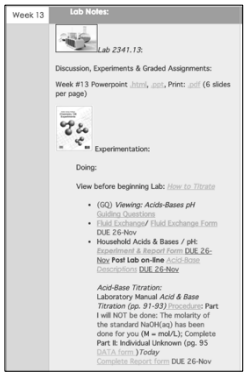
Chem 108: Lab
Week 13

Sign in / Pick up Papers

Pick a vial and a plastic dropper

Using the vial number, sign-in next to your name on the Lab roster


Week 13 Lab Notes:

Lab 2341.13:

Discussion, Experiments & Graded Assignments:

Week #13 Powerpoint .html, .pdf, Print: .pdf (6 slides per page)

Experimentation:

Doing:

View before beginning Lab: How to Titrate

- (GQ) *Viewing: Acids-Bases pH* Guiding Questions
- Fluid Exchange/ Fluid Exchange Form DUE 26-Nov
- Household Acids & Bases / pH: Experiment & Report Form DUE 26-Nov **Post Lab on-line** Acid-Base Descriptions DUE 26-Nov

Acid-Base Titration:
Laboratory Manual *Acid & Base Titration (pp. 91-93)* Procedure: Part I will NOT be done; The molarity of the standard NaOH(aq) has been done for you (M = mol/L); Complete **Part II: Individual Unknown** (pg. 95 DATA form)*Today* Complete Report form DUE 26-Nov

Chem 108: Class/ Lab
Week 13

TODAY:
1) Fluid Exchange
(Handout) *Due Next Lab*

2) To *Do:* Acid-Base Equilibrium Experiment
(Handout)
Data completed & signed before leaving Lab
3) To *Do:* Unknown acid titration
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)

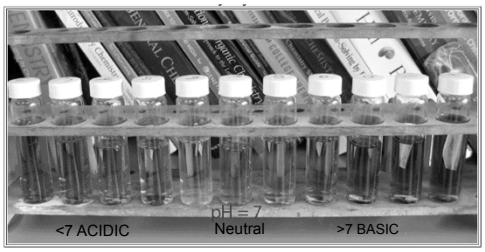
3) You have been assigned a geographical location for your Global Residence. Check the ***Global Homelands Map,*** which follows, for your location and if necessary move to your place of residence.

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

Global Homelands Map
(Front of Lab)

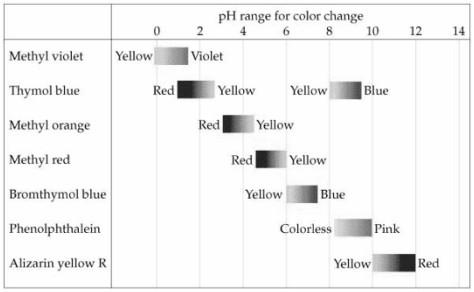
Wait for Dr. R's instructions on exchanging fluids, keeping records, and using the forms provided.

Acid-Base Indicators



Indicators

Acid-Base Indicators



Chem 108: Class/ Lab

Week 13

1) Fluid Exchange
(Handout) *Due Next Lab*

TODAY:
2) To *Do:* Acid-Base Equilibrium Experiment
(Handout)
Data table completed & signed before leaving Lab

Fully Completed Handout Due Next Week

Lab: universal Indicator, litmus & pH paper

		Red Litmus	Blue Litmus	Solution pH (pH Paper)	Solution pH (Indicator)	Description
A	HCl(aq) stomach acid	red	red	1	2	acid
B	NaOH(aq) drain cleaner	blue	blue	13	14	base
C	$H_2O(l)$ deionized water	red	blue	7	7	Neutral (BOTH acid & base)
D	$H_2O(l) + CO_2(aq)$ carbonated water (Seltzer)					
E	$Na_2CO_3(aq)$ baking soda	blue	blue	10	10	
F	$CH_3COOH(aq)$ vinegar					
G	$CH_3COO^-, Na^+(aq)$ salt solution	blue	blue	8	9	
H	$NH_3(aq)$ ammonia (household cleaner)	blue	blue	12	12	
I	$NH_4Cl(aq)$ ammonium chloride					

J	NaCl(aq) salt solution					
K	NaOCl(aq) bleach	blue	blue	11	11	
L	$Mg(OH)_2$ Milk of Magnesia	blue	blue	11	10	
M	Orange juice	red	red	4	3	
N	Milk	red	red	6	7	
O	Saliva (spit) and blood	blue	blue	7.4 (pH meter)		
P	Vomit	red	red	2.0 (pH meter)		
Q	Buffer (pH 7)	red	blue	7.0 (pH meter)		

pH = -log[H+]

0	10^0	1
1	10^{-1}	0.1
2	10^{-2}	0.01
3	10^{-3}	0.001
4	10^{-4}	0.0001
5	10^{-5}	0.00001
6	10^{-6}	0.000001
7	10^{-7}	0.0000001
8	10^{-8}	0.00000001
9	10^{-9}	0.000000001
10	10^{-10}	0.0000000001
11	10^{-11}	0.00000000001
12	10^{-12}	0.000000000001
13	10^{-13}	0.0000000000001
14	10^{-14}	0.00000000000001

		Red Litmus	Blue Litmus	Solution pH (pH Paper)	Solution pH (Indicator)	Description
A	HCl(aq) stomach acid	red	red	1	2	acid
B	NaOH(aq) drain cleaner	blue	blue	13	14	base
C	$H_2O(l)$ deionized water	red	blue	7	7	Neutral (BOTH acid & base)
D	$H_2O(l) + CO_2(aq)$ carbonated water (Seltzer)					
E	$Na_2CO_3(aq)$ baking soda	blue	blue	10	10	
F	$CH_3COOH(aq)$ vinegar					
G	$CH_3COO^-, Na^+(aq)$ salt solution	blue	blue	8	9	
H	$NH_3(aq)$ ammonia (household cleaner)	blue	blue	12	12	
I	$NH_4Cl(aq)$ ammonium chloride					

J	NaCl(aq) salt solution					
K	NaOCl(aq) bleach	blue	blue	11	11	
L	$Mg(OH)_2$ Milk of Magnesia	blue	blue	11	10	
M	Orange juice	red	red	4	3	
N	Milk	red	red	6	7	
O	Saliva (spit) and blood	blue	blue	7.4 (pH meter)		
P	Vomit	red	red	2.0 (pH meter)		
Q	Buffer (pH 7)	red	blue	7.0 (pH meter)		

Lab pH: pH Meter (Chem 120)

		Red Litmus	Blue Litmus	Solution pH	Description
A	HCl(aq) stomach acid	red	red	1.0	acid
B	NaOH(aq) drain cleaner	blue	blue	13.0	base
C	$H_2O(l)$ deionized water	red	blue	7.0	Neutral (BOTH acid & base)
D	$H_2O(l) + CO_2(aq)$ carbonated water (Seltzer)			6.4	
E	$Na_2CO_3(aq)$ baking soda	blue	blue	10.1	
F	$CH_3COOH(aq)$ vinegar			4.7	
G	$CH_3COO^-, Na^+(aq)$ salt solution	blue	blue	8.4	
H	$NH_3(aq)$ ammonia (household cleaner)	blue	blue	12.0	
I	$NH_4Cl(aq)$ ammonium chloride			6.1	

J	NaCl(aq) salt solution			7.0
K	NaOCl(aq) bleach	blue	blue	10.9
L	$Mg(OH)_2$ Milk of Magnesia	blue	blue	12.2
M	Orange juice	red	red	3.8
N	Milk	red	red	6.4
O	Saliva (spit) and blood	blue	blue	7.3
P	Vomit	red	red	1.9
Q	Buffer (pH 7)	red	blue	7.0

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

pH = -log[H+]

0	10^0	1
1	10^{-1}	0.1
2	10^{-2}	0.01
3	10^{-3}	0.001
4	10^{-4}	0.0001
5	10^{-5}	0.00001
6	10^{-6}	0.000001
7	10^{-7}	0.0000001
8	10^{-8}	0.00000001
9	10^{-9}	0.000000001
10	10^{-10}	0.0000000001
11	10^{-11}	0.00000000001
12	10^{-12}	0.000000000001
13	10^{-13}	0.0000000000001
14	10^{-14}	0.00000000000001

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

Chem 108: Class/ Lab

Week 13

1) Fluid Exchange
(Handout) *Due Next Lab*
2) To *Do:* Acid-Base Equilibrium Experiment
(Handout)
Data completed & signed before leaving Lab

TODAY:

3) To *Do:* Unknown acid titration
Data completed & signed before leaving Lab

Chem 108: Lab

Standardization (Part 1) will not be done. Molarity of sodium hydroxide standard solution will be provided.

Name: _____

Section: _____

Individual Titrations of Unknown Acid
To Do Today

Report Form – Acid Base Titration

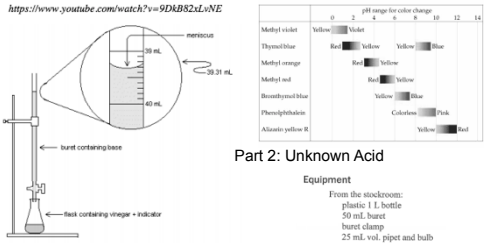
Part 1–Standardization of NaOH Solution

Molarity of HCl used						
Titration	1	2	3	4	5	6
Base buret, final reading (mL)						
Base buret, initial reading (mL)						
Volume of base used (mL)*						
Molarity of NaOH (M)*						
Average molarity of NaOH*				M		

Show the calculations for each of the entries in the Data Table marked with * on the calculations page for one titration.

https://www.youtube.com/watch?v=9DkB82xLvNE

Acid-Base Titration



Part 2: Unknown Acid

Equipment

From the stockroom:
- plastic 1 L bottle
- 50 mL buret
- buret clamp
- 25 mL vol. pipet and bulb

From the common drawer:
- ring stand

From your drawer:
- funnel
- 125 mL flask
- 250 mL flask
- 2 beakers (one for waste)
- wash bottle

Chem 108: Lab

Part 2:

To Do (individually) today. Have signed before leaving lab.

Part 2–Determination of Unknown Acid

Unknown code						
Average Molarity of Base from Part 1		0.2051 mol/L				
Titration	1	2	3	4	5	6
Base buret, final reading (mL)						
Base buret, initial reading (mL)						
Volume of base used (mL)*						
Molarity of unknown acid (M)*						
Average molarity of unknown (M)*				M		

Show the calculations for each of the entries in the Data Table marked with * on the calculations page for one titration.

3 trials must be within +/- 0.20 mL

Take a clean, dry, 125 mL erlenmeyer flask to the stockroom window and get unknown acid solution. Record unknown number. Have data page signed before leaving lab today.

https://www.youtube.com/watch?v=9DkB82xLvNE

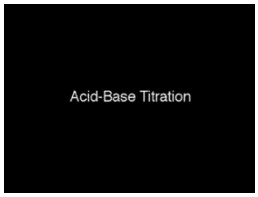
Neutralization Reactions

Titration

$$H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O_{(l)}$$

Neutralization Reactions

Titration



pH curves
Chem 120/121

Unkown Acid Neutralization

Net Ionic Equation/ Calculation

$$HNO_{3(aq)} + NaOH_{(aq)} \longrightarrow NaNO_{3(aq)} + H_2O_{(l)}$$

acid — base — salt — water
conj. base — conj. acid

$$H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O_{(l)}$$

acid — base — water

25.00 mL of $M_{H+\,(aq)}$= ? (unknown monoprotic nitric acid solution) was titrated with a sodium hydroxide solution, M_{OH-}= ? 0.2162 M. It required 24.20 mL as an average of three trials which were within +/- 0.20 mL to reach a faint pink color.

$M_{H+\,(aq)}$ = ?

$$?M_{H+} = [M_{OH-} \times V_{OH-} / V_{H+}]\ [? \text{ mol}_{H+} / ? \text{ mol}_{OH-}]$$

Unkown Acid Neutralization

Net Ionic Equation/ Calculation

$$H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O_{(l)}$$

acid base water

25.00 mL of $M_{H+\,aq}$= ? (unknown monoprotic acid solution) was titrated with a sodium hydroxide solution, M_{OH-}= ? 0.2162 M. It required 24.20 mL as an average of three trials which were within +/- 0.20 mL to reach a faint pink color.

$$?M_{H+} = [M_{OH-} \times V_{OH-} / V_{H+}\,] [? \text{ mol}_{H+} / ? \text{ mol}_{OH-}]$$

$$= \frac{0.2162 \text{ mol}_{OH-} \times 0.02420 \text{ L}_{OH-} \times 1 \text{ mol}_{H+}}{\text{L}_{OH-} \times 0.02500 \text{ L}_{H+} \times 1 \text{ mol}_{OH-}} = 0.2093 \; M_{H+}$$

QUESTION

A 35.00 mL sample of a monoprotic acid of unknown concentration was titrated with 42.30 mL of 0.2250 M KOH. What is the concentration of the unknown acid?

A.0.0930 M
B.0.3030 M
C.0.2719 M
D.0.1356 M
E.0.3720 M

$$H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O_{(l)}$$

$$?M_{H+} = [M_{OH-} \times V_{OH-} / V_{H+}\,] [? \text{ mol}_{H+} / ? \text{ mol}_{OH-}]$$

QUESTION

A 35.00 mL sample of sulfuric acid (a di-protic acid) of unknown concentration was titrated with 42.30 mL of 0.2250 M KOH. What is the concentration of the unknown acid?

A.0.0930 M
B.0.3030 M
C.0.2719 M
D.0.1356 M
E.0.3720 M

$$1\ H_2SO_4 \qquad 2 \qquad 2$$

$$H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O_{(l)}$$

$$? M_{H+} = [M_{OH-} \times V_{OH-} / V_{H+}\,] [? \text{ mol}_{H2SO4} / ? \text{ mol}_{OH-}]$$

Chem 108: Lab

Part 2: Week 13

To Do (individually) today

Part 2–Determination of Unknown Acid

Unknown code						
Average Molarity of Base from Part 1		0.2051 mol/L				
Titration	1	2	3	4	5	6
Base buret, final reading (mL)						
Base buret, initial reading (mL)						
Volume of base used (mL)*						
Molarity of unknown acid (M)*						
Average molarity of unknown (M)*				M		

Show the calculations for each of the entries in the Data Table marked with * on the calculations page for one titration.

Take a clean, dry, 125 mL erlenmeyer flask to the stockroom window and get unknown acid solution. Record unknown number. Have data page signed before leaving lab today.