SCH 3U

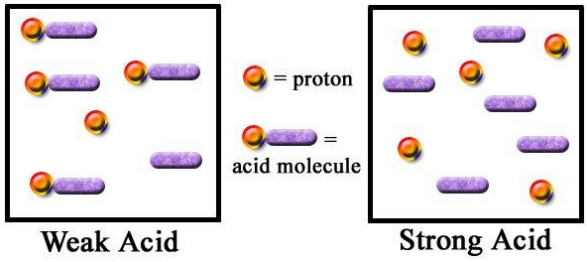
STRONG VS. WEAK ACIDS/BASES

PART A: STRENGTH OF ACIDS

DILUTE (little solute & MUCH WATER)	versus	***CONCENTRATED*** (MUCH SOLUTE & little water)
Eg. 0.000 001 mol/L		Eg. 1.0 mol/L

WEAK ACID (small % dissociation into ions)	**STRONG ACID (100% DISSOCIATION into ions)**
Eg. $HCH_3COO_{(aq)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + CH_3COO^-_{(aq)}$ Only 1% of $HCH_3COO_{(aq)}$ dissociate.	**Eg.** $HCl_{(aq)} + H_2O_{(l)} \rightarrow H_3O^+_{(aq)} + Cl^-_{(aq)}$ All HCl molecules dissociate.

It is important to note that the words ***strong*** **and** ***weak*** should not be confused with the terms ***concentrated*** **and** ***dilute***. The strength of an acid is related to the proportion of it which has reacted with water to produce ions. The concentration indicates how much of the original acid is mixed in the solution. It is perfectly possible to have a concentrated solution of a weak acid, or a dilute solution of a strong acid.



	BINARY ACIDS	OXO ACIDS
WEAK ACIDS	HF	**If** $(\#O's - \#H's) < 2$ H_3PO_4 H_2CO_3 All organic acids, such as acetic acid, CH_3COOH
STRONG ACIDS	**HCl** **HBr** **HI**	**If** $(\#O's - \#H's) \geq 2$ **H_2SO_4** **HNO_3** **$HClO_4$**

POLYPROTIC ACIDS — monoprotic, diprotic, triprotic

- Acids that have the ability to lose more than one H^+
- Only the first H^+ lost can be strong
- All subsequent dissociated hydrogens will always be weak (regardless of #O's - #H's) – WHY? – hard to remove H^+ ion from negative ion

Eg. H_2SO_4 can lose 2 H^+ (diprotic)

$$H_2SO_{4(aq)} + H_2O_{(l)} \rightarrow H_3O^+_{(aq)} + HSO^-_{4(aq)}$$

$$HSO^-_{4(aq)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + SO^{-2}_{4(aq)}$$

Eg. H_3PO_4 can lose 3 H^+ (triprotic)

PART B: STRENGTH OF BASES

	IA – hydroxides & oxides	IIA – hydroxides & oxides	Nitrogens
WEAK BASES	None	Be (small ion)	All eg. NH_3
STRONG BASES	**All**	**All, except Be**	

Eg. Illustrate the dissociation of each base in water.

$NaOH_{(s)}$

$NH_{3(g)}$

$Na_2O_{(s)}$

PART C: NAMING ACIDS

① BINARY ACIDS: (H + NM)

FIRST WORD	SECOND WORD
hydro $\underline{\quad\quad\quad\quad}$ ic $non-metal\ root$	acid

EXAMPLES: Name each acid.

1. HCl
2. HBr
3. HI
4. HF
5. H_2S

② OXOACIDS: (H + polyatomic)

POLYATOMIC ION that ends in...	CHANGE TO...	EXAMPLE
-ate	-ic acid	H_2CO_3 contains CO_3^{-2} carbon**ate ion** → **carbonic acid**
-ite	-ous acid	HNO_2 contains NO_2^- nitr**ite ion** → **nitrous acid**
exceptions: Roots of S and P oxoacids are... sulfur- and phosphor-		H_3PO_4 – contains PO_4^{-3} – based on rules, phosphate→ phosphic acid *ACTUAL NAME* → phosphoric acid

NOTE: hypo- and per- remain in name of acid if it is part of the polyatomic ion.

Eg. $HClO_4$ contains ClO_4^-, **per**chlor**ate** → **per**chlor**ic acid**

EXAMPLES: Name each acid.

1. $HClO_2$
2. $HBrO_3$
3. H_2SO_4
4. HNO_3
5. H_2SO_3
6. HIO_4
7. HCN
8. HCNO

PART D: pH

$$H_2O_{(l)} + H_2O_{(l)} \rightarrow H_3O^+_{(aq)} + OH^-_{(aq)}$$

2 ppm molecules undergo this reaction.

NEUTRAL SOLUTIONS: distilled water is a poor conductor of electricity.

At 25°C, $[H_3O^+] = 1.0 \times 10^{-7} mol/L$ and $[OH^-] = 1.0 \times 10^{-7} mol/L$

ACIDS	BASES
$[H_3O^+] > [OH^-]$	$[H_3O^+] < [OH^-]$

$\boldsymbol{pH = -\log [H_3O^+]}$	$\boldsymbol{[H_3O^+] = 10^{-pH}}$
$\boldsymbol{pOH = -log[OH^-]}$	$\boldsymbol{[OH^-] = 10^{-pOH}}$
$\boldsymbol{pH + pOH = 14}$	$\boldsymbol{[H_3O^+][OH^-] = 10^{-14}}$

EXAMPLES:

1. What is the pH of a 3.51 x 10^{-3} mol/L solution of $HNO_{3(aq)}$?

2. What is the pH of a 7.48 x 10^{-6} mol/L solution of $NaOH_{(aq)}$?

3. What is the pH of a 4.74 x 10^{-5} mol/L solution of $Mg(OH)_{2(aq)}$?

4. What is the $[H_3O^+]$ of a solution with pH 2.57?

5. What is the $[OH^-]$ of the same solution with pH 2.57?

6. A solution of $Ba(OH)_2$ has a pH of 10.7. What is the $[Ba(OH)_2]$?

7. What is the pH of a 1.0 mol/L solution of $HCl_{(aq)}$?

8. Most acids are bought as 16.0 mol/L solutions. What is the pH?

9. A 1.00 L solution of hydrochloric acid consisting of 4.00 g of solute is mixed with 0.50 L of 0.20 M sodium hydroxide solution. What is the final pH of the mixture?