Name: KEY Official Class: _____ Date: _____

Teacher: _____ Period: _____ Class: _____

Intro to Acids and Bases

Acids

- Acids can be strong or weak electrolytes in aqueous solutions.
- Acids (example HCl) react with certain metals to produce $H_2(g)$
- Acids cause color changes in acid-base indicators:
  - Blue litmus paper turns red in an acid
  - Phenolphthalein is colorless in an acid.
- Acids have a sour taste.
- Table K has a list of common acids and bases

Bases

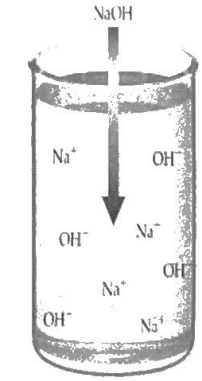
- Bases can be strong or weak electrolytes in aqueous solutions.
- Bases cause color change in acid-base indicators.
  - Red paper turns blue in a base.
  - Phenolphthalein is pink in a base.
- Bases feel slippery and taste bitter.
- Table L has a list of common bases

Arrhenius Acid

- An Arrhenius acid gives off H^+ (hydrogen ions) in aqueous solutions.
- Example: HCl, HBr, H_2SO_4.
- The H^+ in solutions attaches to H_2O to form H_3O^+ (hydronium ion)
- $HCl + H_2O \rightarrow H^+ + Cl^- + H_2O \rightarrow Cl^- + H_3O^+$

Arrhenius Base

- An Arrhenius base has OH and give off OH^- (hydroxide ions) in an aqueous solution.
- Example: NaOH, KOH, $Ca(OH)_2$
- Group 1 metals react with water to produce bases.
- $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$



$NaOH(aq) \longrightarrow Na^+(aq) + OH^-(aq)$

Check Point Questions

1. Which substance can be classified as an Arrhenius acid?
   - a. HCl ↳ H^+ or H_3O^+
   - b. NaCl
   - c. LiOH
   - d. KOH
2. Which substance can be classified as an Arrhenius base?
   - a. HCl
   - b. NaOH ↳ OH^-
   - c. $LiNO_3$
   - d. $KHCO_3$
3. According to the Arrhenius theory, a substance that is classified as an acid will always yield
   - a. $H^+_{(aq)}$ acid
   - b. $NH^+_{4(aq)}$
   - c. $OH^-_{(aq)}$ (base)
   - d. $CO_3^{2-}{}_{(aq)}$

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Bronsted-Lowry Acids and Bases

- An acid is an H+ donor (proton donor).
- A base is an H+ acceptor (proton acceptor)
- Acid Base

$$HCl(g) + H_2O(l) \leftrightarrow H_3O^+(aq) + Cl^-(aq)$$

donates H+ accepts H+

- HCl is an acid because it donates an H+ to the H_2O.

base acid

$$NH_3(aq) + H_2O(l) \leftrightarrow NH_4^+(aq) + OH^-(aq)$$

accepts H+ donates H+

- NH_3 is a base because it accepts H^+ from the H_2O.
- Water can either be an proton donor (acid) or proton acceptor (base), water is amphoteric.

Bases Accept Acids Donate (H^+)

Check Point Questions

4. According to the Bronsted-Lowry theory, a chloride ion (Cl^-), acts as a base when it combines with
   a. An OH^- ion
   b. A K^+ ion
   c. An H^- ion
   d. An H^+ ion

BAAD (H^+)

5. According to the Bronsted-Lowry theory, an acid is
   a. A proton donor, only
   b. A proton acceptor, only
   c. A proton donor & proton acceptor
   d. Neither a proton donor nor a proton acceptor

BAAD H^+ = proton

Conjugate Acids and bases

Base Acid

$$NH_3(aq) + H_2O(l) \leftrightarrow NH_4^+(aq) + OH^-(aq)$$

conjugate acid conjugate base

- A conjugate base is what is remaining after the acid gives up H^+.
- A conjugate acid is what is formed when a base accepts a H^+.

Conjugate Acid-Base Pairs Practice

- For each pair label acid, base, conjugate acid, conjugate base

B A CA CB

$$NH_{3(aq)} + H_2O_{(l)} \leftrightarrow NH_4^+{}_{(aq)} + OH^-{}_{(aq)}$$

A B CA CB

$$HCl_{(g)} + H_2O_{(l)} \leftrightarrow H_3O^+{}_{(aq)} + Cl^-{}_{(aq)}$$

Summary

- Acids
  - Arrhenius
    - gives off H^+ in water
  - Bronsted-Lowry
    - H^+ donor
- Bases
  - Arrhenius
    - gives of OH^- in water
  - Bronsted Lowry
    - H^+ acceptor