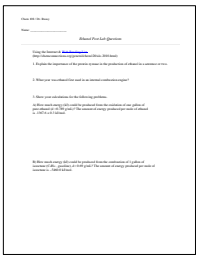
Chem 108: Class/ Lab
Week 13

Pick a vial and a plastic dropper
Using the vial number, sign-in on the Lab roster

Pick up HANDOUTS
1) Fluid Exchange Form & Post Lab (Handout)
2) Acid-Bases: pH (Handout)

Fermentation / Distillation
Report pp. 66-67 + POST LAB Questions
Due Today
http://chemconnections.org/general/chem120/ethanol-ques-108.htm

Chem 108: Class/ Lab
Week 13: 2019s

Do Today:
1) Fluid Exchange (Handout)
Due Next Lab

2) Acid-Base: pH (Handout)
Data completed & signed before leaving Lab

Follow Instructions

http://chemconnections.org/general/chem120/fluid-ex.108.html

Chem 108: Class/ Lab
Week 13

TODAY:
Fluid Exchange (Handout)

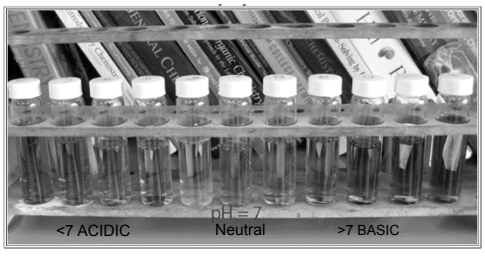
3) You have been assigned a geographical location for your Global Residence. Check the ***Global Homelands Map,*** which follows, for your location and if necessary move to your place of residence.

http://chemconnections.org/general/chem120/fluid-ex.108.html

Global Homelands Map
(Front of Lab)

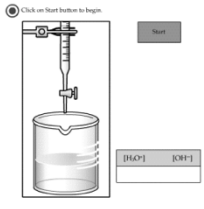
Wait for Dr. R's instructions on exchanging fluids, keeping records, and using the handout provided.

Acid-Base Indicators



Water as an Acid and a Base
Self-ionization

$$H_2O(l) + H_2O(l) \rightleftharpoons H_3O^+(aq) + OH^-(aq)$$



http://chemconnections.org/general/movies/KwActivity.swf

Pure Water is an Acid and a Base

It is amphoteric. (It can behave either as an acid or a base).

$$H_2O(l) + H_2O(l) \rightleftharpoons H_3O^+(aq) + OH^-(aq)$$

$$H_2O + H_2O \leftrightarrows H_3O^+ + OH^-$$

acid 1 base 2 — conj acid 2 — conj base 1

$$K = \frac{[H_3O^+][OH^-]}{[H_2O][H_2O]}$$

- $K_w = 1 \times 10^{-14}$ at 25°C
- $K_w = [H_3O^+][OH^-] = [1 \times 10^{-7}M][1 \times 10^{-7}M]$

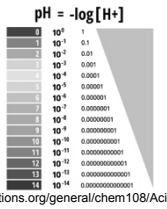
*NOTE: **only concentrations [mol/L] are used in the calculation**; liquids (l) and solids (s) are not included*

https://phet.colorado.edu/en/simulation/ph-scale-basics

The pH Scale

pH: the negative logarithm of the hydrogen ion concentration.

Beer's pH ~ 4



Quantitative, logarithmic, numeric scale based on testing the electric current of aqueous solutions & relating it to the equilibrium concentration of the hydrogen ion, $[H^+_{(aq)}] = [H_3O^+_{(aq)}]$

Introduced in 1909 by Søren Sørensen, Danish brewer/chemist, as a convenient way of expressing acidity……. Providing much improved quality control in brewing.

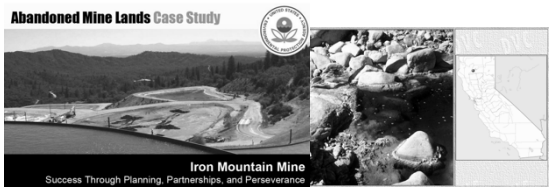
http://www.chemconnections.org/general/chem108/Acids-Bases%20Guide.html

The pH Scale

- $pH \approx -\log[H^+] \approx -\log[H_3O^+]$
- pH in water ranges from 0 to 14.
  $K_w = 1.00 \times 10^{-14} = [H^+]\,[OH^-]$
  $pK_w = 14.00 = pH + pOH$
- As pH rises, pOH falls (sum = 14.00).
- There are no theoretical limits on the values of pH or pOH. (e.g. pH of 2.0 M HCl is -0.301)

https://phet.colorado.edu/en/simulation/ph-scale-basics

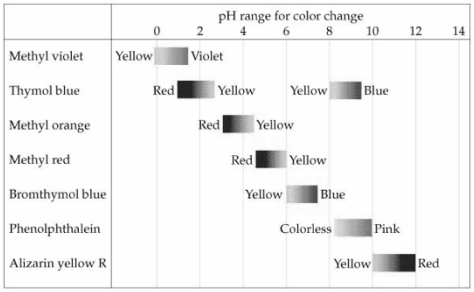
The pH Scale

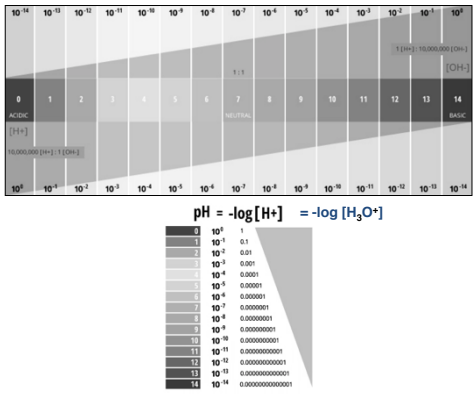


The drainage water from the Iron Mountain Mine is the most acidic water on Earth; some samples collected in 1990 and 1991 have been measured to have a pH value of -3.6, which is the lowest pH observed globally in a natural environment.

Indicators

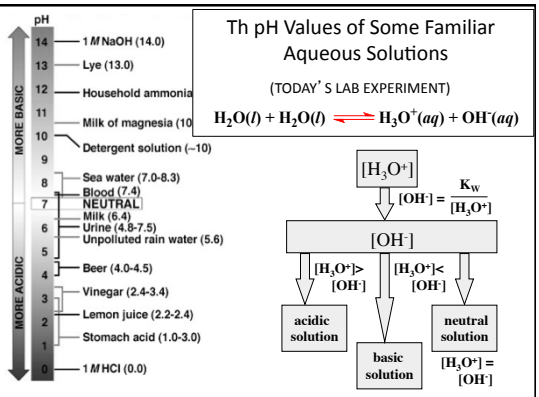
Acid-Base Indicators





The Relations Among $[H_3O^+]$, pH, $[OH^-]$, and pOH

	$[H_3O^+]$	pH	$[OH^-]$	pOH
MORE BASIC	1.0×10^{-15}	15.00	1.0×10^{1}	−1.00
	1.0×10^{-14}	14.00	1.0×10^{0}	0.00
	1.0×10^{-13}	13.00	1.0×10^{-1}	1.00
BASIC	1.0×10^{-12}	12.00	1.0×10^{-2}	2.00
	1.0×10^{-11}	11.00	1.0×10^{-3}	3.00
	1.0×10^{-10}	10.00	1.0×10^{-4}	4.00
	1.0×10^{-9}	9.00	1.0×10^{-5}	5.00
	1.0×10^{-8}	8.00	1.0×10^{-6}	6.00
NEUTRAL	1.0×10^{-7}	7.00	1.0×10^{-7}	7.00
	1.0×10^{-6}	6.00	1.0×10^{-8}	8.00
	1.0×10^{-5}	5.00	1.0×10^{-9}	9.00
	1.0×10^{-4}	4.00	1.0×10^{-10}	10.00
ACIDIC	1.0×10^{-3}	3.00	1.0×10^{-11}	11.00
	1.0×10^{-2}	2.00	1.0×10^{-12}	12.00
	1.0×10^{-1}	1.00	1.0×10^{-13}	13.00
	1.0×10^{0}	0.00	1.0×10^{-14}	14.00
MORE ACIDIC	1.0×10^{1}	−1.00	1.0×10^{-15}	15.00



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Acid-Base Strengths

pH [indicator paper & pH meter]

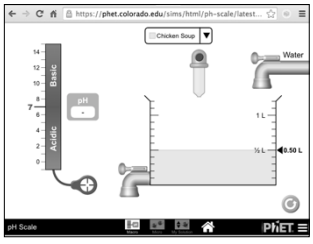
https://phet.colorado.edu/en/simulation/ph-scale

Strong Acid:

Strong Base:

Weak Acid:

Weak Base:



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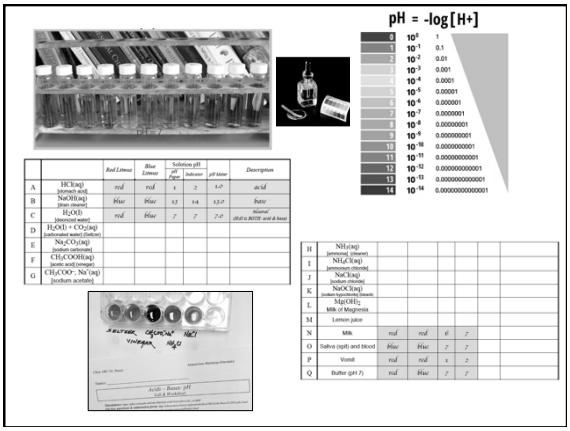
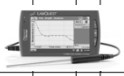


Lab pH: pH Meter

		Red Litmus	*Blue Litmus*	Solution pH		*pH Meter*	*Description*
				pH Paper	*Indicator*		
A	HCl(aq) [stomach acid]	*red*	*red*	1	2	1.0	*acid*
B	NaOH(aq) [drain cleaner]	*blue*	*blue*	13	14	13.0	*base*
C	$H_2O(l)$ [deionized water]	*red*	*blue*	7	7	7.0	*Neutral (H₂O is BOTH: acid & base)*
D	$H_2O(l) + CO_2(aq)$ [carbonated water] (Seltzer)					6.4	
E	$Na_2CO_3(aq)$ [sodium carbonate]					10.1	
F	$CH_3COOH(aq)$ [acetic acid] (vinegar)					4.7	
G	$CH_3COO^-, Na^+(aq)$ [sodium acetate]					8.4	
H	$NH_3(aq)$ [ammonia] (cleaner)					12.0	
I	$NH_4Cl(aq)$ [ammonium chloride]					6.1	
J	NaCl(aq) [sodium chloride]					7.0	
K	NaOCl(aq) [sodium hypochlorite] (bleach)					10.9	
L	$Mg(OH)_2$ Milk of Magnesia					12.2	
M	Lemon juice					3.8	
N	Milk	*red*	*red*	6	7	6.4	
O	Saliva (spit) and blood	*blue*	*blue*	7	7	7.3	
P	Vomit	*red*	*red*	1	2	1.9	
Q	Buffer (pH 7)	*red*	*blue*	7	7	7.0	



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