Chem 108: Lab Week 13

Sign in / Pick up Papers

Pick a vial and a plastic dropper

Using the vial number, signin next to your name on the Lab roster



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.

Global Homelands Map

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



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





| | | D. J.T. | Blue | Solution pH | | D |
|---|---|------------|--------|-------------|-----------|-----------------------------------|
| | | Red Litmus | Litmus | pH Paper | Indicator | Description |
| А | HCl(aq) stomach acid | red | red | 1 | 2 | acíd |
| в | NaOH(aq) drain cleaner | blue | blue | 13 | 14 | base |
| С | $H_2O(l)$ deionized water | red | blue | 7 | 7 | Neutral (BOTH: acid & base) |
| D | H ₂ O(l) + CO ₂ (aq) carbonated water (Seltzer) | | | | | |
| Е | Na ₂ CO ₃ (aq) baking soda | blue | blue | 10 | 10 | |
| F | CH ₃ COOH(aq) vinegar | | | | | |
| G | CH ₃ COO [−] , Na ⁺ (aq) salt solution | blue | blue | 8 | 9 | |
| Н | NH ₃ (aq) ammonia (household cleaner) | blue | blue | 12 | 12 | |
| Ι | NH ₄ Cl(aq) ammonium chloride | | | | | |

| J | NaCl(aq) salt solution | | | | | |
|---|---|------|------|----------------|----------|--|
| к | NaOCl(aq) bleach | blue | blue | 11 | 11 | |
| L | Mg(OH) ₂ Milk of Magnesia | blue | blue | 11 | 10 | |
| М | Orange juice | red | red | 4 | 3 | |
| Ν | Milk | red | red | 6 | 7 | |
| 0 | Saliva (spit) and blood | blue | blue | 7•4 (pH meter) | | |
| Р | Vomit | red | red | 2.0 (pH meter) | | |
| Q | Buffer (pH 7) | red | blue | 7.0 (p | H meter) | |



| | | D 17. | Blue | Solut | ion pH | - |
|---|---|------------|--------|-------------|-----------|-----------------------------------|
| | | Red Litmus | Litmus | pH Paper | Indicator | Description |
| Α | HCl(aq) stomach acid | red | red | 1 | 2 | acíd |
| в | NaOH(aq) drain cleaner | blue | blue | 13 | 14 | base |
| С | H ₂ O(l) deionized water | red | blue | 7 | 7 | Neutral (BOTH: acid & base) |
| D | H ₂ O(l) + CO ₂ (aq) carbonated water (Seltzer) | | | | | |
| E | Na ₂ CO ₃ (aq) baking soda | blue | blue | 10 | 10 | |
| F | CH ₃ COOH(aq) vinegar | | | | | |
| G | CH ₃ COO ⁻ , Na ⁺ (aq) salt solution | вие | blue | 8 | 9 | |
| Н | NH ₃ (aq) ammonia (household cleaner) | blue | blue | 12 | 12 | |
| Ι | NH ₄ Cl(aq) ammonium chloride | | | | | |

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 | 0.000000001 |
| 11 | 10 ⁻¹¹ | 0.0000000001 |
| 12 | 10 ⁻¹² | 0.000000000001 |
| 13 | 10 ⁻¹³ | 0.000000000001 |
| 14 | 10 ⁻¹⁴ | 0.00000000000001 |

| J | NaCl(aq) salt solution | | | | | |
|---|---|------|------|----------------|----------|--|
| К | NaOCl(aq) bleach | blue | blue | 11 | 11 | |
| L | Mg(OH) ₂ Milk of Magnesia | blue | blue | 11 | 10 | |
| М | Orange juice | red | red | 4 | 3 | |
| N | Milk | red | red | 6 | 7 | |
| 0 | Saliva (spit) and blood | blue | blue | 7•4 (pH meter) | | |
| Р | Vomit | red | red | 2.0 (pH meter) | | |
| Q | Buffer (pH 7) | red | blue | 7.0 (p | H meter) | |

Lab pH: pH Meter (Chem 120)



| | | Red Litmus | Blue Litmus | Solution pH | Description |
|---|---|------------|----------------|-------------|-----------------------------------|
| Α | HCl(aq) stomach acid | red | red | 1.0 | acíd |
| в | NaOH(aq) drain cleaner | blue | blue | 13.0 | base |
| С | $H_2O(l)$ deionized water | red | blue | 7.0 | Neutral (BOTH: acid & base) |
| D | H ₂ O(l) + CO ₂ (aq) carbonated water (Seltzer) | | | 6.4 | |
| E | Na ₂ CO ₃ (aq) baking soda | blue | blue | 10.1 | |
| F | CH ₃ COOH(aq) vinegar | | | 4.7 | |
| G | CH ₃ COO ⁻ , Na ⁺ (aq) salt solution | blue | blue | 8.4 | |
| H | NH ₃ (aq) ammonia (household cleaner) | blue | blue | 12.0 | |
| Ι | NH ₄ Cl(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 | |
| М | Orange juice | red | red | 3.8 | |
| N | Milk | red | red | 6.4 | |
| 0 | Saliva (spit) and blood | blue | blue | 7.3 | |
| Р | 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+]

10⁰ 10-1 0.1 10⁻² 0.01 10-3 0.001 10-4 0.0001 10-5 0.00001 10-6 0.000001 10⁻⁷ 0.0000001 10-8 0.00000001 10⁻⁹ 0.000000001 10⁻¹⁰ 0.0000000001 10-11 0.00000000001 10-12 0.000000000000 10⁻¹³ 0.0000000000000 10-14 0.0000000000000000 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

 Fluid Exchange (Handout) *Due Next Lab* 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



Report Form – Acid Base Titration

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

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:

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

Part 2-Determination of Unknown Acid

3 trials must

+/- 0 20 ml

be within

| 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)* | | | | М | | | | | |

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

Neutralization Reactions Titration



 $H^+_{(aq)} + OH^-_{(aq)} \longrightarrow H_2O_{(l)}$ NAIT Titration with a **Buret**

Neutralization Reactions Titration



pH curves Chem 120/121

Unkown Acid Neutralization

Net Ionic Equation/ Calculation



 $M_{H^+(aq)} = ?$

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

Unkown Acid Neutralization

Net Ionic Equation/ Calculation

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

acid

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.

water

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

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



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?

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

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 $H^{+}_{(aq)} + OH^{-}_{(aq)} \rightarrow H_{2}O_{(l)}$

 $P(M_{H+} = [M_{OH-} \times V_{OH-} / V_{H+}] [P(M_{H+}) + [M_{OH-} / P(M_{H+})]$

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.