ACIDS AND BASES

Acids	Bases
Tastes sour	Tastes bitter
Turns litmus paper red	Turns litmus paper blue
Reacts with some metals to give off hydrogen gas.	Feels slimey or slippery to the touch.

STRONG ACID AND WEAK ACID

Strong acids (HCl) are fully ionised but weak acids (CH_3COOH- acetic acid) are only partly ionised in solution.

STRONG BASE AND WEAK BASE

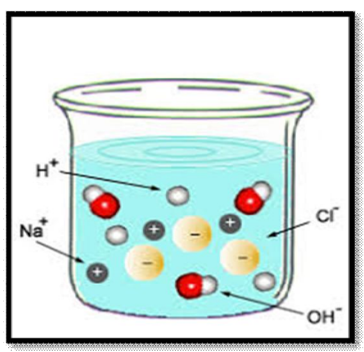
Strong base (sodium hydroxide) are fully ionised but weak base (ammonia) are only partly ionised in solution.

AMPHOTERIC

Able to react both as a base and as an acid.

ARRHENIUS THEORY:

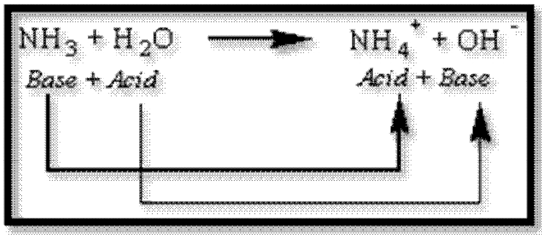
Introduced in 1887 by the Swedish scientist Svante Arrhenius, that acids are substances that dissociate in water to yield electrically charged atoms or molecules, called ions, one of which is a hydrogen ion (H^+), and that bases ionize in water to yield hydroxide ions (OH^-).



BRONSTED-LOWRY THEORY:

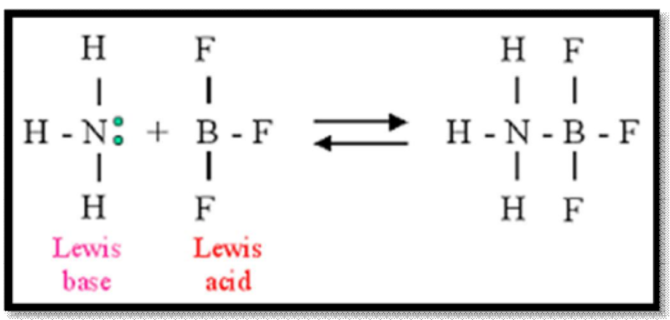
An acid is proton donor.

A base is a proton acceptor



LEWIS THEORY OF ACID-BASE REACTIONS:

bases donate pairs of electrons and acids accept pairs of electrons. A Lewis acid is therefore any substance, such as the H^+ ion, that can accept a pair of nonbonding electrons. In other words, a Lewis acid is an electron-pair acceptor.



Acid and Base

Maintenance of the **internal environment** is one of the **vital functions** (it has same importance as circulation or respiration). (1) isohydria (stable pH), (2) isovolumia (stable volume), (3) isoosmolarity (stable tonicity), and (4) isoionia (stable plasma ion composition).

Acids and bases in the body

Source of acids in the body is chiefly **metabolism**, **source of bases** is predominantly **nutrient.**

Acids and bases undergo either (1) **metabolic conversion** (e.g. lactate to glucose in gluconeogenesis, lactate to pyruvate and oxidation in cardiomyocytes), or (2) **excretion** from body.

Three types of reactions can be distinguished from point of view of the acid-base balance. (1) **proton-productive**, (2) **proton-consumptive**, (3) **proton-neutral**. Examples follow:

<u>1) Proton-productive reactions</u>

a) Anaerobic glycolysis in muscles and erythrocytes

$$\text{Glucose} \rightarrow 2\ CH_3CHOHCOO^- + 2\ \mathbf{H^+}$$

2) <u>Proton-consumptive reactions</u>

a) Gluconeogenesis

$$2\ \text{lactate} + 2\ \mathbf{H^+} \rightarrow \text{Glc}$$

<u>3) Proton-neutral reactions</u>

Complete oxidation

$$\text{Carbon skeleton} \rightarrow CO_2 + H_2O \rightarrow HCO_3^- + \mathbf{H^+}$$

Acids can be divided into two groups: (1) **volatile acids** (respiratory acids), (2) **non-volatile acids** (metabolic acids).

The most important volatile acid is **carbonic acid** (H_2CO_3). H_2CO_3 is produced by reaction of **carbon dioxide** (CO_2 is acid-forming oxide) with water. 15 000 – 20 000 mmol CO_2 (therefore same amount of carbonic acid) is **produced every day. Respiratory system** however very efficiently eliminates it. This justifies the term volatile acid.

Two groups are distinguished among non-volatile acid: (1) **organic**, and (2) **inorganic**. **1 mmol/kg** of body weight is produced **every day**. Non-volatile acid could be either (1) **metabolised**, or (2) **excreted** (using mainly kidneys).

Organic non-volatile acids are for example: (1) **lactic acid**, (2) **fatty acids**). They are continually produced by metabolism (incomplete oxidation of TAG, carbohydrates, proteins). As organic non-volatile acids are products of metabolism in **normal** conditions they are oxidized completely to CO_2 and H_2O. Therefore they have no influence on proton overall balance.