

## ACIDS AND BASES

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### Properties of Acids

- acids taste sour
- indicators change color in acids
- acids typically react with metals to form:  
**Acid + Metal  $\rightarrow$  H<sub>2</sub> + Salt + Heat** (Salts have no acid/base properties)
- acids are good enthalpy storers (lots of chemical potential energy)
- Acids typically react with carbonates to form:  
**Acid + Carbonate  $\rightarrow$  CO<sub>2</sub> + H<sub>2</sub>O + Salt + Heat**
- Acids are electrolytic
- acids require water to be acidic
- when acids are added to salts they form:  
**Acid + Salt  $\rightarrow$  New Acid + New Salt + Heat**
- Acids react as oxidizing agents (gain/steal electrons)

### Naming Acids

- acids are chemicals where hydrogen cations are bonded to any other anion
- Binary Acids*: have 2 types of atoms: HCl, H<sub>2</sub>S, HBr, HI....
  - Hydro + anion + (“ide to ic”) acid
- Arrhenius: acids increase the concentration of aqueous H ions
- acids dissociate because they’re soluble
- Oxyacids*: hydrogen and a polyatomic ion: H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub>, HClO<sub>4</sub>...
  - Anion + (ate/ic or ite/ous) acid

### Mono vs. Poly Protic

- HCl + H<sub>2</sub>O  $\rightarrow$  H<sup>+</sup> + Cl<sup>-</sup>
- protons do not exist outside of high energy physics labs. Protons are highly reactive, ½ life is very small, will distort the electron cloud of everything.
- We still count protons!
  - mono, di, tri, poly refers to the number of possible “acidic” hydrogen atoms attached.
    - H<sub>2</sub>SO<sub>4</sub> - diprotic
    - HNO<sub>3</sub> - monoprotic

### Properties of Bases (alkali)

- taste bitter
- change indicators
- soapy feel
- electrolytic solutions

### Naming Bases

- bases are capable of “absorbing” acids
- Bases are named “as is”
- typically, they contain hydroxide ions, but common base ions are OH<sup>-</sup>, CO<sub>3</sub><sup>-2</sup>, and PO<sub>4</sub><sup>-3</sup>
- each of these can absorb protons or donate electron pairs

- Arrhenius: base is any substance that increases the concentration of aqueous hydroxide ions
- NaOH - monobasic, Mg(OH)<sub>2</sub> - dibasic etc...

### Neutralization Reactions



- Salts are: - the remnants of acid and base reactions
  - combination of metals and non-metals
  - display no acid or base characteristics

### Definitions of Acids and Bases

-different definitions have differing areas of coverage (umbrella thing)

Lewis \_\_\_\_\_  
 Bronsted-Lowry \_\_\_\_\_  
 Arrhenius \_\_\_\_\_

#### Bronsted-Lowry

- Acid: a species which is characterized as a proton (H<sup>+</sup>) donor
- Base: a species which is characterized as a proton (H<sup>+</sup>) acceptor
  1. Acidity can occur outside of aqueous systems.
  2. Common bases now make sense: NH<sub>3</sub>, CO<sub>3</sub><sup>-1</sup>, PO<sub>4</sub><sup>-3</sup>

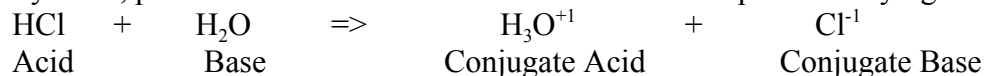
#### Lewis

1. Based on the idea of reviewing chemical bonds
2. H<sup>+</sup> can "accept" an electron pair, while OH<sup>-1</sup> can "donate" an electron pair
3. Acid is an "electron pair acceptor"  
 Base is an "electron pair donor"      With these, it's all about dative bonds!!!

-competition for the proton

### Role of the Oxonium/Hydronium Ion

-In all aqueous systems, protons DO NOT EXIST! Water becomes the proton carrying vehicle



*Bron-Lowry:* proton donor    proton acceptor    Possible Proton donor    Possible proton acceptor

*Lewis:*    Epair acceptor    Epair donor    Possible Epair acceptor    Possible Epair donor

-touch up on VSEPR shapes and flying wedge projections

### Concept of Conjugates

- all polyspecies dissociate in a stepwise manner
- Amphoteric: a species that can act as either an acid or a base, in complete dissociation, amphoteric species are always intermediate steps
- don't include water in amphoteric stuff!!!
- amphoteric species are in the list of both acids and bases
- number of amphoteric species = (number of protic) - 1
- strong acids form weak conjugate bases

-strong bases form weak conjugate acids

-weak acids form strong conjugate bases

-weak bases form strong conjugate acids

If it gave away protons, then why would it want any back???