CHEM 261 September 16, 2020

**Acids and Bases**

**Bronsted – Lowry :**

* An acid **donates proton (H+)**
* A base **accepts a proton (H+)**



* Very fast reaction as HCl is a strong acid and NaOH is a strong base. NaCl is a weak base (weak conjugate base) and H2O is a weak acid (weak conjugate acid).

**Lewis Acid/Base:**

* An **acid accepts a pair of electrons**
* A **base donates a pair of electrons**

e.g) BF3

- Lewis Acid



Boron tetrafluoride

-sp3

-Tetrahedral

-109o bond angle

Boron trifluoride

-sp2

-Trigonal planar

-120o bond angle

BF3 can react with potassium fluoride (KF) to obtain an inert gas configuration. However, BF4- is unhappy with a formal negative charge, so the reaction is reversible.

* Every Bronsted-Lowry acid/base is also a Lewis acid/ base. The converse statement is not true; not all Lewis acids/bases can be classified as a Bronsted-Lowry acids/bases.

 Keq = Ka = [H+][A-]

Ka = acidity constant

pKa = -logKa

[HA]

Ex #1) Water:

Ka = [H+][-OH] = 10-15.7

[HOH]

pKa = -logKa = 15.7



The equilibrium above lies far (exclusively) to the left. Hydroxide will NOT deprotonate methane.

Ex # 2) Ammonia Gas:

Ka = [H+][-NH2] = 10-36

[NH3]

pKa = 36



Ammonia gas is a better acid compared to methane (bigger KA), because nitrogen is more electronegative than carbon. It can hold a negative charge easier than carbon.

NB: The lower the pKa the more acidic

pKa of “Ammonia” in biological system



Ex #3) Methane:



Ka = [H+][CH3-] = 10-46

[HCH3]

pKa = -logKa = 46

NB: Oxygen is more electronegative than nitrogen, which makes water more acidic than ammonia. Nitrogen more electronegative than carbon and that makes ammonia more acidic than methane.



The equilibrium above lies far (exclusively) to the left. Hydroxide will NOT deprotonate methane.

Ex #4) Strong acid/base



The reaction lies far (exclusively) to the left since ammonia is not a strong enough base to deprotonate methane