

Acid - Base Theories



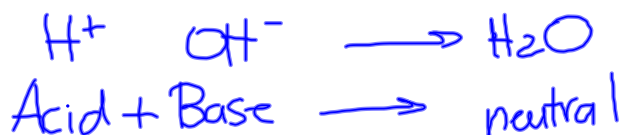
Arrhenius Theory of Acids and Bases

- acids are hydrogen-containing compounds that ionize in aqueous solutions to give H^+
- bases ionize to give OH^- ions

Monoprotic Acid - one hydrogen will ionize Ex. HNO_3

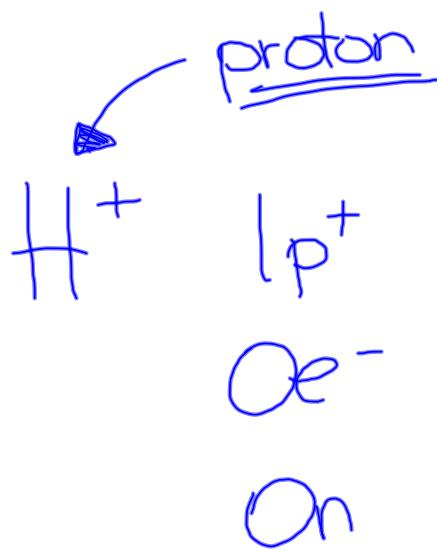
Diprotic Acid - two hydrogens will ionize Ex. H_2SO_4

Triprotic Acid - three hydrogens will ionize Ex. H_3PO_4



Advantage: it explained neutralization as H^+ and OH^- combining to give H_2O

Disadvantage: not all hydrogen containing substances have acid properties (i.e., CH_4) and not all bases have OH^- (NH_3).



1.01

$p+n = amu$

①

BRONSTED - LOWRY THEORY OF ACIDS & BASES

Bronsted-Lowry Acids and Bases

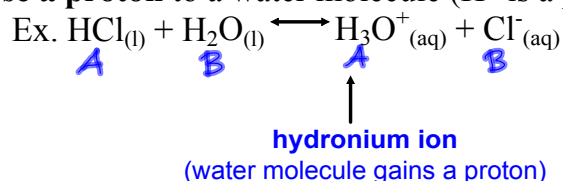
A new theory was needed because:

- (i) not all acid/base reactions involve water.
- (ii) not all bases contain hydroxide ions (Na_2CO_3 , NH_3).

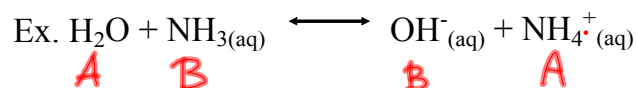
Bronsted - Lowry Acid - a proton (hydrogen-ion) donor

Bronsted - Lowry Base - a proton (hydrogen-ion) acceptor

- acids lose a proton to a water molecule (H^+ is a proton!)

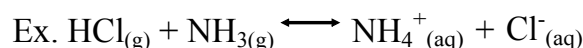


- bases gain a proton from a water molecule



(H_2O acts as an acid, NH_3 acts as a base)

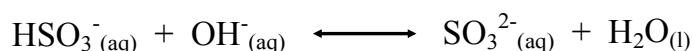
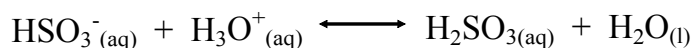
However water does not have to be present in order to have a proton exchange.



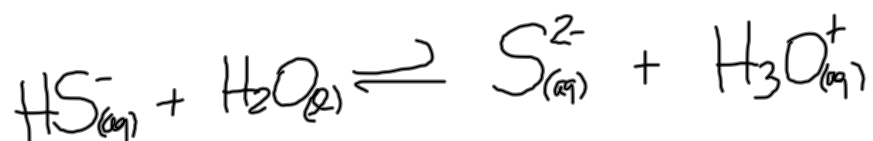
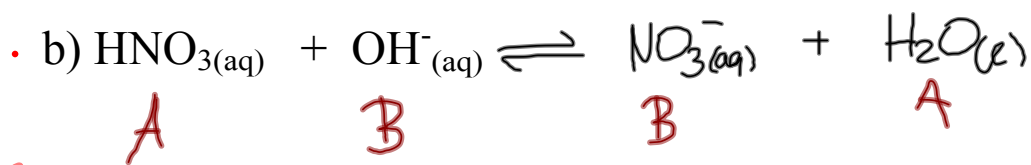
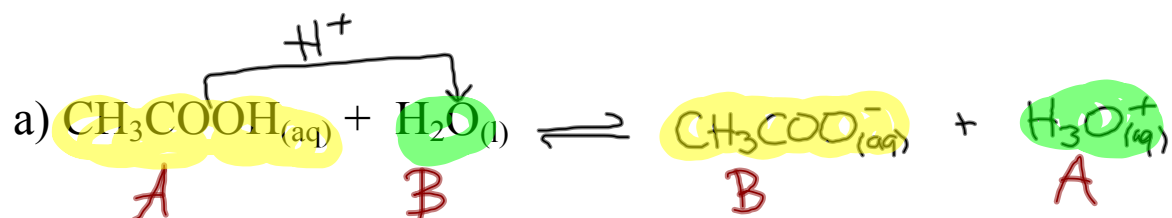
HCl donates a proton (acid)

NH_3 accepts a proton (base)

amphoteric (amphiprotic) - substance that can act as a Bronsted-Lowry acid in some reactions and a Bronsted-Lowry base in other reactions.



Predict the products for the following reaction, and identify each substance as an acid or a base.



Conjugate Acid-Base Pairs



Acid-Base reactions are at equilibrium !

(Look at forward reaction and reverse reaction)

- Every acid-base reaction at equilibrium has two acids and two bases.
- Acid on 'product' side is formed by addition of proton to base on 'reactant' side
- Base on 'product' side is formed by removal of a proton from acid on 'reactant' side

Conjugate acid-base pair

A pair of substances that differ by only a proton

Ex.

See Appendix F, p. 611

Homework

p. 593 #3-5,7,8