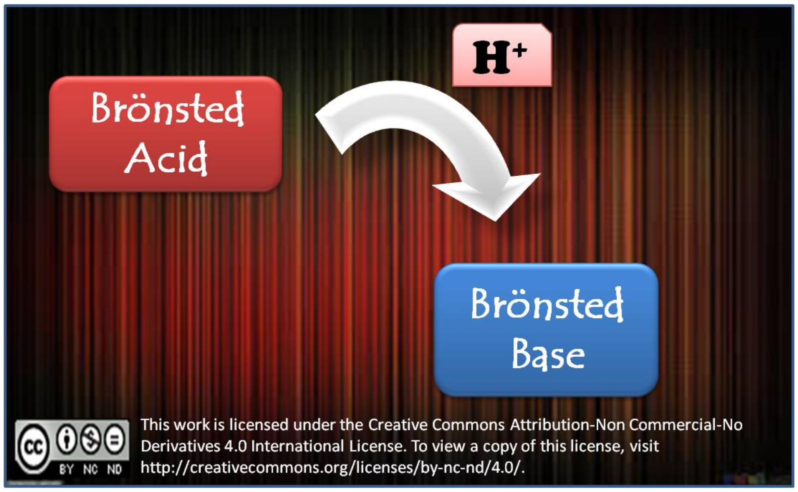
BRONSTED -LOWRY ACID BASE THEORY

Johannes Brönsted and Thomas M. Lowry gave a generalized definition of acids and bases. They defined them by a common term "proton (H+)". Acids are those which give proton and bases are those which accept proton.



Let's see if this theory can explain the basic nature of NH_3.

$NH_{3(aq)} + H_2O_{(l)} \rightleftharpoons NH_4^+{}_{(aq)} + OH^-{}_{(aq)}$

Here NH_3 accepts proton from H_2O, hence it is called as base.

This theory not only defines acid and base but also clarifies their relation with each other. Acid and base are like the two sides of a coin. As either side of a coin cannot stay alone, acid and base also can't stay alone. Each of them has its counterpart which is named as conjugate.

In the above equation NH_3 accepts proton and becomes NH_4^+, here it acts as base.

$NH_{3(aq)} \longrightarrow NH_4^+{}_{(aq)}$

When you see the reverse reaction, you will see NH_4^+ donates proton and becomes NH_3, thus it acts as acid. NH_3 is a base and$NH_4^+$is its conjugate acid or vice versa.

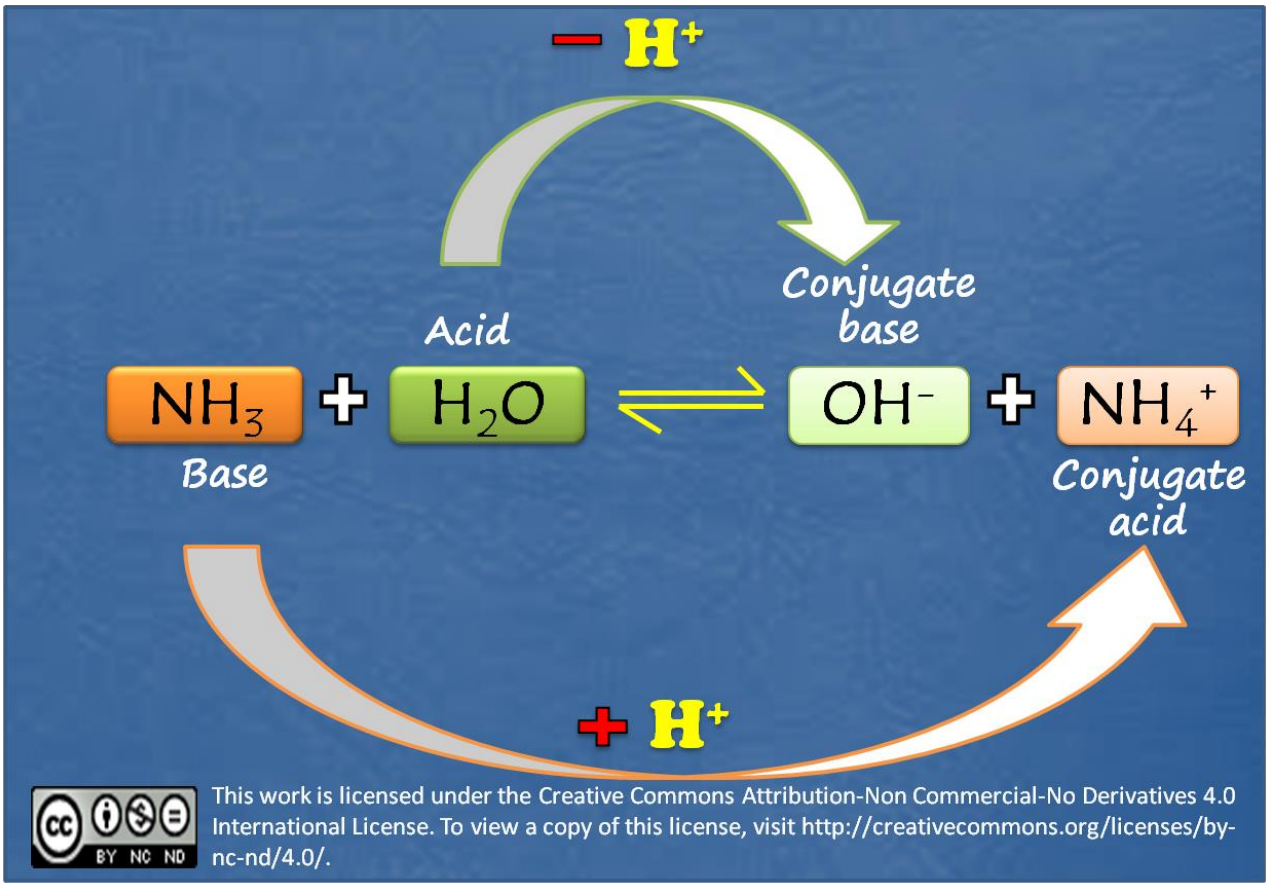
$NH_{3(aq)} \longleftarrow NH_4^+{}_{(aq)}$

Similarly H_2O gives proton to NH_3 and becomes OH^- , so H_2O acts as an acid and OH^-

is its conjugate base, which accepts proton from NH_4^+ in reverse reaction. Let's see one more equation.

$HCl_{(aq)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + Cl^-_{(aq)}$

Here HCl gives proton H^+ and acts as acid, while H_2O accepts proton and acts as base. I hope now you can find their respective conjugate. HCl has its conjugate base Cl^- and H_2O has its conjugate acid OH^-.



In the above two equations you have seen that H_2O acts as acid when it comes with NH_3 and acts as base when it comes with HCl. That means acid and base are comparative terms.

For example when 2 comes with 1, 2 looks bigger than 1 but if it comes with 3, it looks smaller. Similarly H_2O acts as acid when it comes with NH_3 and acts as base when it comes with stronger acid HCl.

Which factor decides the strength of an acid or base? Readiness to give off the proton decides the strength of any acid. If we compare two acids, the one which readily gives off the proton is the stronger acid. And similarly the one which accepts proton readily is the stronger base.

It is very easy to figure out the corresponding conjugates for acids and bases. If you want to find conjugate acid of any species just add proton (H^+) to it and if you want to find conjugate base, subtract proton (H^+) from it. Let's practice few examples of conjugate acid- base pair:

Species	Conjugate Acid	Conjugate Base
NH_3	NH_4^+	NH_2^-
H_2O	H_3O^+	HO^-
HSO_4^-	H_2SO_4	SO_4^{2-}

Now you must be able to guess the nature of species and also to find the conjugate acid and base of any species. But what happens to those species which lack a Hydrogen? For example, how can we find out whether BF_3 is an acid or base? Arrhenius concept and Brönsted -Lowry acid base theory both are not able to help us in this case. So how do we find the right answer? In the next post we will try to find out its answer.

Source : http://chemistrynotmystery.blogspot.in/2015/01/bronsted-lowry-acid-base-theory.html