Chemistry 20	Unit 3
Lesson 8 - Modified Arrhenius Acids and Bases	84 mins

Arrhenius Acid

- Has H and will produce $H^+_{(aq)}$	$HCl_{(aq)} \rightarrow H^+_{(aq)} + Cl^-_{(aq)}$

Arrhenius Base

- Has OH and will produce $OH^-_{(aq)}$	$NaOH_{(aq)} \rightarrow Na^+_{(aq)} + OH^-_{(aq)}$

Modified Arrhenius Acid

- Increases the concentration of hydronium
    - Changed because H+ is really just a proton… protons can't exist for long by themselves as they are volatile.
    - Requires water still
	$HCl \rightarrow H^+_{(aq)} + Cl^-_{(aq)}$
	
	Becomes
	
	$HCl_{(aq)} + H_2O_{(l)} \rightarrow H_3O^+_{(aq)} + Cl^-_{(aq)}$

Modified Arrhenius Base (No change)

Strong and Weak Acids

Strong Acid - Completely gives up H^+ $HCl_{(aq)} + H_2O_{(l)} \rightarrow H_3O^+_{(aq)} + Cl^-_{(aq)}$ - Top 6 in your data booklet	Weak Acid - Doesn't completely give up H^+ - Lots of examples (MOST acids actually) $HF_{(aq)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + F^-_{(aq)}$ - NOTE: (⇋ means reversible…)

$[HCl_{(aq)}] = [HF_{(aq)}]$

- **Which will have the higher pH?**

Strong and Weak Bases

Strong Base - Completely dissociates into OH^- (NOT necessarily dissolve well…) $Ca(OH)_{2(aq)} \rightarrow Ca^{2+}_{(aq)} + 2OH^-_{(aq)}$ - Generally ALL group 1 and 2 metals with OH^-	Weak Base - Doesn't completely produce OH^- $NH_{3(aq)} + H_2O_{(l)} \rightleftharpoons NH_4^+{}_{(aq)} + OH^-_{(aq)}$

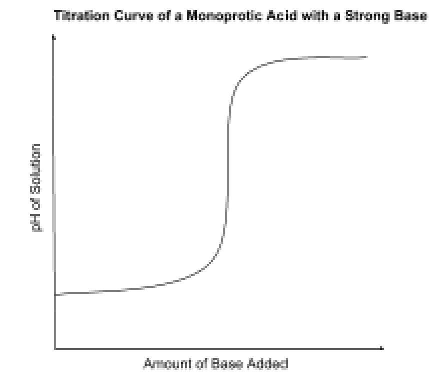
$[Ca(OH)_{2(aq)}] = [NH_{3(aq)}]$

- **Which will have the higher pH?**

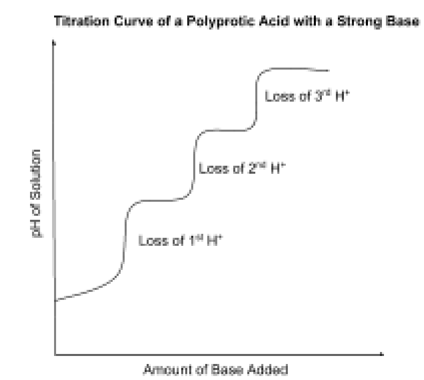
Brønsted-Lowry Acids and Bases

Arrhenius has a tough time explaining weak acids and bases and why they are reversible. Also some acids and bases can still be acids and bases without water. Weak Acids reaction example $HF_{(aq)}$ + $H_2O_{(l)}$ ⇋ $H_3O^+_{(aq)}$ + $F^-_{(aq)}$ Acid — Base — Conjugate Acid — Conjugate Base Gives up Protons — Accepts Protons — Will give up protons... — Will accept protons... Conjugate means Related	Brønsted-Lowry Acid - A molecule that gives up PROTONS Brønsted-Lowry Base - A molecule that accepts PROTONS This means ALL weak acids and bases in reverse are the opposite $NH_{3(aq)}$ is a weak base, $NH_{4(aq)}$ is a weak base $HF_{(aq)}$ is a weak acid, $F^-_{(aq)}$ is a weak base This also means that $H_2O_{(l)}$ is both an acid AND a base

Monoprotic Acids

- Single H^+, dissociates once. - Examples. HCl, CH_3COOH	$HCl_{(aq)} + H_2O_{(l)} \rightarrow H_3O^+_{(aq)} + Cl^-_{(aq)}$ 

Polyprotic Acids

- Contains multiple H+, can dissociate many times, draw curves, each step get weaker - H_2SO_4, H_3PO_4	$H_3PO_{4(aq)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + H_2PO_4^-{}_{(aq)}$ $H_2PO_4^-{}_{(aq)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + HPO_4^{2-}{}_{(aq)}$ $HPO_4^{2-}{}_{(aq)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + PO_4^{3-}{}_{(aq)}$ 

Neutralization Reactions

- Acids and bases react to form water and a neutral ionic compound (A SALT) (NOT just NaCl) - Neutralizations are used in titrations (a chemistry lab technique) to determine a quantity of an unknown acid by neutralizing it with a base.	$H_2SO_{4(aq)} + NaOH_{(aq)} \rightarrow 2H_2O_{(l)} + Na_2SO_{4(aq)}$ Acid Base Water Salt The Salt is generally produced by the "spectator" ions that are produced by the Acids and Bases producing H_3O^+ and OH^- in water. - Na and SO_4 in this case are the spectators

There are other theories that do an even BETTER job of explaining observations of acids and bases and even are able to explain the existence or SUPER acids and bases… but that is for another day.

Chemistry 20 - Unit 2 - Modified Arrhenius Acids and Bases

Name: ____

1. Complete the following table of acids and bases. The first row has been completed as an example.

Chemical Name:	Chemical Formula:	Arrhenius Acid or Arrhenius Base:	Strong or Weak:	Products After Reaction with $H_2O_{(l)}$:
Hydrochloric acid	$HCl_{(aq)}$	Acid	Strong	$H_3O^+_{(aq)} + Cl^-_{(aq)}$
Sulfuric acid				
	$HI_{(aq)}$			
Oxalic acid				
	$HNO_{2(aq)}$			
Potassium hydroxide				
Rubidium hydroxide				
	$CH_3COOH_{(aq)}$			
Lithium hydroxide				
	$H_3PO_{4(aq)}$			
Barium hydroxide				

1. Compare and contrast strong acids with weak acids.

2. Roseletta and Merribelle obtain two samples of unknown acids of equal concentration. Explain how Roseletta and Merribelle can identify which of the two acids is stronger.