7.6: Properties of Acids & Bases and Acid Nomenclature

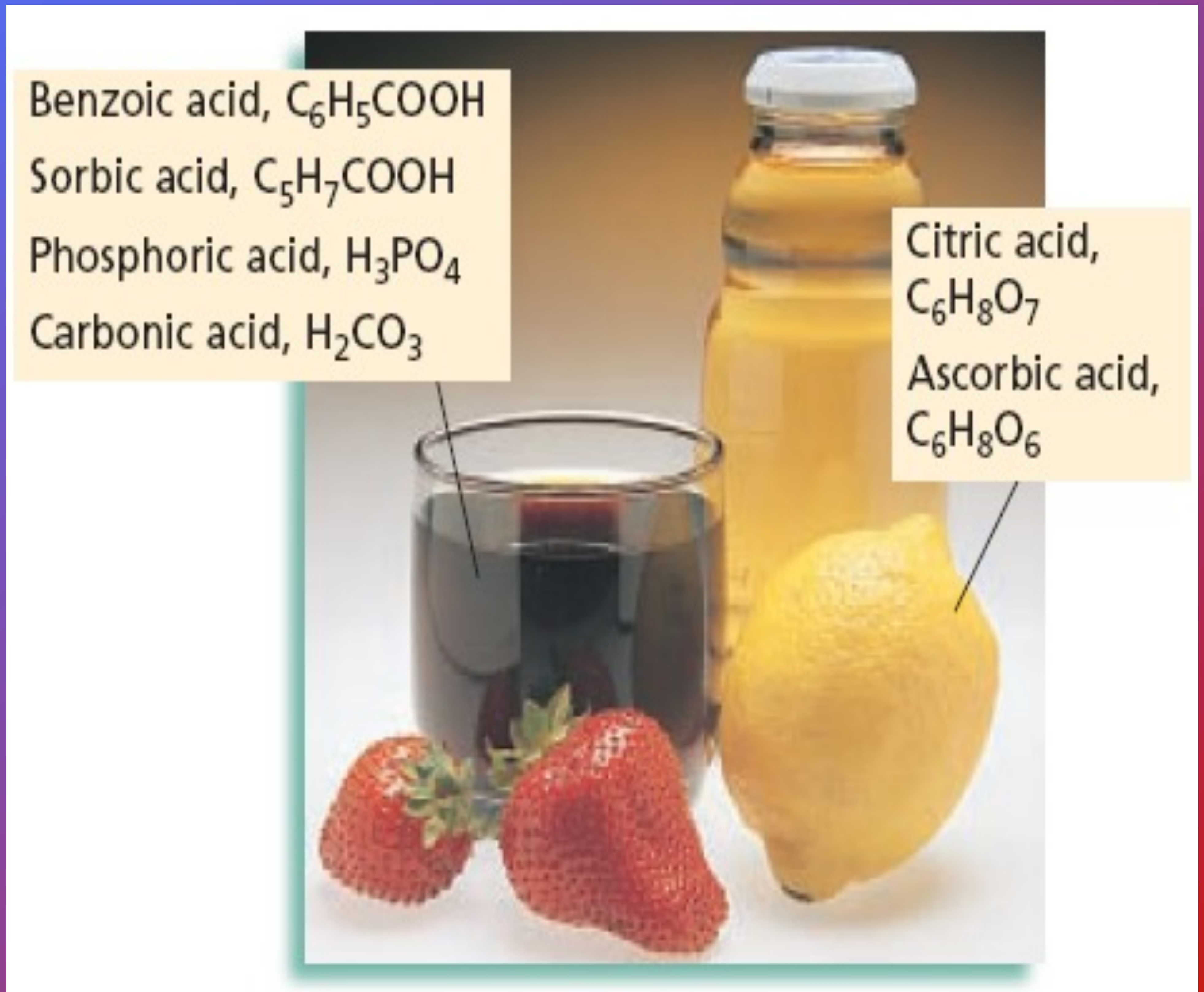
Remember:

- Have your **7.6 notesheet** ready!
- You can **pause** the video anytime.
- You can **rewind** the video anytime.
- Write down **questions/comments** as you go for discussion in class.

Are you ready???

Part I: General Properties of Acids & Bases

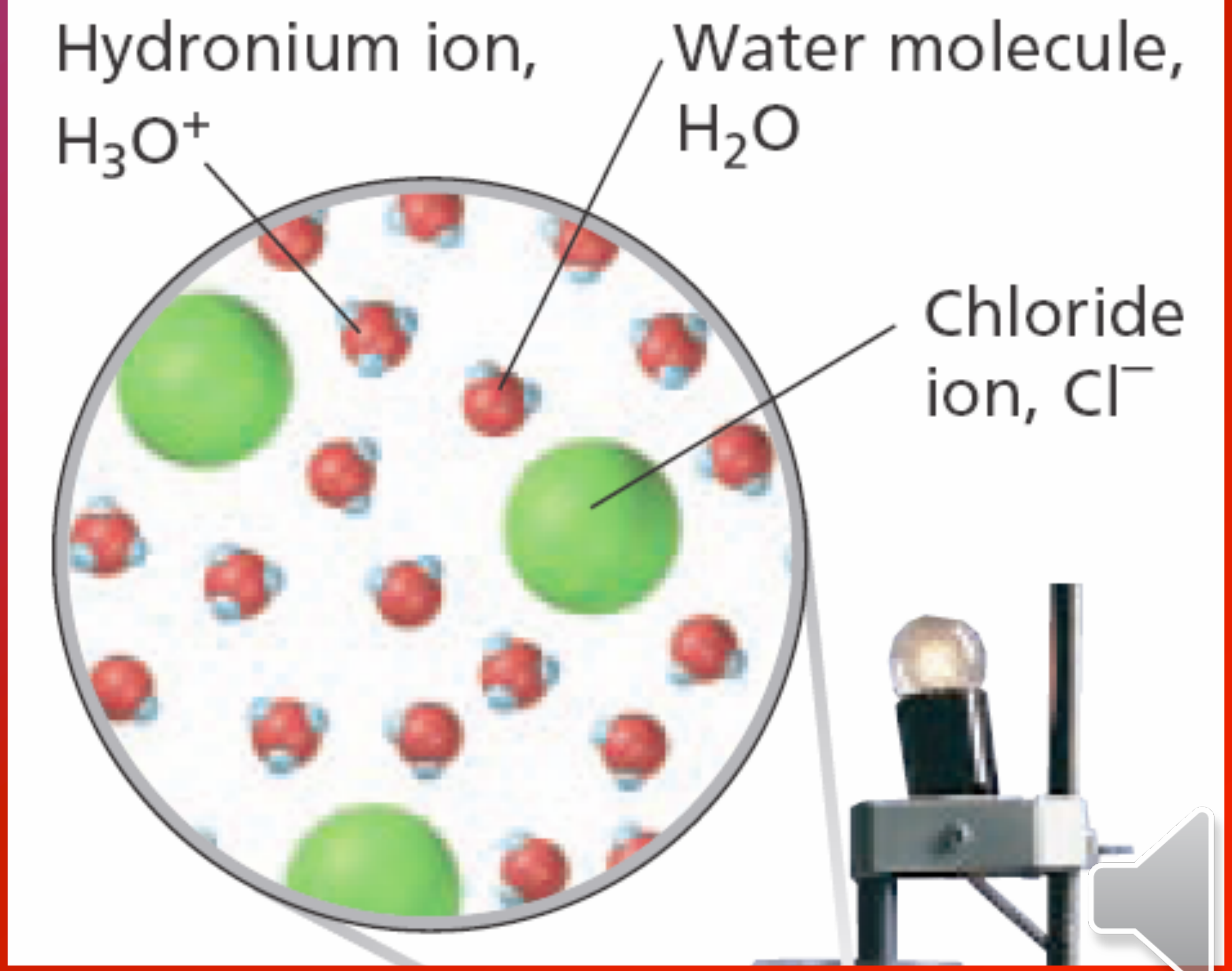
- *acids and bases are found in many everyday items, like foods, cleaners, and medicines.*
  - ***acids** give citrus fruits their sour flavor, and soft drinks their tart flavor*
  - ***bases** are found in both mild and powerful cleaners, like soap and Drano, and also in many antacids, such as Tums*
- *acids and bases have **distinct properties** that distinguish them:*



- *acids and bases have **distinct properties** that distinguish them:*

Acid Properties	*Base Properties*
*aqueous solutions have a **tart** flavor*	*aqueous solutions have a **bitter** flavor*
*change the color of indicators to **red***	*change the color of indicators to **blue***
***react with metals** to form H_2 gas*	*aqueous solutions **feel slippery***
*are considered "**corrosive**"*	*are considered "**caustic**"*
*some can be **poisonous***	*can cause **severe burns** by dissolving tissues*
*named using **acid nomenclature***	*named using **ion card** like always*
Properties of Both Acids and Bases	
*acids react with bases to form a **salt** (a metal + a halogen) and water*	
*both produce **electrolytes** in aqueous solutions (extent depends on polarity)*	





Part II: Definitions of Acids & Bases

- *there are **two** distinct **definitions** that describe the sort of chemicals that can be called acids and bases: **Arrhenius** and **Brønsted-Lowry***
  - ***Arrhenius Acids & Bases***
    - *the general Arrhenius acid and base definition depends on **what ions a compound makes** in aqueous solution:*

Arrhenius Acids	*Arrhenius Bases*
produce hydrogen ions (H^+)	*produce hydroxide ions (OH^-)*
***ex**: HCl, HNO_3, CH_3COOH*	***ex**: NaOH, $Ca(OH)_2$, $Al(OH)_3$*

  - *this definition is the most exclusive, meaning relatively few substances can be considered Arrhenius acids or bases because of the ions they must make in order to fit the definition.*
  - ***Brønsted-Lowry Acids & Bases***
    - *the general Brønsted-Lowry acid and base definition depends on whether the compound can be considered a **proton donor** or a **proton acceptor**:*

Arrhenius Acids	*Arrhenius Bases*
produce hydrogen ions (H^+)	*produce hydroxide ions (OH^-)*
***ex**: HCl, HNO_3, CH_3COOH*	***ex**: NaOH, $Ca(OH)_2$, $Al(OH)_3$*

- *this definition is the most exclusive, meaning relatively few substances can be considered Arrhenius acids or bases because of the ions they must make in order to fit the definition.*
- ***Brønsted-Lowry Acids & Bases***
  - *the general Brønsted-Lowry acid and base definition depends on whether the compound can be considered a **proton donor** or a **proton acceptor**:*

Brønsted-Lowry Acids	*Brønsted-Lowry Bases*
donate protons (in the form of H^+)	*accept protons (usually have a neg. charge)*
***ex**: HCl, HNO_3, CH_3COOH, H_2O*	***ex**: OH^-, HSO_4^-, CO_3^{-2}, H_2O*

Brønsted-Lowry Acids	*Brønsted-Lowry Bases*
donate protons (in the form of H^+)	*accept protons (usually have a neg. charge)*
***ex**: HCl, HNO_3, CH_3COOH, H_2O*	***ex**: OH^-, HSO_4^-, CO_3^{-2}, H_2O*

- *to **donate a proton** means to **produce an H^+ ion** in aqueous solution, so a Brønsted-Lowry acid is essentially defined the same way as an Arrhenius acid*
- *the ability to **accept a proton** is the ability to **gain 1 or more H^+ ions** and form a new, neutral compound, so a Brønsted-Lowry base is, by definition, **different** from an Arrhenius base. This means that most B-L bases must have a **neg. charge**.*
- *this definition is the **least exclusive**, meaning more substances can be considered B-L acids or bases because there are **less rules** a compound must obey in order to fit the definition.*

Part III: Acid & Base Strength

- *the strength of an Arrhenius acid or base depends only on the* ***degree of ionization/ dissociation*** *the acid or base undergoes*
- *in other words, the higher the* ***polarity*** *of the acid or base, the* ***stronger*** *it is*

TABLE 15-3 Common Aqueous Acids

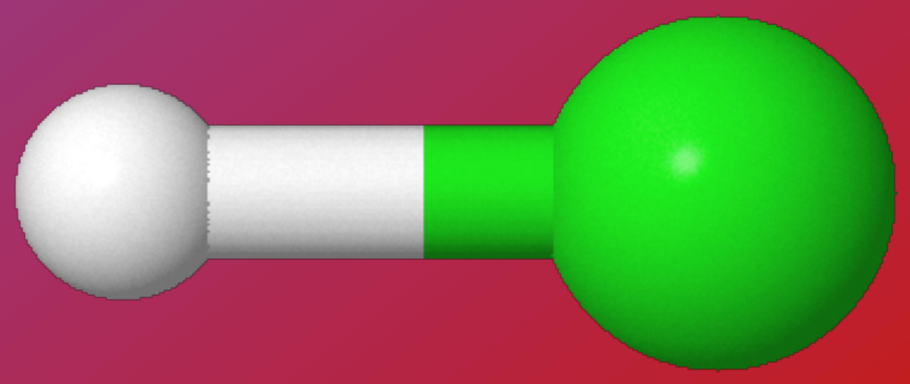
Strong acids	Weak acids
$H_2SO_4 + H_2O \longrightarrow H_3O^+ + HSO_4^-$	$HSO_4^- + H_2O \rightleftharpoons H_3O^+ + SO_4^{2-}$
$HClO_4 + H_2O \longrightarrow H_3O^+ + ClO_4^-$	$H_3PO_4 + H_2O \rightleftharpoons H_3O^+ + H_2PO_4^-$
$HCl + H_2O \longrightarrow H_3O^+ + Cl^-$	$HF + H_2O \rightleftharpoons H_3O^+ + F^-$
$HNO_3 + H_2O \longrightarrow H_3O^+ + NO_3^-$	$CH_3COOH + H_2O \rightleftharpoons H_3O^+ + CH_3COO^-$
$HBr + H_2O \longrightarrow H_3O^+ + Br^-$	$H_2CO_3 + H_2O \rightleftharpoons H_3O^+ + HCO_3^-$
$HI + H_2O \longrightarrow H_3O^+ + I^-$	$H_2S + H_2O \rightleftharpoons H_3O^+ + HS^-$
	$HCN + H_2O \rightleftharpoons H_3O^+ + CN^-$
	$HCO_3^- + H_2O \rightleftharpoons H_3O^+ + CO_3^{2-}$

TABLE 15-4 Common Aqueous Bases

Strong bases	Weak bases
$Ca(OH)_2 \longrightarrow Ca^{2+} + 2OH^-$	$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$
$Sr(OH)_2 \longrightarrow Sr^{2+} + 2OH^-$	$C_6H_5NH_2 + H_2O \rightleftharpoons C_6H_5NH_3^+ + OH^-$
$Ba(OH)_2 \longrightarrow Ba^{2+} + 2OH^-$	
$NaOH \longrightarrow Na^+ + OH^-$	
$KOH \longrightarrow K^+ + OH^-$	
$RbOH \longrightarrow Rb^+ + OH^-$	
$CsOH \longrightarrow Cs^+ + OH^-$	

Part IV: Acid Nomenclature

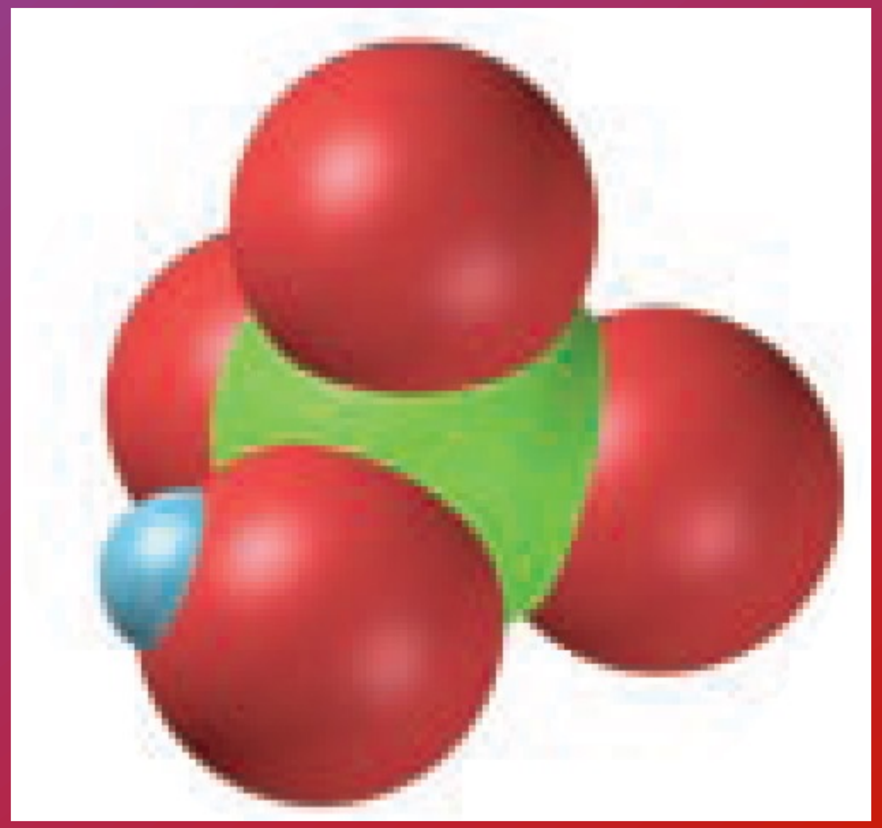
- *acids are distinguished from other substances by the presence of one or more **hydrogen ions (H^+)** or **hydrogen atoms** at the **beginning** of the formula.*
- *to name an acid correctly, you must know the types of acid it is. There are two types of acids: **Binary Acids** and **Oxyacids***
  - ***binary acid** = an acid consisting of **only 2 elements**. One of the elements is always **hydrogen**, and the other is usually a **halogen** or other **nonmetal**.*



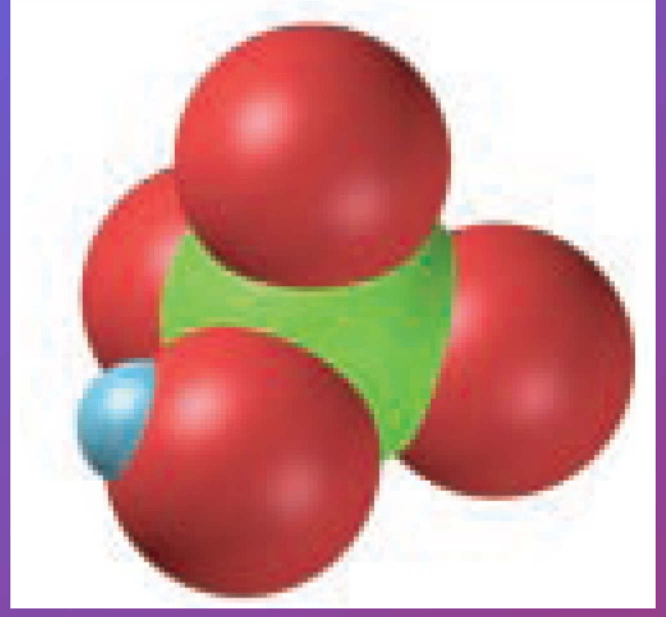
    - *to name a binary acid, follow this procedure: (**HCl** as an example)*

1. *use the prefix "**hydro-**"* — ***hydro**__________*
2. *name the **element** the H is bonded to* — *chlorine*
3. *take the **ending** off the element name* — *hydro**chlor**-*
4. *add the suffix "**-ic**" to the element name* — *hydrochlor**ic***
5. *add the separate word "**acid**" to the end* — *hydrochloric **acid***

- *try naming/formulating these **binary acids**:*
  - *HBr =* hydrobromic acid
  - *HI =* hydroiodic acid
  - *H_2S =* hydrosulfuric acid
  - *hydrofluoric acid =* HF
  - *hydroxic acid =* H_2O
  - *hydroselenic acid =* H_2Se
- ***<u>oxyacid</u>*** *= an acid consisting of **3 or more elements**. One of the elements is always **hydrogen**, and the other 2 or more come from a **polyatomic ion** (PAI).*
  - *to name a oxyacid, follow this procedure:*



- ***oxyacid*** = *an acid consisting of **3 or more elements**. One of the elements is always **hydrogen**, and the other 2 or more come from a **polyatomic ion** (PAI).*



  - *to name a oxyacid, follow this procedure:* (***H_2CO_3*** *as an example)*

    1. ***name the PAI** the H is bonded to* — *carbonate*
    2. *take the **ending** off the PAI name* — ***carbon-***
    3. *add a **suffix** to the PAI name—if the PAI ends in:*
       a. *"**-ite**," use the suffix "**-ous**"*
       b. *"**-ate,**" use the suffix "**-ic**"* — *carbon**ic***
    4. *add the separate word "**acid**" to the end* — *carbonic **acid***

- *try naming/formulating these* ***oxyacids****:*
  - HNO_3 = nitric acid
  - H_2SO_4 = sulfuric acid
  - H_2SO_3 = sulfurous acid
  - $HBrO$ = hypobromous acid
  - *permanganic acid* = $HMnO_4$
  - *chloric acid* = $HClO_3$
  - *chlorous acid* = $HClO_2$
  - *phosphoric acid* = H_3PO_4

- *Make sure notesheet is* ***completely filled in,*** *read about industrial acids*
- *Preview the* ***funsheet*** *(7.6)*
- ***Rewind and review*** *any parts that were not clear*
- *Bring both* ***notesheet*** *and* ***funsheet packets*** *to class*