

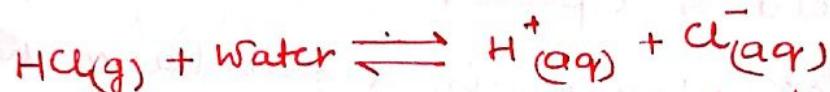
Acids and Bases

There are several concepts to explain the acids and bases. Some of them are discussed below.

Asthenius Concept :

(Acid :) An acid is a substance which dissociates to give hydrogen ions when dissolved in water.

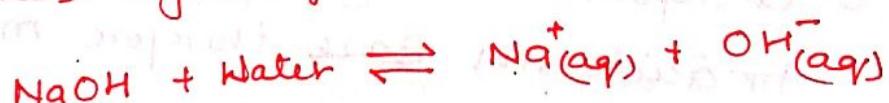
Thus HCl gas is an acid because when dissolved in water it gives Hydrogen ion.



(aq) indicates that ions are hydrated. It means associated with one or more molecules of water.

Base : Base is a substance which dissociates into hydroxyl ions when dissolved in water

thus NaOH is a base because it furnishes hydroxyl ion in aqueous solution.



* High dielectric constant of water lower the force of attraction between oppositely charged ions and thus cause the dissociation of electrolyte.

Hydronium ion : Hydrogen ion is merely a proton. Smallest ion known, no any electron so it has strong tendency to get hydrated. It exists largely as attached to a molecule of water forming H_3O^+ ion. (Hydronium ion)

Due to simplicity, Arrhenius concept was widely accepted and used.

It fails to account for the behaviour of acids and bases in solvents other than water.
ie in non-aqueous solvents.

Proton Transfer Theory; Lowry and Bronsted Concept:

- * More General Definition

- * Applicable to aqueous as well as non-aqueous solns

Acid: Acid is a substance which has a tendency to donate a proton to any other substance.

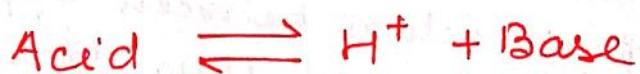
- * Acid is a proton donor.

Base: Base is a substance which has a tendency to accept a proton from any other substance.

- * Base is a proton acceptor.

- * When acid loses a proton then its remaining part has a tendency to gain the proton. therefore it behaves as base.

An acid and Base therefore may be defined by a general equation



- * Ionisation of acetic acid.



Acid	Base	Acid	Base
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- * Acetic acid donates proton to water and thus act as an acid.

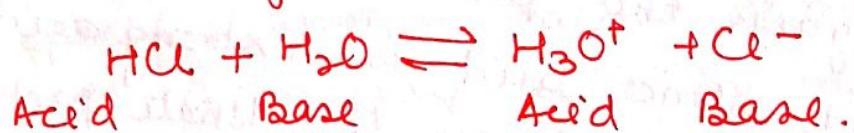
- * Water accepts a proton and therefore act as base.

- * In the reverse action H_3O^+ donates a proton to acetate ion and act as acid
- * Acetate ion accepts the proton from H_3O^+ hence act as base.
- ** Such pairs of substances which can form each other by the gain or loss of proton are known as Conjugate Acid-Base Pairs.

- * Acetic Acid is conjugate acid of Acetate ion.
- * Water is conjugate base of Hydrogenium ion.

Conclusion from Above Discussion:

- * A substance is able to show its acidic character only if another substance capable of accepting a proton is present.
- * Hydrogen ion in aqueous solution does not exist as H^+ but as hydrated ion H_3O^+ .
- * Not only molecules but even ions may act as acids or bases. like in above ions and the given one.



- * Acid_1 and Base_1 are conjugate acid-base pairs of each other
- * Acid_2 & Base_2 are conjugate acid-base pairs of each other.

- * An acid requires a solvent that can take up a proton. for its ionization.
• Likewise
- * A Base requires a solvent that can give up a proton. for its ionization.
- * Water (H_2O) Possess both Basic and acidic properties. So acid as well as base can ionise in water.
- * Such substances which act as acid as well as Base are known as ~~Antithetic~~ Amphiprotic.



Base, Acid, Acid, Base.

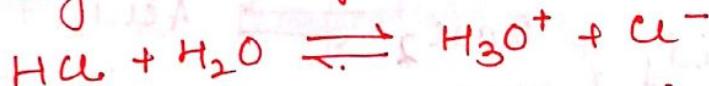
- * Ammonium ion is conjugate acid for Ammonia (Base).
- * OH^- is conjugate bas of H_2O

Relative Strength of Acid and Base:

According to this concept (Lorng & Bronsted) strength of an acid depends upon tendency to loose the proton.

strength of a base depends upon tendency to gain the protons.

e.g. Hydrochloric acid is a strong acid. It has a strong tendency to donate protons.



The reverse of this reaction is representing the gain of protons by Cl^- ion. leading to formation of HCl but upto a very small extent.

- * So Cl^- is weaker base than H_2O .



- * Acetic acid has considerable less tendency to donate proton so weak acid than that of H_3O^+ .
- * CH_3COO^- has much greater tendency to gain the protons so strong base than that of H_2O .
- # * Stronger the acid weaker will be its conjugate base.
and.
Stronger the base weaker will be its conjugate acid.
- * It may be pointed out strong acids like HCl , HNO_3 , H_2SO_4 being covalent compounds get ionise only in solvent like water which can take up protons.
- * Strong Bases such as NaOH , KOH & Ba(OH)_2 being electrovalent compounds, exist as ions even in solid state.

The basic character of these epds is exclusively due to presence of hydroxyl ion. which is always therefore no interaction with a solvent like water is necessary in such cases.

Lux-Flood Concept : Proposed by Lux and
Extended by Flood.

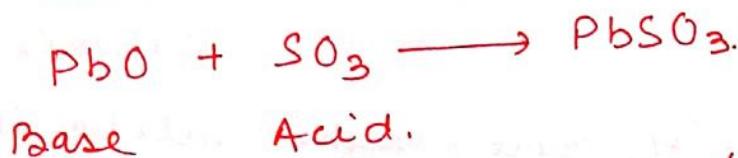
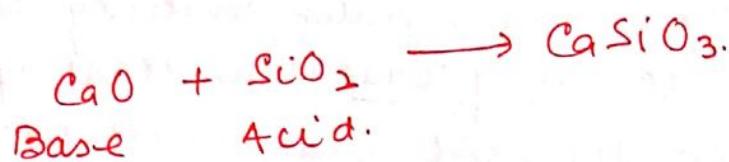
- * It consider acid-base reactions in terms of specific reaction of oxide ions and it is mainly used for molten oxides at high temperature.

Acid : Acid is a substance which accepts oxide ion.

- * So H_2O known as oxide ion acceptor.

Base: Base is a substance which donates oxide ion.

* Base is an oxide donor.



* This concept has very limited scope.

The Solvent-System (or Autoionisation) Concept

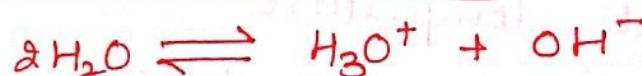
* Put forward by Franklin

Acid: An acid is a substance which, in a solvent, increases the concentration of a cation characteristic of the solvent.

Base: A base is a substance which, in a solvent, increases the concentration of an anion characteristic of the solvent.

* The characteristic cations and anions of the solvent are the ions produced during its autoionization.

Autoionization of water:

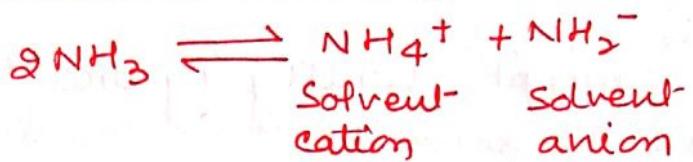


Solvent Solvent
cation anion.

* Thus in water substance giving H_3O^+ ions are acid.

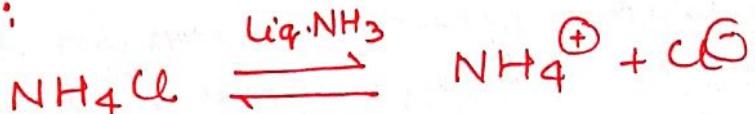
* Those which give OH^- ions are Base.

Liquid Ammonia Undergoes Autoionization

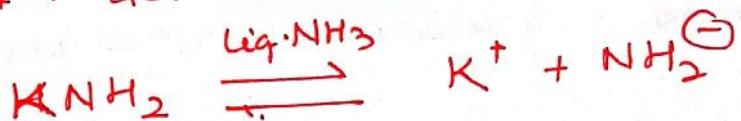


- * According to solvent-system concept in liquid NH_3 , substances which give NH_4^+ ions act as acid.
- * Substances giving NH_2^- act as base.

For e.g.:



- * NH_4Cl act as acid.

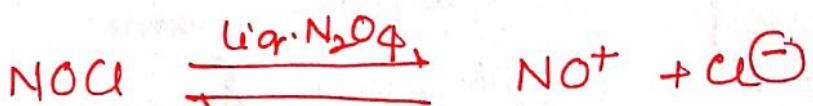


- * KNH_2 act as Base.

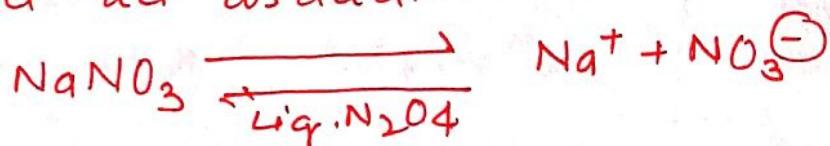
Autoionization of liquid Nitrogen tetroxide



- * Substances which furnish NO^+ are known as acids
- * Substances which furnishes NO_3^- are known as bases. in this solvent



- * NOCl act as acid.



- * NaNO_3 act as Base.