Chem 108: Class/ Lab

Week 14: 2019f

Sign in / Pick up Papers

Due Today:
1) Fluid Exchange (Handout)

2) Acid-Base: pH (Handout) 1 completed form per group with names of all who contributed

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

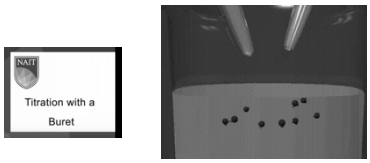
Each of you are to take a clean 250 mL erlenmeyer flask and place it in the gray plastic tub on the lab's side bench.

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

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

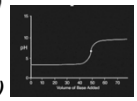
strong acid base salt water

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

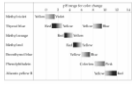
$CH_3COOH_{(aq)} + NaOH_{(aq)} \longrightarrow CH_3COONa_{(aq)} + H_2O_{(l)}$

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

2

Equivalence point: **pH = ?**

Aqueous Reactions: Neutralization

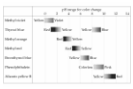
Salt in this case is a Weak Base

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

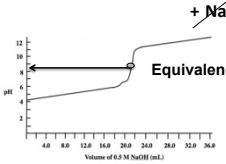
weak acid base **salt** water

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

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



Titration End point pH > 7

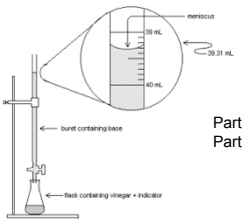


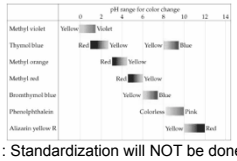
Equivalence point pH >7

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 0.2240			

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, 0.2240M.

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

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

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

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 2 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 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~~			**0.2240** 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.

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~~			**0.2240** 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.

After completing enough trials that 3 of them are within +/- 0.20 mL show this data page to Dr. R.