+1})

OH^{-1} hydroxide ion

	H_3O^{+1} vs. OH^{-1}	pH scale (0 - 14)
acidic	$H_3O^{+1} > OH^{-1}$	less than 7
neutral	$H_3O^{+1} = OH^{-1}$	= 7
basic	$H_3O^{+1} < OH^{-1}$	more than 7

10^{-7}

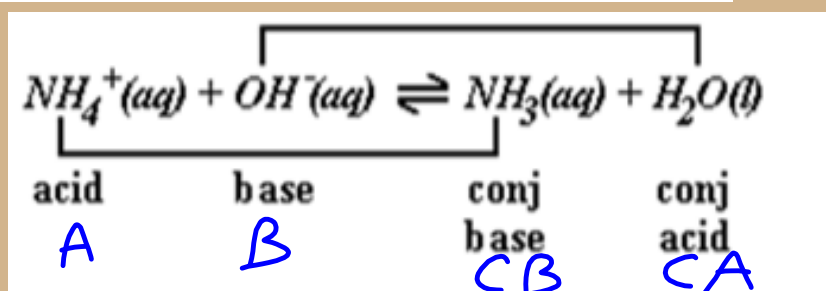
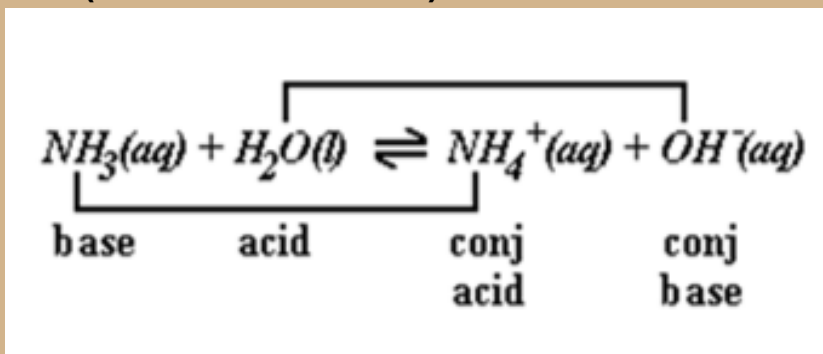


CONJUGATE ACIDS and BASES

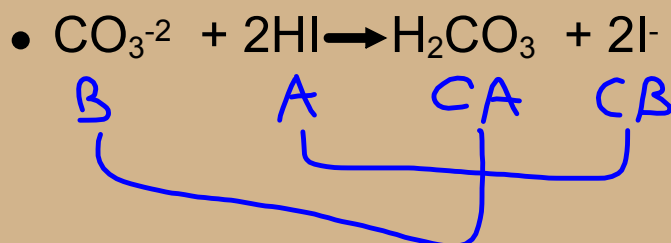
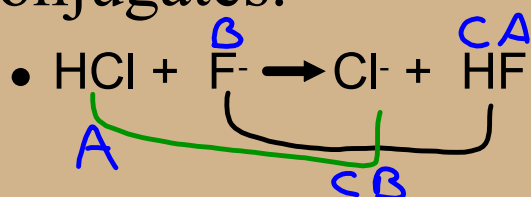
Conjugate: Substance after H⁺ had been donated or accepted

ESSENTIALLY SAME ELEMENT/MOLECULE...EXCEPT FOR H⁺

**Note: Any ACID becomes a conjugate BASE
(and VISE-VERSA)**



Pick out the acid, base, and the conjugates.



Do. page 37, 1-14
page 38, 1-6

