Target: I can define acids and bases in various ways, and can perform simple pH calculations.

N-46
Acids, Bases, & pH Calculations

YouTube Link to Presentation: https://youtu.be/RY1SB8vuxzI

PROPERTIES OF ACIDS AND BASES

ACIDS

- Juices/Fruits
- Tart, sour, sharp taste
- They are electrolytes
  - Conduct electricity
- React with Metals
- Common as aqueous and liquids

BASES

- Cleaning products
- Bitter tasting
- Slippery to the touch
- Common as Solids

THREE DIFFERENT DEFINITIONS OF ACIDS/BASES

Arrhenius

- Acids make H^+ ions in aqueous solutions
- Bases make OH^- ions in solution

Bronsted-Lowry

- Acids donate protons
- Bases accept protons

Lewis

- Acids accept electron pairs
- Bases donate electron pairs

THREE DIFFERENT DEFINITIONS OF ACIDS/BASES

Arrhenius

- Acids make H^+ ions in aqueous solutions
- Bases make OH^- ions in solution

$$HNO_3 \rightarrow H^+ + NO_3^-$$

$$KOH \rightarrow K^+ + OH^-$$

Exactly what we are used to thinking of as acids and bases!

THREE DIFFERENT DEFINITIONS OF ACIDS/BASES

Bronsted-Lowry

- Acids donate protons
- Bases accept protons

Bronsted-Lowry Base

$$NH_3 + HCl \rightleftharpoons NH_4^+ + Cl^-$$

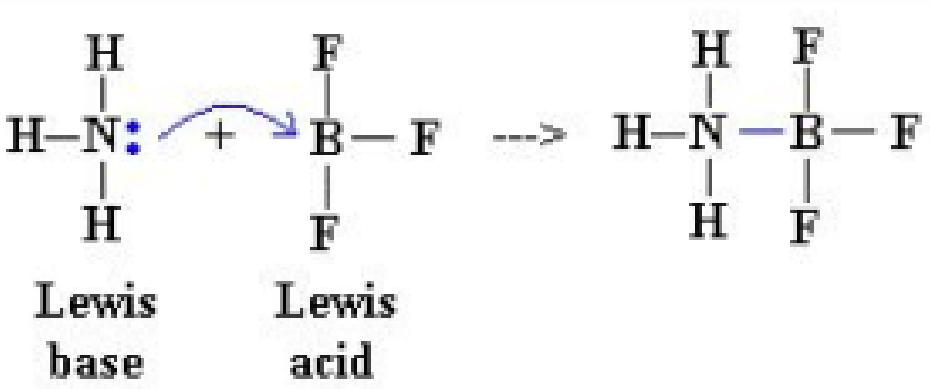
Bronsted-Lowry Acid

More things count as bases than in Arrhenius model!

THREE DIFFERENT DEFINITIONS OF ACIDS/BASES

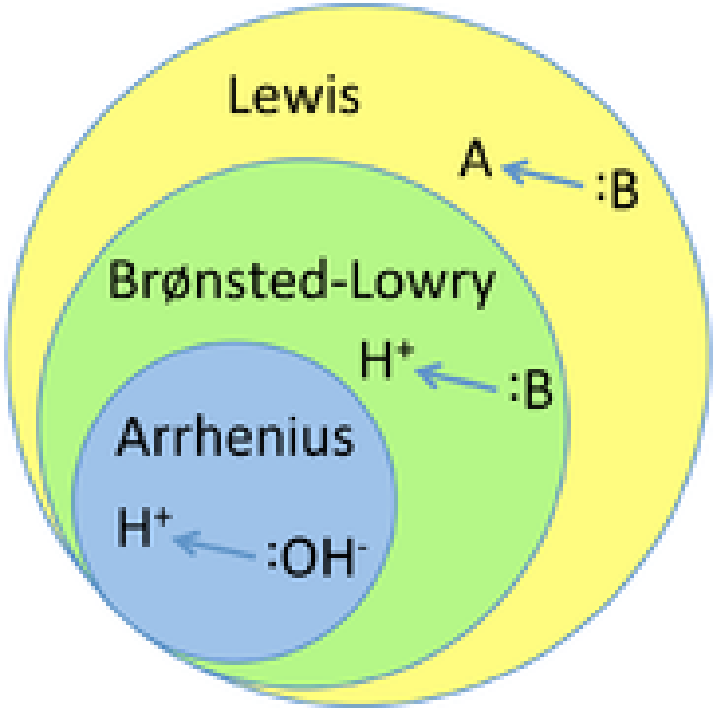
Lewis

- Acids accept electron pairs
- Bases donate electron pairs



More things count as acids and bases than either Arrhenius or Bronsted-Lowry

THREE DIFFERENT DEFINITIONS OF ACIDS/BASES



- Arrhenius is MOST specific
- Bronsted-Lowry is less specific
- Lewis is LEAST specific

Water can act as an acid or a base!

WEIRD FACT!

$$NH_3 + H(OH) \rightarrow NH_4^+ + OH^-$$

Water is donating a proton…

ACID!

$$HCl + H(OH) \rightarrow H_3O^+ + Cl^-$$

Water is accepting a proton…

BASE!

Water can act as an acid or a base!

WEIRD FACT!

$NH_3 + H(OH) \rightarrow NH_4^+ + OH^-$

Water is donating a proton…

ACID!

$HCl + H(OH) \rightarrow H_3O^+ + Cl^-$

Water is accepting a proton…

BASE!

Amphoteric!

Greek amphoteros = "each of two"

Which type of acid/base???

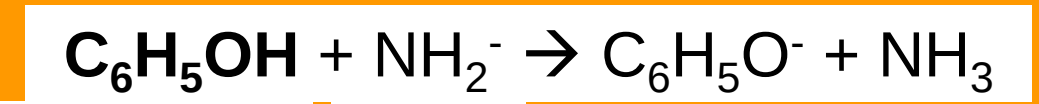
HBr

Arrhenius Acid

LiOH

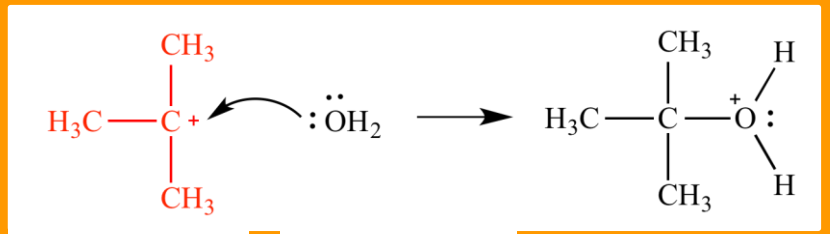
Arrhenius Base

Bronsted-Lowry Base



Arrhenius Acid

B.L Base



Lewis Acid

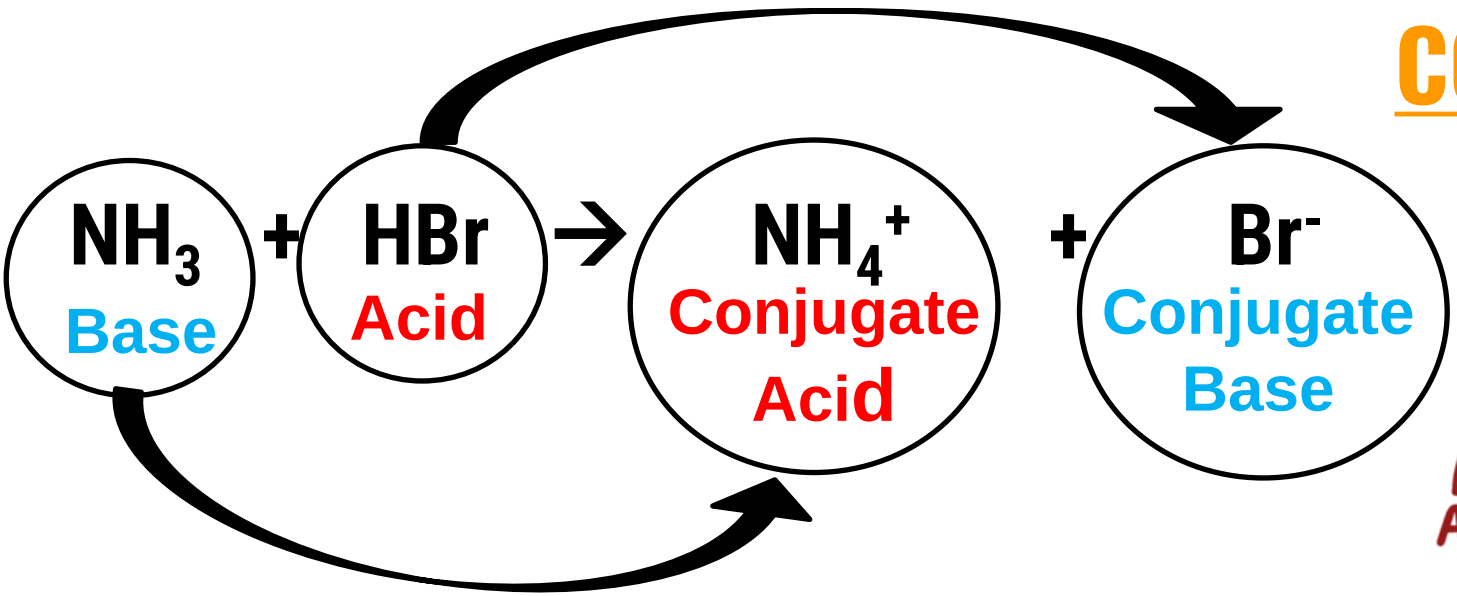
Lewis Base

CONJUGATES

Acids turn into “Conjugate Bases” once they have lost their proton/hydrogen

Bases turn into “Conjugate Acids” once they have gained a proton/hydrogen

CONJUGATES



Tips for Finding Each

- Find the Acid First – usually easiest!
- Find It's Conjugate Base – the part left after donating its H+!
- Repeat with Base and Conjugate Acid

Identify A/B/CA/CB

$HF + SO_3^{2-} \rightarrow F^- + HSO_3^-$

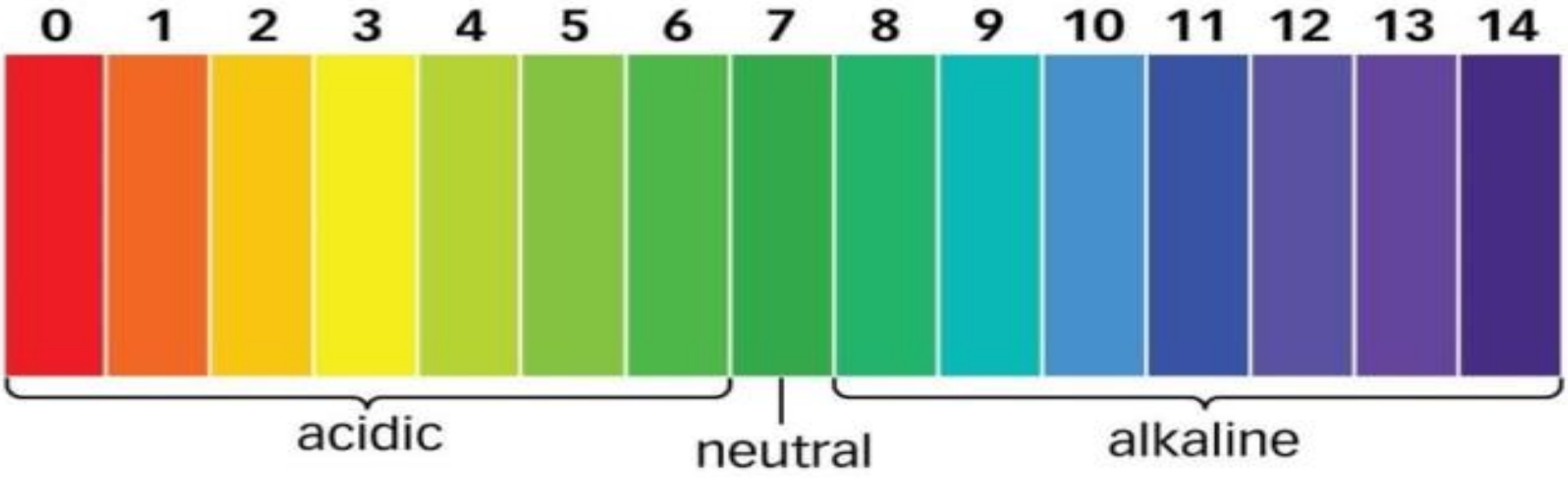
ACID | BASE | CONJ. BASE | CONJ. ACID

$H_2O + CH_3COOH \rightarrow H_3O^+ + CH_3COO^-$

BASE | ACID | CONJ. ACID | CONJ. BASE

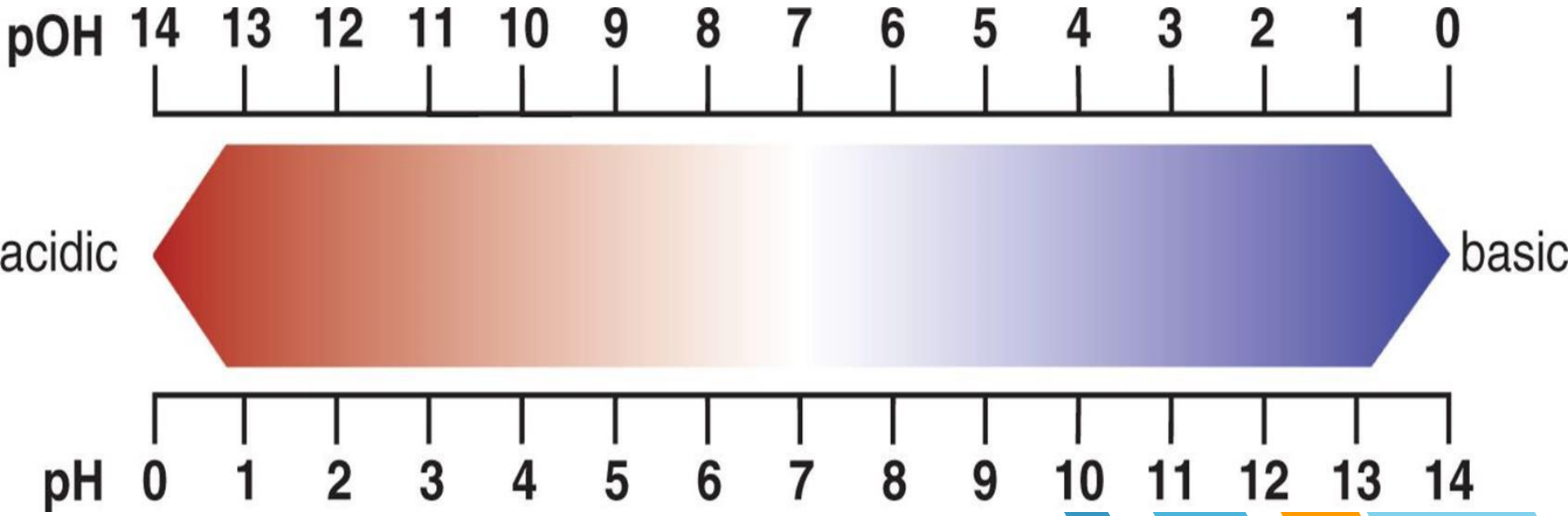
pH SCALE

A scale that lets us measure the relative “power of hydronium ions” in a solution – how acidic or basic is it.



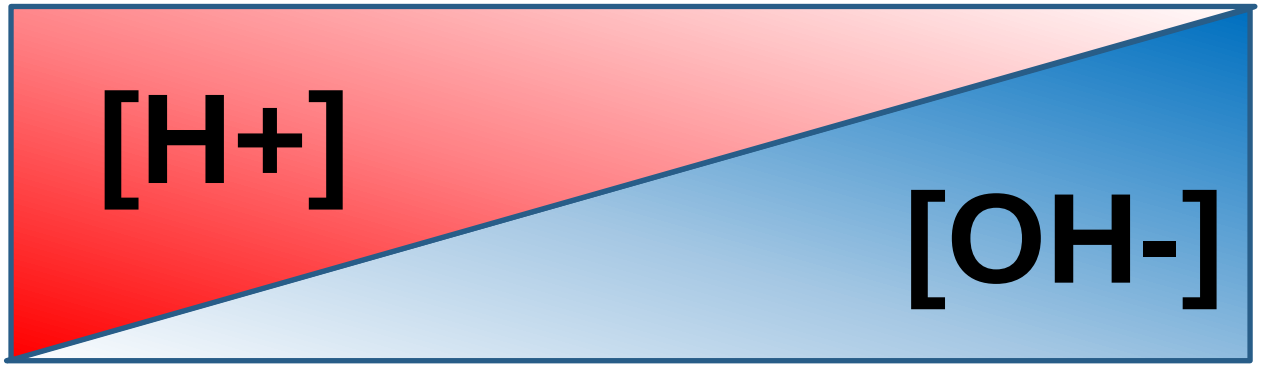
pOH IS OPPOSITE OF pH

Sometimes it is easier to measure the pOH instead of the pH



pH IS KIND OF A BACKWARDS SCALE

pH =	0	7	14
[H+] =	10^{0}	10^{-7}	10^{-14}



[OH-] =	10^{-14}	10^{-7}	10^{0}
pOH =	14	7	0

So how do we go from [H+] to the pH number???

Logarithms!

$[H^+] = 10^0$
$-\log(10^0)$
$pH = 0$

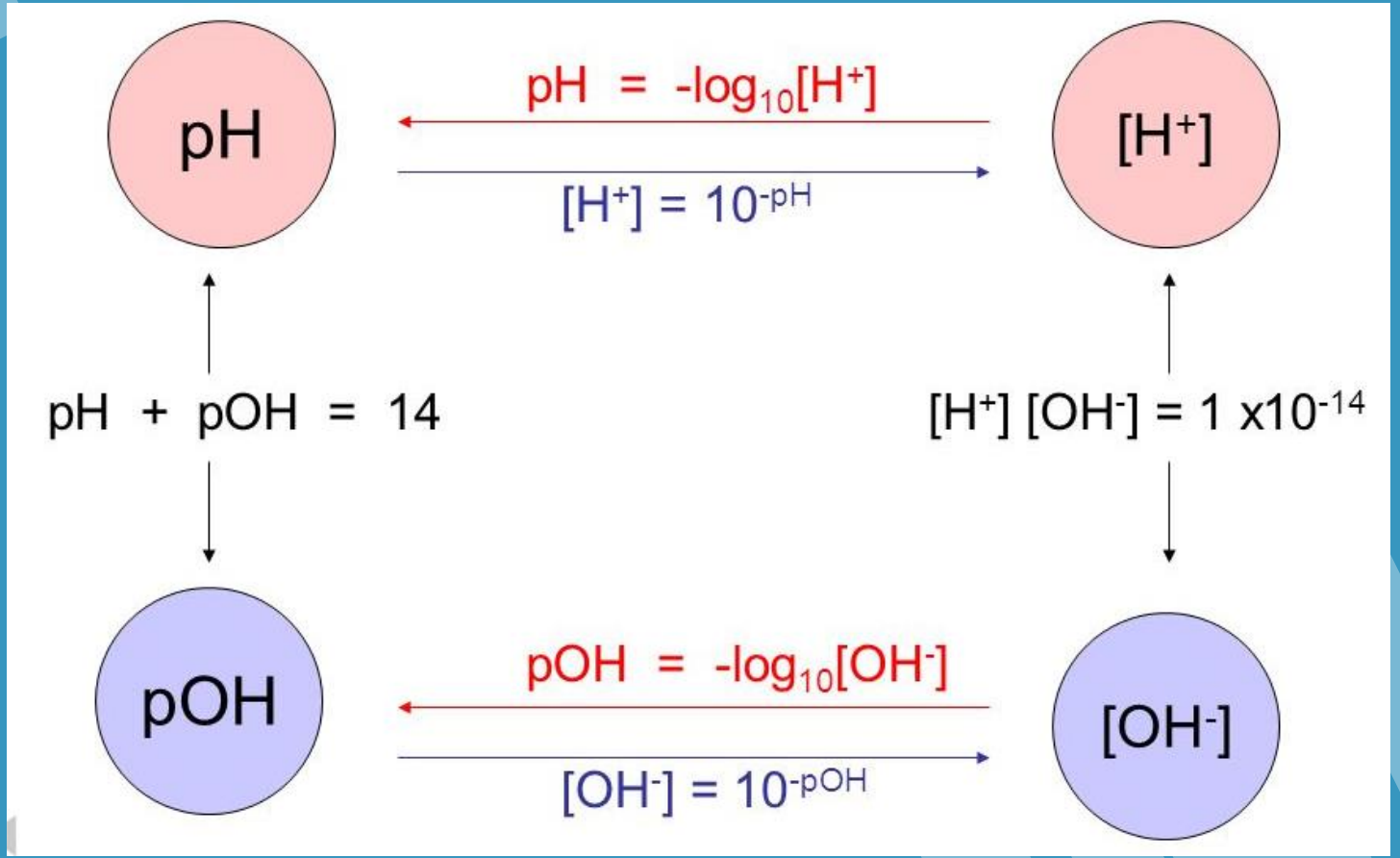
$[H^+] = 10^{-7}$
$-\log(10^{-7})$
$pH = 7$

$[H^+] = 10^{-14}$
$-\log(10^{-14})$
$pH = 14$

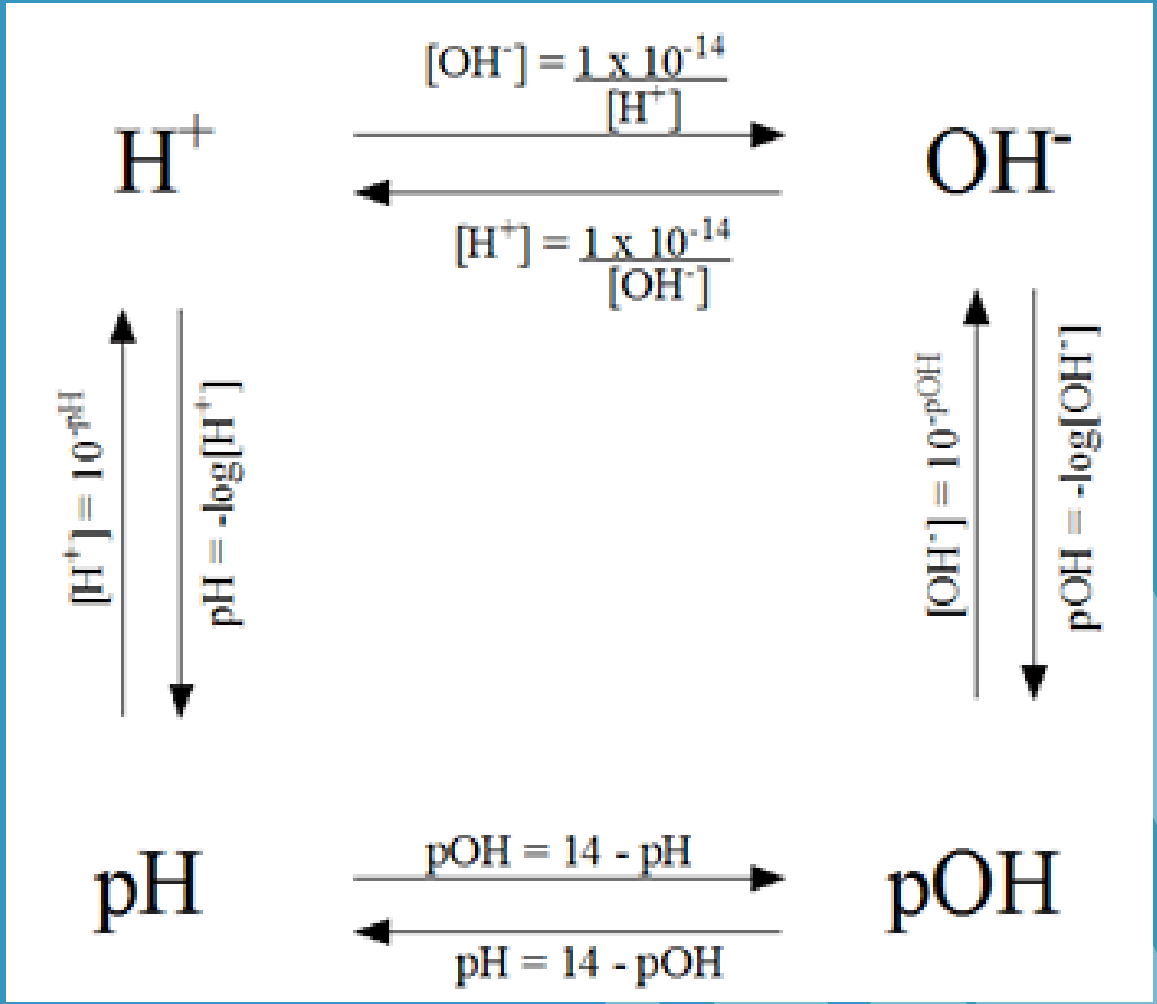
Various pH Calculations

$pH = -\log [H^+]$	$pOH = -\log [OH^-]$
$[H^+] = 10^{-pH}$	$[OH^-] = 10^{-pOH}$
$pH + pOH = 14$	
$[H^+][OH^-] = 1 \times 10^{-14}$	
With these calculations you can plug in, rearrange, substitute and find everything no matter what you are given in the problem!	

pH Square #1


pH
$pH = -\log_{10}[H^+]$
$[H^+] = 10^{-pH}$
$[H^+]$
pH + pOH = 14
$[H^+][OH^-] = 1 \times 10^{-14}$
pOH
$pOH = -\log_{10}[OH^-]$
$[OH^-] = 10^{-pOH}$
$[OH^-]$

pH Square #2


H^+
OH^-
pH
pOH
$[OH^-] = \frac{1 \times 10^{-14}}{[H^+]}$
$[H^+] = \frac{1 \times 10^{-14}}{[OH^-]}$
$[H^+] = 10^{-pH}$
$pH = -\log[H^+]$
$[OH^-] = 10^{-pOH}$
$pOH = -\log[OH^-]$
pOH = 14 - pH
pH = 14 - pOH

WS #2 – Crash Course Video Notes

http://tinyurl.com/crashcourseacidrain

YouTube Link to Presentation:

https://youtu.be/RY1SB8vuxzI