Chem 108: Class/ Lab

Week 14: 2019s

Sign in / Pick up Papers

Due Today:

1) Fluid Exchange (Handout)

2) Acid-Base: pH (Handout)

Do Today: *Laboratory Manual Acid & Base Titration Procedure (pp. 91-93)*

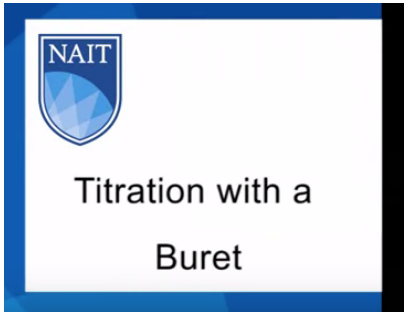
Each of you are to take a clean 250 mL erlenmeyer flask and place it in the gray plastic tub on the lab's side bench.

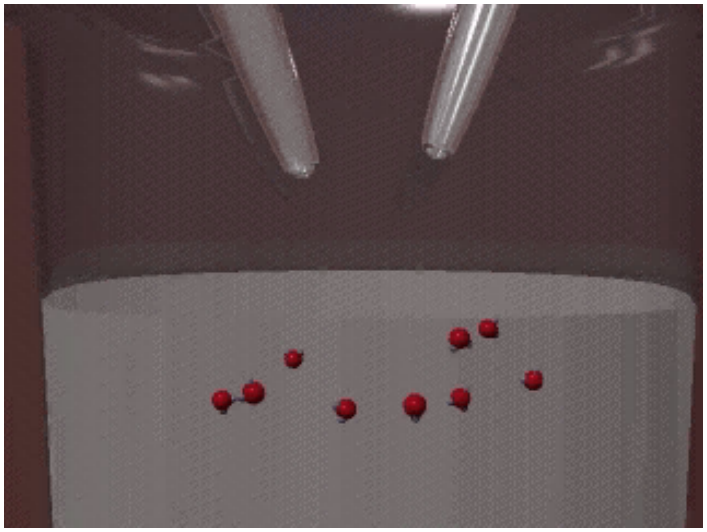
https://www.youtube.com/watch?v=9DkB82xLvNE

Neutralization Reactions

Titration

http://chemconnections.org/general/movies/acidbasetitration.mov





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

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

Neutralizations / Titrations

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

Aqueous Reactions: Neutralization

Net Ionic Equations

$$HCl_{(aq)} + NaOH_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$$

strong acid | base | salt | water

Titration end point

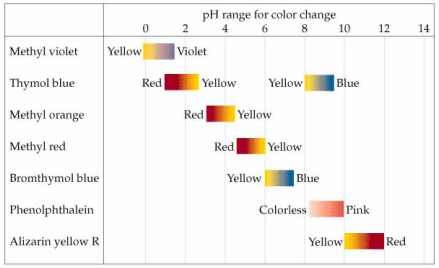
pH > 7

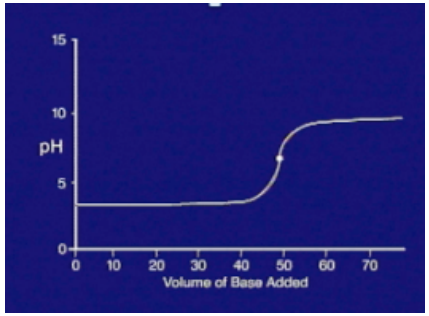
- $HCl_{(aq)} \longrightarrow H^+_{(aq)} + Cl^-_{(aq)}$
- $NaOH_{(aq)} \longrightarrow Na^+_{(aq)} + OH^-_{(aq)}$
- $NaCl_{(aq)} \longrightarrow Na^+_{(aq)} + Cl^-_{(aq)}$

$$Na^+_{(aq)} + OH^-_{(aq)} + H^+_{(aq)} + Cl^-_{(aq)} \longrightarrow$$

$$Na^+_{(aq)} + Cl^-_{(aq)} + H_2O_{(l)}$$

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





Equivalence point: pH = 7

Aqueous Reactions: Neutralization

Net Ionic Equations

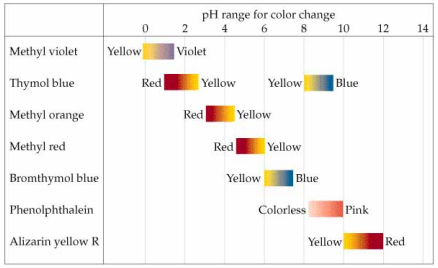
$$CH_3COOH_{(aq)} + NaOH_{(aq)} \longrightarrow CH_3COONa_{(aq)} + H_2O_{(l)}$$

weak acid | base | salt | water

$$CH_3COO^-_{(aq)} + H^+_{(aq)} + Na^+_{(aq)} + OH^-_{(aq)} \longrightarrow$$

$$CH_3COO^-_{(aq)} + Na^+_{(aq)} + H_2O_{(l)}$$

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



Titration end point

pH > 7

Same Net Ionic Equation (NIE) **for any neutralization**

Eg. H_2SO_4

$$2\ H^+_{(aq)} + 2\ OH^-_{(aq)} \longrightarrow 2\ H_2O_{(l)}$$

$$\frac{}{2}$$

Equivalence point: **pH = ?**

Aqueous Reactions: Neutralization

Salt in this case is a Weak Base

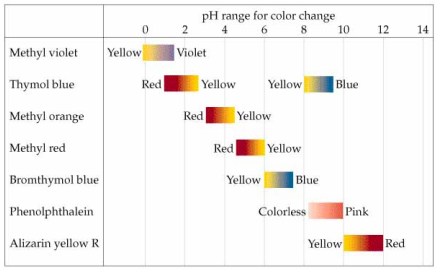
$$CH_3COOH_{(aq)} + NaOH_{(aq)} \longrightarrow CH_3COONa_{(aq)} + H_2O_{(l)}$$

weak acid | base | **salt** | water

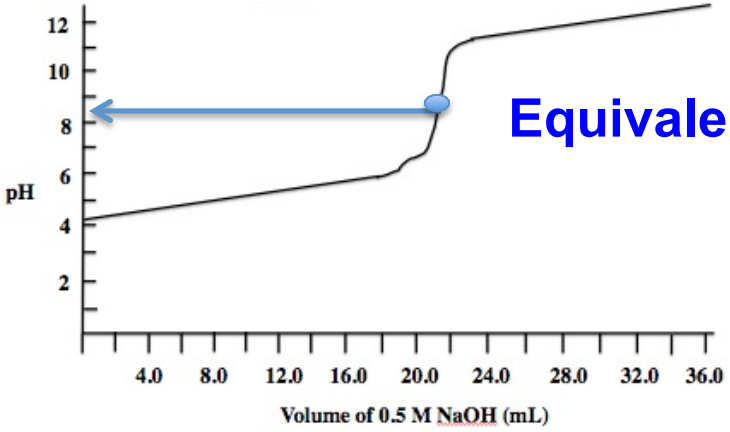
$$CH_3COO^-_{(aq)} + H_2O_{(aq)} \longrightarrow CH_3COOH_{(aq)} + OH^-_{(aq)}$$

CH_3COO^- **salt** + ~~$Na^+_{(aq)}$~~

~~+ $Na^+_{(aq)}$~~



Titration
End point
pH > 7

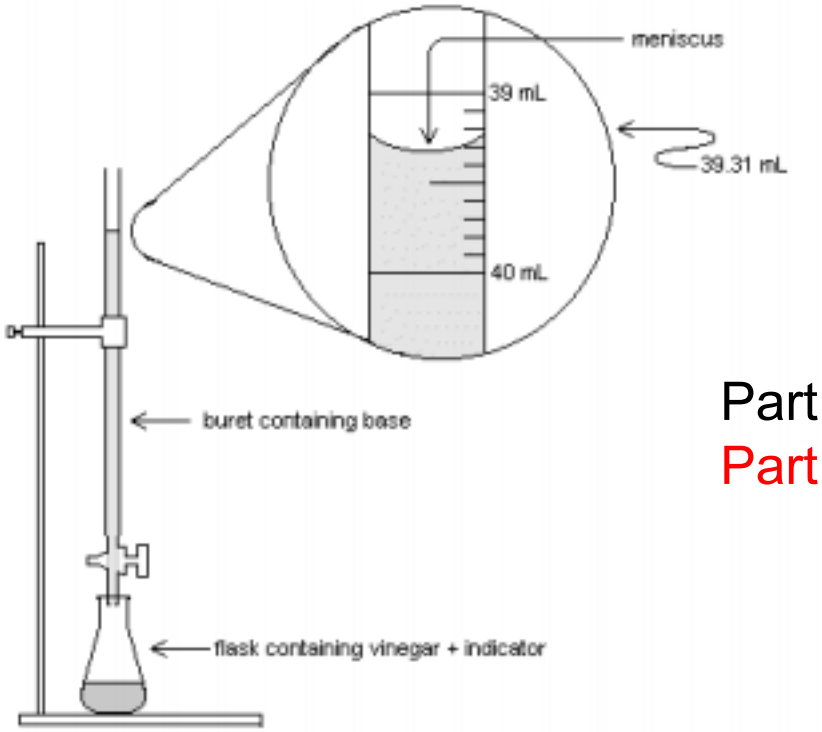


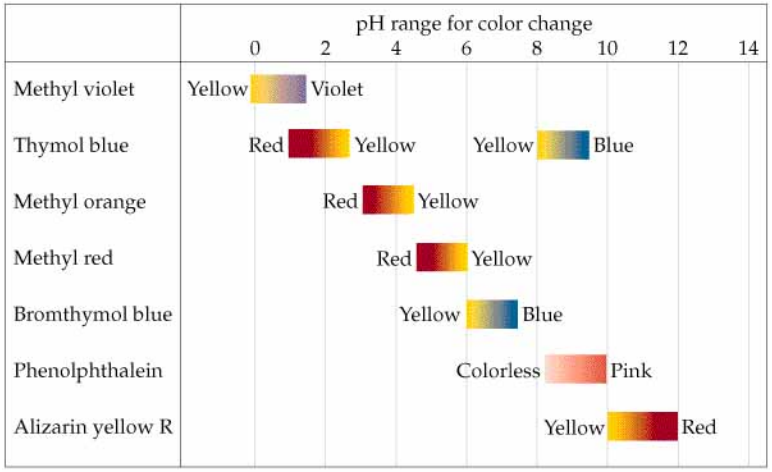
Equivalence point pH >7

Equivalence point: **pH = ?**

Acid-Base Titration

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





Part 1: Standardization will NOT be done.

Part 2: Will be done individually.

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

Week 14

Part 1 will not be done by you.
It has been done for you.

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	0.2099	

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

Record and use the molarity above.

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.*

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

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

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.*

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

$$= \frac{0.2162\ mol_{OH-} \times 0.02420\ L_{OH-} \times 1\ mol_{H+}}{L_{OH-} \times 0.02500\ L_{H+} \times 1\ mol_{OH-}} = 0.2093\ M_{H+}$$

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

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

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

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

$$? M_{H+} = [M_{OH-} \times V_{OH-} / V_{H+}] [? mol_{H2SO4} / ? mol_{OH-}]$$

Chem 108: Lab

Part 2: Week 13

To Do today (individually); each of you will do a separate unknown.

3 trials must be within
+/- 0.20 mL

1mL ~ 20 drops

Part 2–Determination of Unknown Acid

Unknown code						
Average Molarity of Base from Part 1			0.2099 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.

Each of you will do a separate unknown. Take an erlenmeyer flask from the gray tub and record its code & the Molarity of Base.