Chem 108: Lab

Lab:

Discussion, Experiments & Graded Assignments:

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

Experimentation:

- Doing:
Global Warming Questions
Scantron DUE Today

Acid-Base Titration:
Laboratory Manual *Acid & Base Titration (pp. 91-93)*Procedure: Part I Completed;
Part II: *To Do Today*
Part I: Standardization (pg. 94 DATA form)
Part II: Unknown (pg. 95 DATA form. *To Do* Today; Complete & have signed Today)

Complete Report form DUE 15-Nov

Chem 108: Lab
Week 13

Sign in / Pick up Papers

*Turn in
Global Warming Questions
Scantron*

Chem 108: Lab

Standardization completed last week

Individual Titrations of Unknown
To Do <u>Today</u>

Name: _____

Section: _____

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.
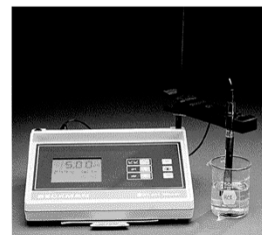

Neutralization Reactions
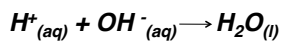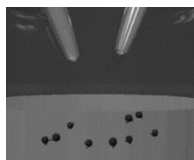
$$H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O_{(l)}$$
There is no difference in the stoichiometry of the reaction of acetic acid & HCl with NaOH, but there is a difference in pH .

Methods for Measuring the pH of an Aqueous Solution

(a) pH paper   (b) Electrodes of a pH meter

Neutralizations / Titrations
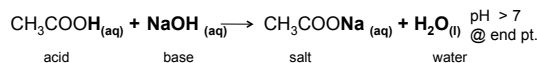

Chem 108 titration: phenolphthalein indicator
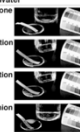Chem 120/121 Titration Curves

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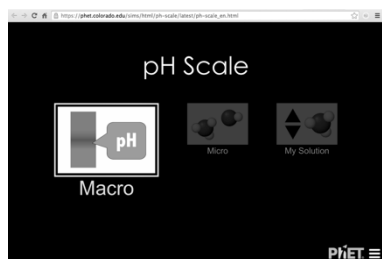## Aqueous Reactions: Neutralization
pH @ the end point

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

$$HCl_{(aq)} + NaOH_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$$
acid   base   salt   water

pH = 7 @ end pt.

$$CH_3COOH_{(aq)} + NaOH_{(aq)} \longrightarrow CH_3COONa_{(aq)} + H_2O_{(l)}$$
acid   base   salt   water

pH > 7 @ end pt.

The Behavior of Salts in Water

Salt Solution (Examples)	pH	Nature of Ions	Ion That Reacts with Water
Neutral [NaCl, KBr, Ba(NO₃)₂]	7.0	Cation of strong base Anion of strong acid	None
Acidic [NH₄Cl, NH₄NO₃, CH₃NH₃Br]	<7.0	Cation of weak base Anion of strong acid	Cation
Acidic [Al(NO₃)₃, CrCl₃, FeBr₃]	<7.0	Small, highly charged cation Anion of strong acid	Cation
Basic [CH₃COONa, KF, Na₂CO₃]	>7.0	Cation of strong base Anion of weak acid	Anion

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Slide 1:

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

pH Scale
Macro

Slide 2:

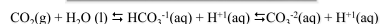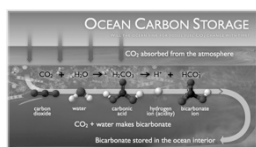http://chemconnections.org/general/movies/pHEstimation.swf

pH Estimation

Using the pH benchmarks, estimate the pH of solutions with each of the following hydronium ion concentrations. Click on the boxes to see the estimate and the calculated value of each solution's pH.

pH Benchmarks

$[H_3O^+]$	pH
1.0 M	0.00
0.10	1.00
0.010	2.00
0.0010	3.00
1.0×10^{-4}	4.00
1.0×10^{-5}	5.00
1.0×10^{-6}	6.00
1.0×10^{-7}	7.00

$[H_3O^+]$	Estimated pH	Calculated pH
0.015 M		
0.058 M		
4.5×10^{-5} M		
3.9×10^{-7} M		

Slide 3:

EQUILIBRIUM
CO_2 & Oceanic Bicarbonate Buffering

OCEAN CARBON STORAGE

$CO_2(g) + H_2O(l) \leftrightharpoons HCO_3^{-1}(aq) + H^{+1}(aq) \leftrightharpoons CO_3^{-2}(aq) + H^{+1}(aq)$

Oceans: pH ~ 8.1 and falling
http://www.tos.org/oceanography/issues/issue_archive/22_4.html
Increasing CO_2 is decreasing ocean pH; long term effects?
http://sos.noaa.gov/datasets/Ocean/ocean_acidification.html
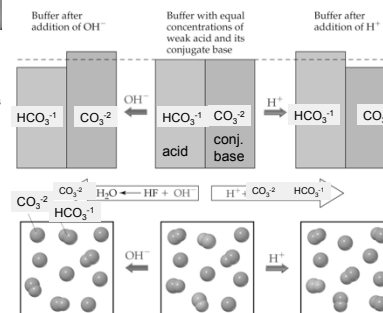

Slide 4:

Bicarbonate Buffer Systems

Which is the buffer?

One is bicarbonate buffer to pH ≈ 8 - 9. One is water plus sodium hydroxide, pH ≈ 8 - 9.

Volunteers to experiment and find out which is which?

Slide 5:

Chem 108: Lab

Part 1
Done with a partner.

Name: _____
Section: _____

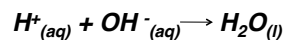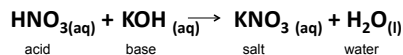Report Form – Acid Base Titration

Part 1–Standardization of NaOH Solution

	1	2	3	4	5	6
Molarity of HCl used						
Titration						
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.

Completed last week.

Slide 6:

Aqueous Reactions: Neutralization

Net Ionic Equations

$HNO_{3(aq)} + KOH_{(aq)} \rightarrow KNO_{3\,(aq)} + H_2O_{(l)}$
acid   base   salt   water

$H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$
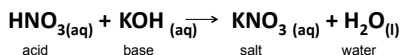
25.00 mL of $M_{HCL} = 0.2160$ M nitric acid solution was titrated with a potassium hydroxide solution. It required 24.20 mL as an average of three trials to reach a faint pink color.

$M_{KOH} = ?$

Aqueous Reactions: Neutralization

Net Ionic Equations

$$HNO_{3(aq)} + KOH_{(aq)} \longrightarrow KNO_{3\ (aq)} + H_2O_{(l)}$$

acid   base   salt   water

25.00 mL of $M_{HCL} = 0.2160\ M$ nitric acid solution was titrated with a potassium hydroxide solution. It required 24.20 mL as an average of three trials to reach a faint pink color.

$$?M_{KOH} = [M_{HNO3}\ x\ V_{HNO3} / V_{KOH}]\ [?\ mol_{KOH} / ?\ mol_{HNO3}]$$

$$= \frac{0.2160\ mol_{HNO3}\ x\ 0.02500\ L_{HNO3}\ x\ 1\ mol_{KOH}}{L_{HNO3}\ x\ 0.02420\ L_{KOH}\ x\ 1\ mol_{HNO3}} = 0.2231\ M_{KOH}$$

QUESTION

A 35.00 mL sample of 0.2250 M HBr was titrated with 42.30 mL of KOH. What is the concentration of the KOH?

A. 0.0930 M
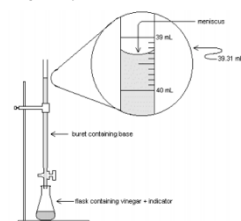B. 0.3030 M
C. 0.2719 M
D. 0.1860 M
E. 0.3720 M

QUESTION

A 35.00 mL sample of 0.2250 M H_2SO_4 was titrated with 42.30 mL of KOH. What is the concentration of the KOH?

A. 0.0930 M
B. 0.3030 M
C. 0.2719 M
D. 0.1860 M
E. 0.3720 M

Acid-Base Titration

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

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: Week 13

To Do (individually) today

Part 2–Determination of Unknown Acid

Unknown code							
Average Molarity of Base from Part 1					M		
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.

QUESTION

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

A. 0.0930 M
B. 0.3030 M
C. 0.2719 M
D. 0.1860 M
E. 0.3720 M