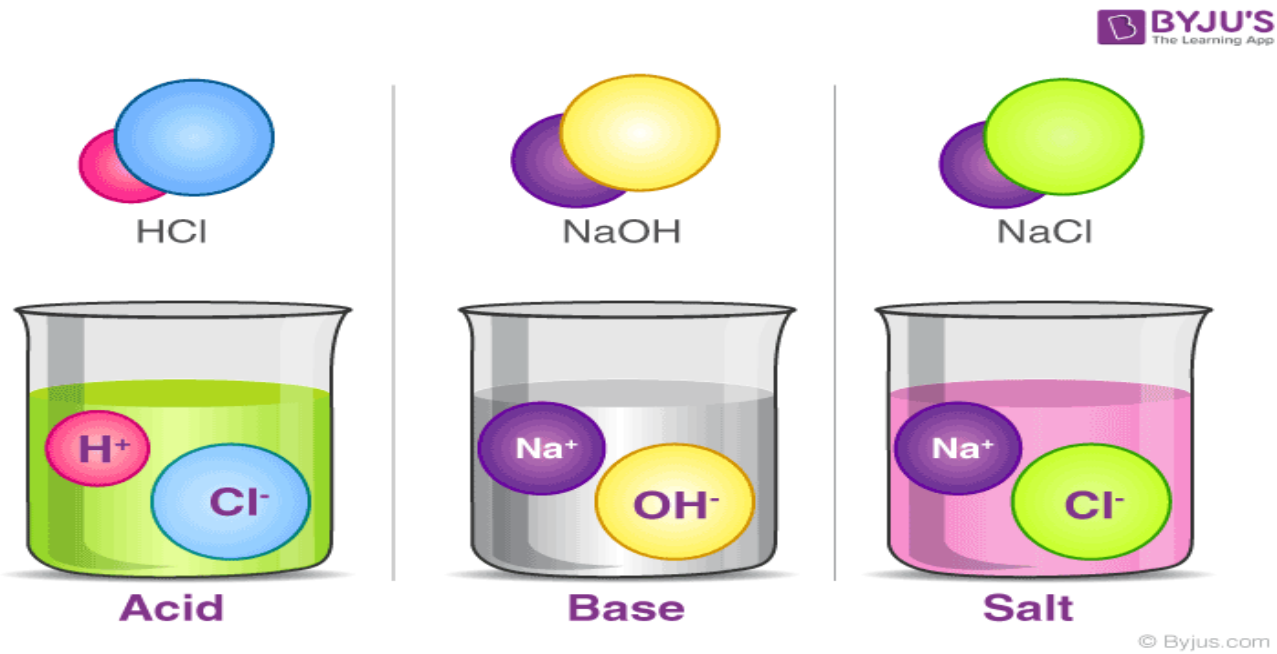
بِسْمِ ٱللَّهِ ٱلرَّحْمَٰنِ ٱلرَّحِيمِ

Acids, Bases, and Salts :



Acids: are compounds that can yield hydrogen ions, (H+) (proton donors) when dissolved in water.

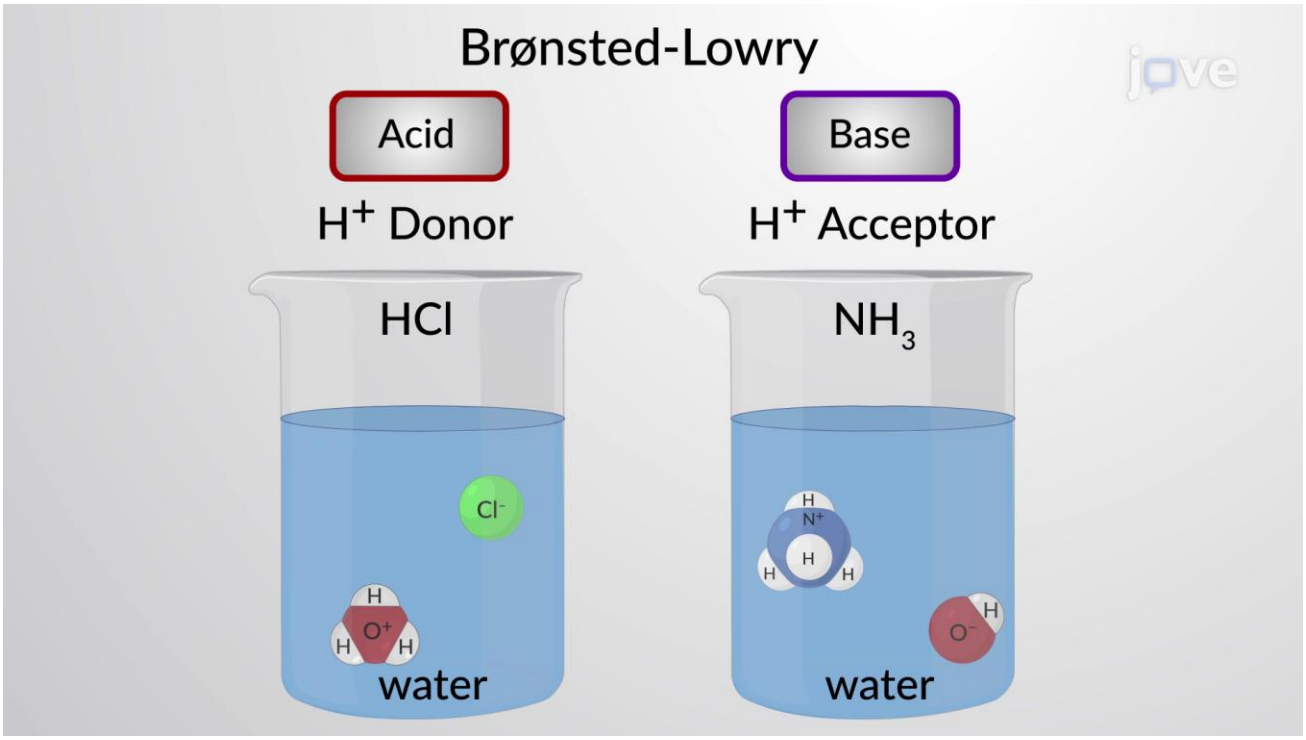
e.g., carbonic acid releases H+ ions.

Bases: are compounds that can yield hydroxide ions, (OH-) [combines with H+ ions in solution(proton acceptor)] .

e.g. Bicarbonate(HCO3-) accepts H+ ions.

Neutralization: is the union of hydrogen and hydroxyl ions to form neutral water:

$$H + OH \rightarrow H2O.$$



Properties of Protonic Acids (Hydrogen acids)

1) They have a sour taste
2) They change the color of certain indicators such as litmus paper (blue to red)
3) They react with oxides and hydroxides of metals, forming salts and water.

acid + metal hydroxide → salt + water

$$HCl_{(aq)} + NaOH_{(aq)} \rightarrow \boxed{NaCl_{(aq)}} + H_2O_{(l)}$$

$$CH_3COOH_{(aq)} + NaOH_{(aq)} \rightarrow CH_3COONa_{(aq)} + H_2O_{(l)}$$

$$H_2SO_{4(aq)} + 2KOH_{(s)} \rightarrow \boxed{K_2SO_{4(aq)}} + 2H_2O_{(l)}$$

$$2HNO_{3(aq)} + Ba(OH)_{2(s)} \rightarrow \boxed{Ba(NO_3)_{2(aq)}} + 2H_2O_{(l)}$$

4) Their aqueous solution conducts an electric current because they contain ions; they are electrolytes.

Formation of Acids:

1. Direct union of elements.

$H_2 + Cl_2 \rightarrow 2HCl$

2. By the action of water on oxides of non-metals.

$CO_2 + H_2O \rightarrow H_2CO_3$

Properties of Hydroxide Bases:

1.They have a bitter taste.

2. They change the colors of certain indicators: litmus paper (red to blue), phenolphthalein (colorless to red).

3. They neutralize aqueous acids, forming salts and water.

4. They give aqueous solutions that conduct an electric current; they are electrolytes.

Formation of Hydroxide Bases:

1. By the action of alkali with water.

$2K + 2H_2O \rightarrow 2K + 2OH^- + H_2\uparrow$

2. By the action of water on the oxides of alkali.

$Na_2O + H_2O \rightarrow 2Na + 2OH$

3. By dissolving ammonia in water.

$NH_3 \rightleftarrows NH_4^+ + OH$

Acid- Base Neutralization:

Neutralization: occurs when aqueous solutions of hydrochloric acid and sodium hydroxide are mixed in the proper proportion during which a reaction takes place causing acidic and basic properties of the solutions to disappear.

So, we can say that acid-base neutralization pertains to the reaction that occurs when equivalent quantities of an acid and base are mixed.

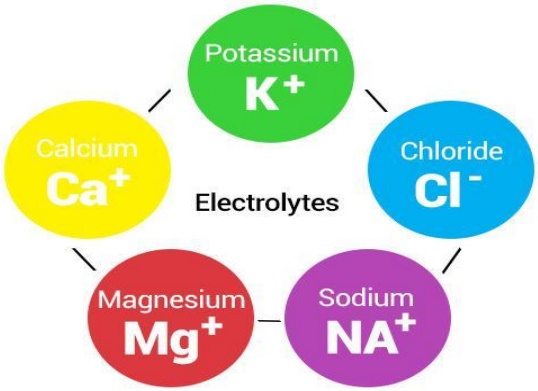
$$HCl + NaOH \rightarrow H_2O + NaCl$$

Salts: are compounds made up of positive and negative ions. These ions may be related only indirectly to acid-base reactions. The direct union of sodium metal with elemental chlorine can form the salt of NaCl.

Preparation of Salts: :

1. By the direct union of the elements.
   $2Na + Cl_2 \rightarrow 2NaCl$
2. By reaction of acids with metals, hydroxide of metals, or oxides of metals.
   $Zn + 2H^+ + SO_4 \rightarrow Zn_2 + SO_4 + H_2\uparrow$
3. By reaction of acid anhydrides and basic anhydrides.
   $BaO + SO_3 \rightarrow BaSO_4$
4. By reaction of acids with salts.
   $BaO_3 + 2H + 2Cl^- \rightarrow Ba^{2+} + 2Cl^- + H_2O + CO_2$
5. By reaction of salts and other salts.
   $Ag + NO_3 + Na^+ Cl^- \rightarrow AgCl\downarrow + Na + NO_3^-$

Electrolytes



An electrolyte is a chemical compound capable of conducting an electrical current when dissolved or molten. The reason an electrolyte can conduct an electrical current is that it forms ions when dissolved or molten. Ions, being positively charged or negatively charged species, are capable of conducting electricity. The most common electrolytes are acids, bases and salts, which ionize when they dissociate in polar solvents such as water or, in the case of salts, become molten. Common electrolytes include salts of metals such as sodium chloride.

$$NaCl_{(s)} \xrightarrow{\text{Water}} Na^{+}_{(aq)} + Cl^{-}_{(aq)}$$

The above equation shows the dissociation of the chloride salt of sodium to form a sodium ion and a chloride ion when dissolved in water. Pure water tends to be a very weak electrolyte as it does not have very many dissociated ions. Therefore, any ions added to water tend to make it a much better conductor of electricity as a result of the mobility of the positive and negative ions.