

Acid-Base Theories

A) Antoine Lavoisier (1743-1794)

Lavoisier classified all chemicals into acids, bases and salts

He believed that all acids were oxygen containing chemicals and the presence of oxygen gave them their sour taste

His theory is, of course, flawed as witnessed by HCl as an acid and the fact that metal oxides form bases

B) Sir Humphrey Davy (1810)

Proposed that acids contain hydrogen rather than oxygen as he showed that HCl was an acid that did not contain oxygen

C) Svante Arrhenius (1887)

His theory revolves around the role of water when an acid or base dissolves forming a solution. His main points are:

- Acids dissociate in water forming hydrogen ions H^+ as one product
- Bases dissociate in water forming hydroxide ions OH^- as one product
- Neutralization reactions involve the reaction of H^+ ions in the acid reacting with OH^- ions forming water salt as products

There are some flaws in his theory:

- Some substances such as NH_3 and Na_2CO_3 behave as bases and do not contain OH^-

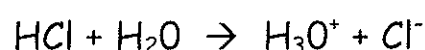
- His theory on acids and bases can only be applied to aqueous solutions
 - His theory does not address relative strengths of acids and bases
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D) Bronsted-Lowry (1923)

An **acid** is a proton H^+ donor to a base

A **base** is a proton acceptor

Examples:



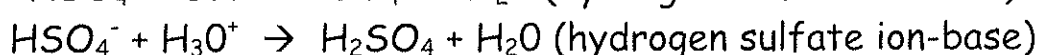
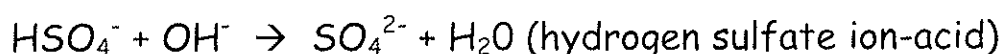
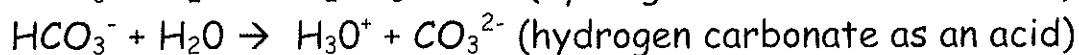
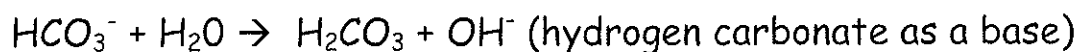
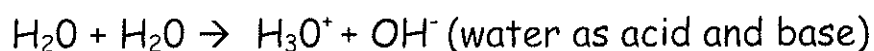
In the first example, hydrochloric acid is donating a proton- an acid

In the second example, ammonia is accepting a proton- a base

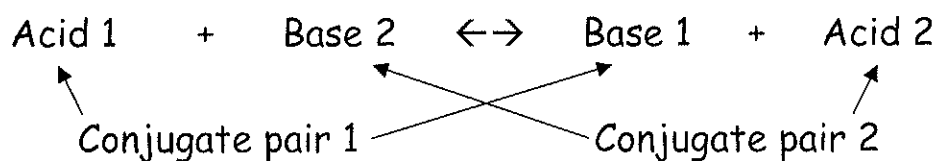
Amphiprotic substances

Chemicals that can react as acids in some reactions and bases in other reactions

Examples:



Bronsted-Lowry conjugate acid-base pairs

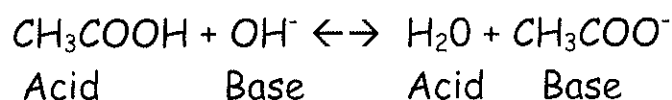


What does this mean?

An acid reacts with a base and forms a conjugate base that can accept a proton

A base can react with an acid to form a conjugate acid that can donate a proton

Example:



The acetic acid donates a proton making it a B-L acid

The hydroxide accepts a proton making it a B-L base

Water can donate a proton in solution making it a B-L acid

The acetate ion can also accept a proton making it a B-L base

How do we predict equilibrium?

The direction of acid-base equilibria is away from the stronger acid base side and towards the weaker acid-base side

The stronger the acid, the weaker its conjugate base

The stronger the base, the weaker its conjugate acid