## September 16, 2020

## CHEM 261 Acids and Bases

## **Bronsted** – Lowry :

- An acid donates proton (H<sup>+</sup>)
- A base accepts a proton (H<sup>+</sup>)

HCI  $\longrightarrow$  H<sup>+</sup> + CI<sup>-</sup> NaOH  $\longrightarrow$  Na<sup>+</sup> + OH<sup>-</sup>

- HCI + NaOH → NaCI + H-OH
- Very fast reaction as HCl is a strong acid and NaOH is a strong base. NaCl is a weak base (weak conjugate base) and H<sub>2</sub>O is a weak acid (weak conjugate acid).

## Lewis Acid/Base:

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



BF<sub>3</sub> can react with potassium fluoride (KF) to obtain an inert gas configuration. However,  $BF_4^-$  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.



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

Ex # 2) Ammonia Gas:

H-NH<sub>2</sub> 
$$\longrightarrow$$
 H  $+ \bigcirc$   $\dot{N}H_2$   $K_a = [H^+][NH_2] = 10^{-36}$   
 $pK_a = 36$ 

Ammonia gas is a better acid compared to methane (bigger  $K_A$ ), 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:

H-CH<sub>3</sub> 
$$\longrightarrow$$
 H<sup>+</sup> + CH<sub>3</sub><sup>-</sup>  
 $K_a = [H^+][CH_3^-] = 10^{-46}$   
 $[HCH_3]$   
 $pK_a = -logK_a = 46$ 

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.

			+ Na
$Na^{+} + OH$	+ CH <sub>4</sub>	Н-О-н	+ :CH <sub>3</sub>
Weak Base	Weak Acid	Strong Acid	Strong Base

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