

Acids: Properties of aqueous solutions of acids

- 1) sour taste
- 2) change the color of acid-base indicators
- 3) some acids produce hydrogen gas when reacting with certain metals
- 4) acids react with bases forming a salt and water
- 5) acids are electrolytes

## Acid nomenclature

**binary acids** contain only two different elements - hydrogen and one of the more electronegative elements

HF	hydrofluoric acid
HCl	hydrochloric acid
HBr	hydrobromic acid
HI	hydriodic acid
H <sub>2</sub> S	hydrosulfuric acid

**Oxyacids** contain hydrogen, oxygen, and a third (usually nonmetal) element. These are known as ternary acid because they contain 3 different elements.

$\text{CH}_3\text{COOH}$       acetic acid      acetate ion

$\text{H}_2\text{CO}_3$       carbonic acid      carbonate ion

$\text{HClO}_3$       chloric acid      chlorate ion

$\text{H}_2\text{SO}_4$       sulfuric acid      sulfate ion

#### Common Industrial Acids

**Sulfuric:** most commonly produced industrial chemical in the world. It is used in the petroleum industry as well as in the production of metals, paper, paint, dyes, detergents, and car batteries.

**Nitric:** has a "suffocating" odor, will stain proteins yellow, used in making explosives as well as rubber, plastics, dyes, and pharmaceuticals.



**Phosphoric:** used to make fertilizers and animal feed. Non-toxic and used as a flavoring agent in beverages.

**Hydrochloric:** stomach acid, used in "pickling" iron and steel (essentially eats away surface impurities). Concentrated HCl is often referred to as muriatic acid and can be found in hardware stores.

**Acetic:** vinegar contains between 4-8%, used in making plastics, food supplements such as lysine. Also used as a fungicide.

## Bases

- taste bitter
- change the color of acid-base indicator
- dilute solutions feel slippery
- react with acids to produce a salt and water
- are electrolytes

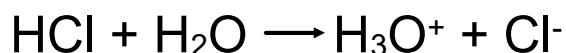
**Arrhenius Acid** is a chemical compound that increases the concentration of  $\text{H}^+$  ions in an aqueous solution.

**Arrhenius Base** is a chemical compound that increases the concentration of  $\text{OH}^-$  ions in an aqueous solution.

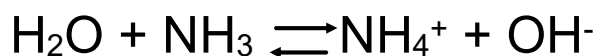
A **strong acid** is one that ionizes completely in an aqueous solution - strong electrolytes with a hydrogen make strong acids. **Strong bases** are ones that completely dissociates in water.

**Bronsted-Lowry acid** is a molecule or ion that is a proton donor

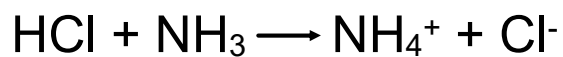
essentially, a molecule that reacts and gives a  $\text{H}^+$  to another molecule is a Bronsted-Lowry acid.



Water can also act as a Bronsted-Lowry acid



**Bronsted-Lowry base** is a molecule or ion that is a proton acceptor.



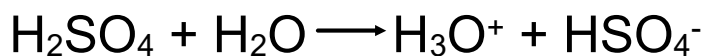
The ammonia is the Bronsted-Lowry base because it accepts the proton from the HCl.

In a Bronsted-Lowry acid-base reaction, protons are transferred from one reactant (acid) to another reactant (base).

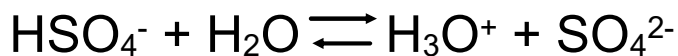
**Monoprotic acid** is one in which each molecule can donate one proton.

**Polyprotic acid** is one in which each molecule can donate more than one proton.

First stage is a strong acid -



Second stage is a weak acid -



**Lewis acid** is an atom, ion, or molecule that accepts an electron pair to form a covalent bond.

