

ACID/BASE EQUILIBRIUM

- Several scientific theories exist that define acid-base chemistry. We will discuss TWO of these theories.
- These theories differ in the way that acids, bases, and their associated reactions are defined, although they cover many of the same reactions.

TWO ACID-BASE THEORIES

① Arrhenius theory

② Bronsted-Lowry theory

ARRHENIUS THEORY

- The oldest model of acid-base chemistry!

- Only applicable to systems where WATER is the solvent!

ACIDS are substances that ionize in water to increase the concentration of HYDRONIUM ION



Hydronium ion

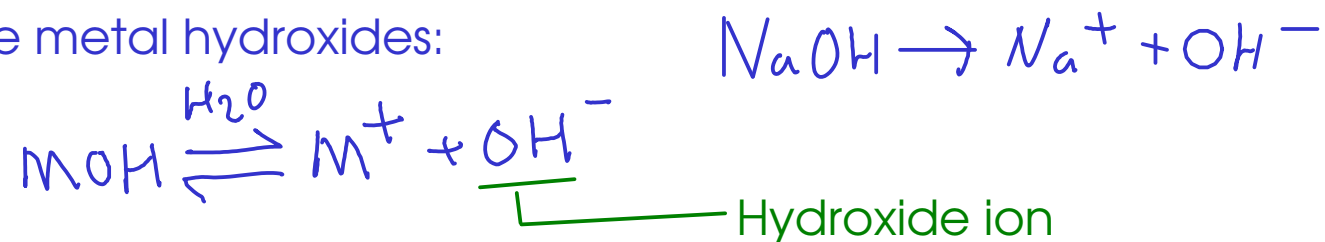


"Hydrogen ion" - doesn't really exist as a free ion in water, but a convenient simplification!

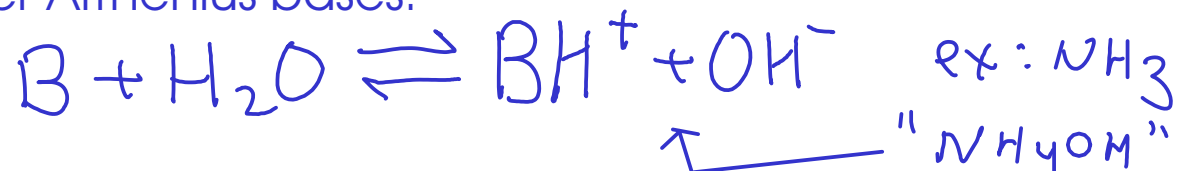
ARRHENIUS THEORY

BASES are substances that ionize in water to increase the concentration of HYDROXIDE ION

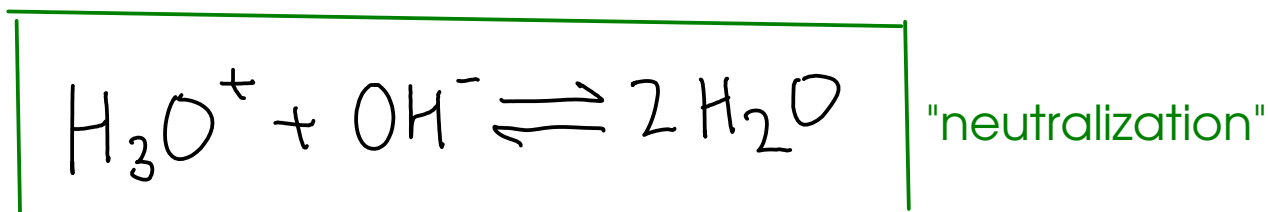
For soluble metal hydroxides:



For other Arrhenius bases:



An Arrhenius acid base reaction can be represented by:



or, using hydrogen ion instead of hydronium



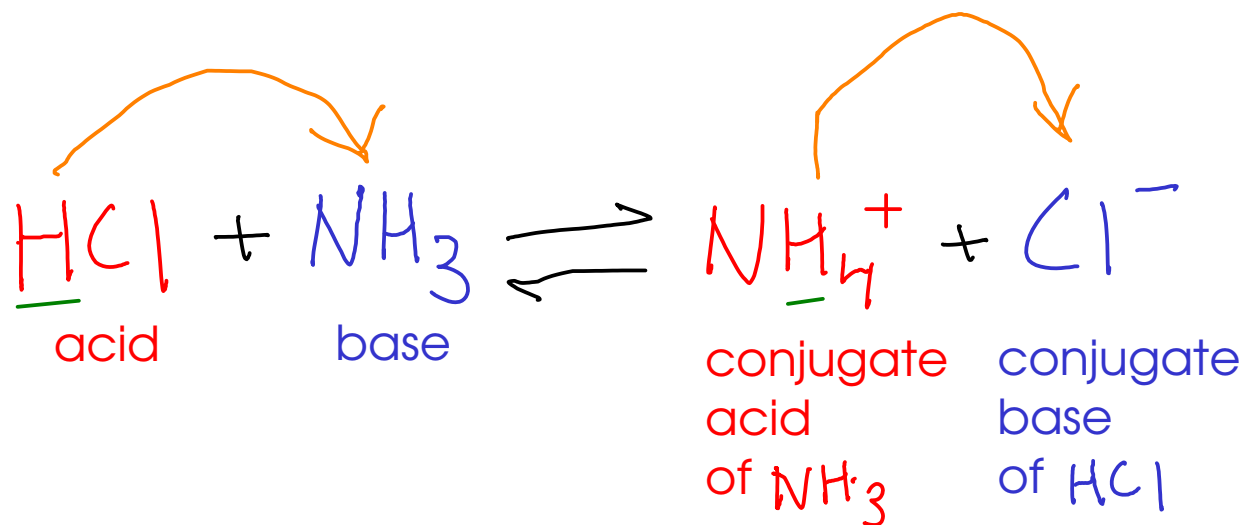
BRONSTED-LOWRY THEORY

H^+ ions!

- Bronsted-Lowry theory views acid-base reactions as PROTON TRANSFER reactions!

ACIDS are PROTON DONORS

BASES are PROTON ACCEPTORS



A CONJUGATE PAIR is an acid and a base that differ by a proton!

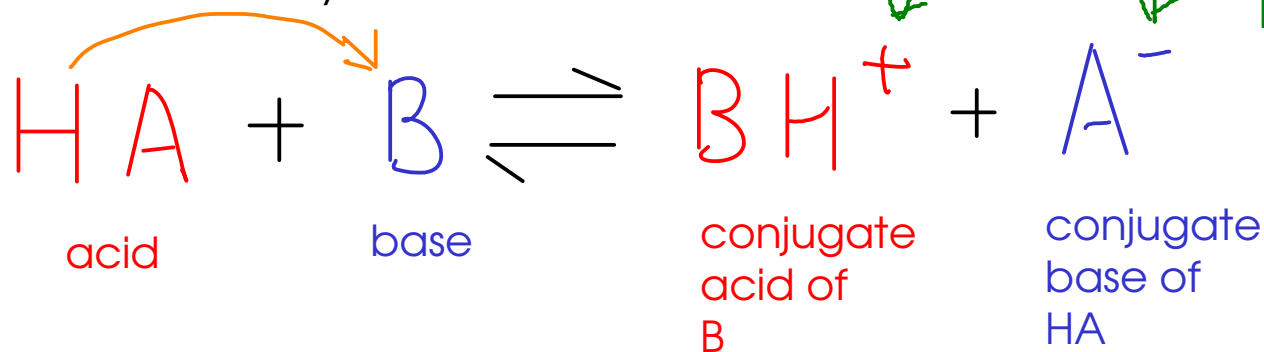
... a few examples of conjugate pairs:

Species	Conjugate
NH_3	NH_4^+
H_2O	OH^-
H_2O	H_3O^+
$\text{HC}_2\text{H}_3\text{O}_2$	$\text{C}_2\text{H}_3\text{O}_2^-$

RED for acid

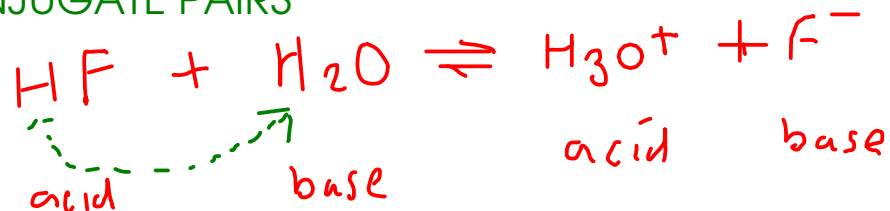
BLUE for base

A generic Bronsted-Lowry acid-base reaction:



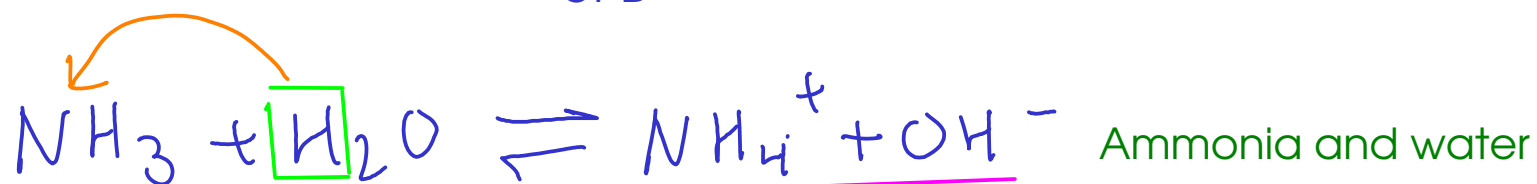
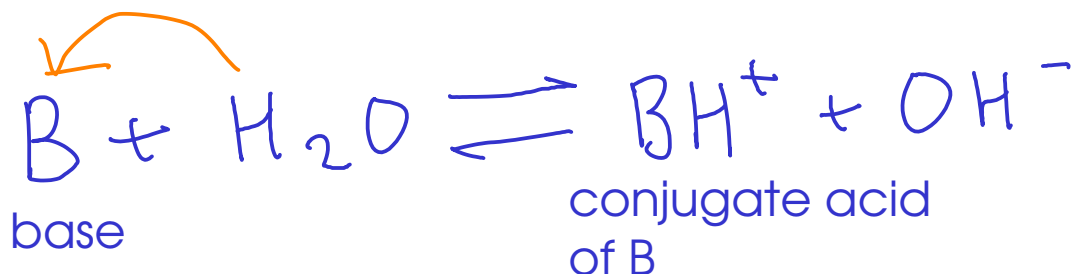
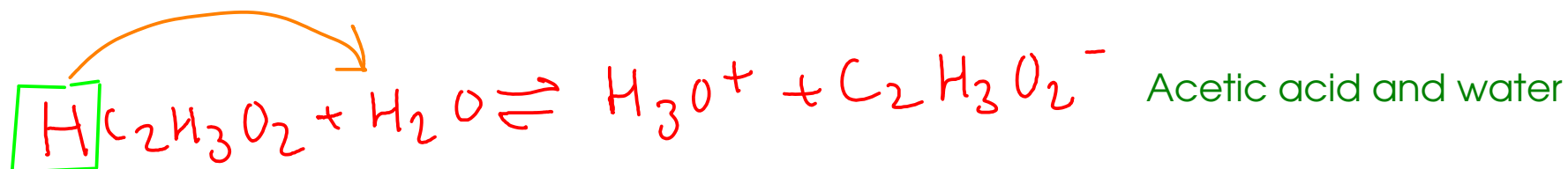
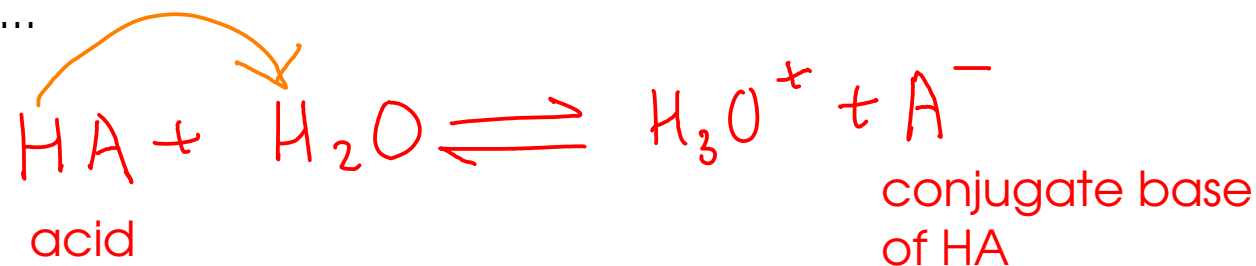
These charges are RELATIVE to whatever charge B and HA originally had...

... you should be able to write the products of a Bronsted-Lowry acid-base reaction, identifying the CONJUGATE PAIRS



BRONSTED-LOWRY THEORY

IN WATER...



This is why we often call an ammonia/water solution "ammonium hydroxide"!

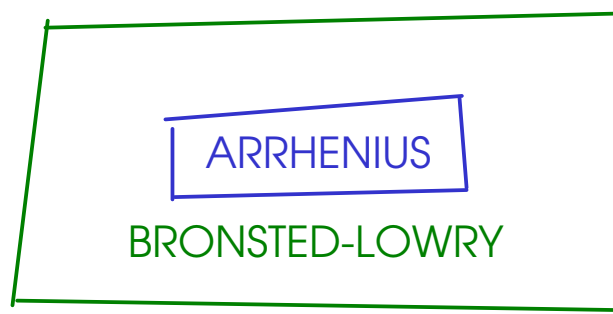
In the red reactions, water functions as a base. In the blue reactions, water functions as an acid!

¹⁰⁸ COMPARING THE THEORIES

- From Arrhenius to B-L, the definitions get broader as you go along. In other words, the later definitions include MORE SUBSTANCES under the acid/base umbrella.

If something is an Arrhenius acid, it is also an acid in the Bronsted Lowry picture.

If something is an Arrhenius base, it is also a base in the Bronsted Lowry picture.



... We will primarily use the BRONSTED-LOWRY theory from this point in the course!