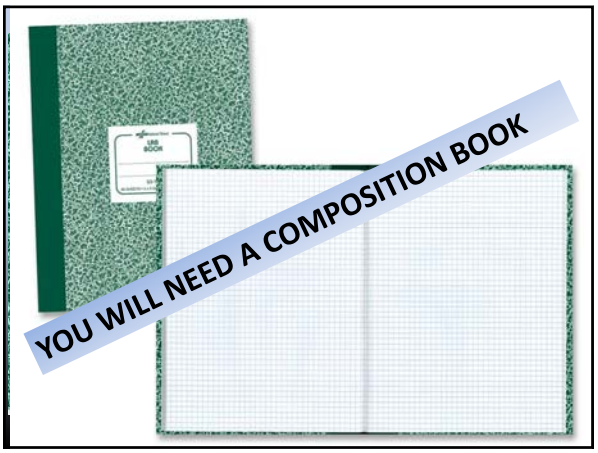
Chemistry 102 Lab Syllabus

Date	Exp. #	Activity	Reports	Unknowns	Tests	Work in Partners	Individual Unknowns
Monday, February 10, 2014	----	Laboratory Procedures; Safety Discussion; Check-in	--	--	--	--	--
Wednesday, February 12, 2014	1	The Iodine "Clock" Reaction (Part I)	--	--	--	Yes	No
Monday, February 17, 2014	----	PRESIDENTS'S DAY(College closed)	--	--	--	--	--
Wednesday, February 19, 2014	1	The Iodine "Clock" Reaction, (Part II)	14	--	--	Yes	No
Monday, February 24, 2014	2	The Hydrolysis of t-Butyl Chloride	--	--	--	Yes	No
Wednesday, February 26, 2014	2	The Hydrolysis of t-Butyl Chloride (Calculations)	10	--	--	Yes	No
Monday, March 03, 2014	5	Stresses on Equilibrium (Part I)	--	--	--	Yes	No
Wednesday, March 05, 2014	5	Stresses on Equilibrium (Part II)	14	--	--	Yes	No
Monday, March 10, 2014	4	The Equilibrium Game	5	--	--	Yes	No
Wednesday, March 12, 2014	----	First Lab Exam	--	--	50	No	--
Monday, March 17, 2014	4	The Equilibrium Constant	--	--	--	Yes	No
Wednesday, March 19, 2014	4	The Equilibrium Constant (Calculations)	10	--	--	Yes	No
Monday, March 24, 2014	6	Acid & Base Strength	10	6	--	Yes	Yes
Wednesday, March 26, 2014	7	pH	10	--	--	Yes	No
Monday, March 31, 2014	----	CESAR CHAVEZ DAY (College closed)	--	--	--	--	--
Wednesday, April 02, 2014	8	pH of Various Solutions (Part I)	7	--	--	Yes	No
Monday, April 07, 2014	----	Spring Break (College closed)	--	--	--	--	--
Wednesday, April 09, 2014	----	Spring Break (College closed)	--	--	--	--	--
Monday, April 14, 2014	8	pH of Various Solutions (Part II)	--	11	--	No	Yes
Wednesday, April 16, 2014	9	Buffers	--	--	--	Yes	No
Monday, April 21, 2014	9	Buffers (Calculations)	10	--	--	Yes	No
Wednesday, April 23, 2014	10	pH Titration	--	--	--	No	Yes
Monday, April 28, 2014	10	pH Titration	--	19	--	No	Yes
Wednesday, April 30, 2014	11	Standardization of NaOH	--	--	--	No	No
Monday, May 05, 2014	12	The Molar Mass of a Diprotic Acid	--	32	--	No	Yes
Wednesday, May 07, 2014	13	A Solubility Product Constant	--	--	--	Yes	No
Monday, May 12, 2014	13	A Solubility Product Constant (Calculations)	10	--	--	Yes	No
Wednesday, May 14, 2014	14	Qualitative Analysis	--	--	--	No	Yes
Monday, May 19, 2014	14	Qualitative Analysis	--	--	--	No	Yes
Wednesday, May 21, 2014	14	Qualitative Analysis	--	32	--	No	Yes
Monday, May 26, 2014	----	MEMORIAL DAY (College closed)	--	--	--	--	--
Wednesday, May 28, 2014	----	Check Out	--	--	--	--	--
Monday, June 02, 2014	---	Second Lab Exam	--	--	140	No	--
		Total Possible	100	100	190		



Chemistry 102 Lab

- http://themalloryfamily.net
- You will need a periodic table, scientific calculator, goggles and a laboratory composition book by Wednesday.
- You ***will need to read iodine clock (experiment #1) by Wednesday*** and be prepared to perform the experiment.

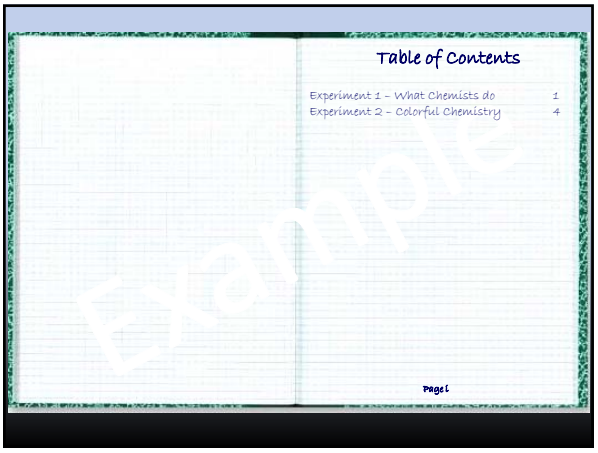
Reports vs Notebook

Reports

- What you provide your boss or instructor
- Neatness counts
- Mistakes unacceptable
- Completed after performing the experiment

Notebook

- What you keep for your own use
- Neatness does not count
- Mistakes expected
- Completed while performing the experiment



Experiment 1
What Chemists Do

John Doe
2/27/18
Page 1

Purpose

1. To identify several common household chemicals by their chemical properties.
2. To analyze mixtures of common household chemicals of unknown composition.

Procedure

See lab manual "Laboratory Chemistry for the Health Sciences" Chemistry 52 by Maria Fenyis

Data/Observations

	Baking Soda	Starch	Alka Seltzer	Table Salt
White Vinegar				
Iodine Tincture				
Distilled Water				

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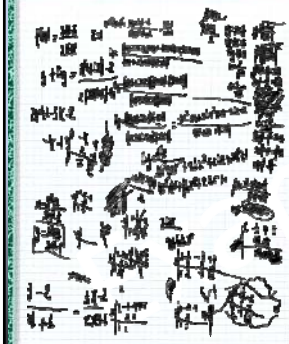
Experiment 2
Colorful Chemistry with Food Dyes

John Doe
2/27/18
Page 4

Page 4



Conclusions

A. Baking Soda

B. Corn Starch

C. Alka Seltzer

D. Table Salt

	Unknown #_____	Unknown #_____	Unknown #_____
White Vinegar			
Iodine Tincture			
Distilled Water			

Page 2

Lockers:
All lockers with the prefix of "C" are available for use.
One locker per student.

Chemistry 102 Lab Equipment

Tonight
Make sure you have all of the equipment on the list
Make sure your glassware is clean

Results

Two Powder mixture

Unknown# _____ contains _____

_____

Unknown# _____ contains _____

_____

Three Powder mixture

Unknown# _____ contains _____

_____

_____

Conclusion

1. I was able to identify several common household chemicals by their chemical properties.
2. I analyzed mixtures of common household chemicals of unknown composition and determined their composition.

Page 3

Beaker

Beakers hold solids or liquids that will not release gases when reacted or are unlikely to splatter if stirred or heated.

Clay Triangle

The clay triangle is used as a support for crucibles when being heated over a Bunsen burner.

Evaporating Dish

The evaporating dish is used for the heating of stable solid compounds and elements.

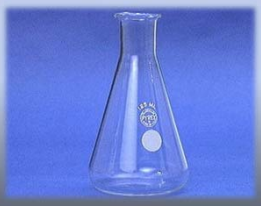
Crucible

Crucibles are used for heating certain solids, particularly metals, to very high temperatures.

Funnel

A funnel is used to aid in the transfer of liquid from one vessel to another.

Erlenmeyer Flask

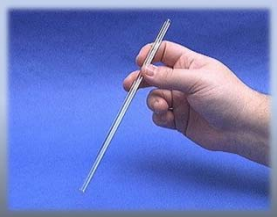


Erlenmeyer flasks hold solids or liquids that may release gases during a reaction or that are likely to splatter if stirred or heated.

Graduated Cylinder

A graduated cylinder is used to measure volumes of liquids.

Glass Stir Rod



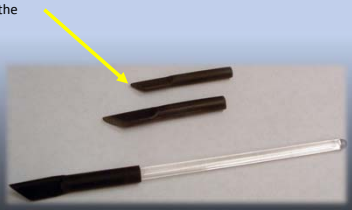
A glass rod is used to manually stir solutions. It can also be used to transfer a single drop of a solution.

Spot Plates

Spot plates are used when we want to perform many small scale reactions at one time. We will use these many times during the year.

Rubber Policeman

Rubber policemen are used on glass stirring rods to assist in the movement of materials



Spatulas

Spatulas are used to dispense solid chemicals from their containers.

Chemicals should never be transferred with your bare hands.

Rubber Stoppers

Rubber stoppers are used to close containers to avoid spillage or contamination.

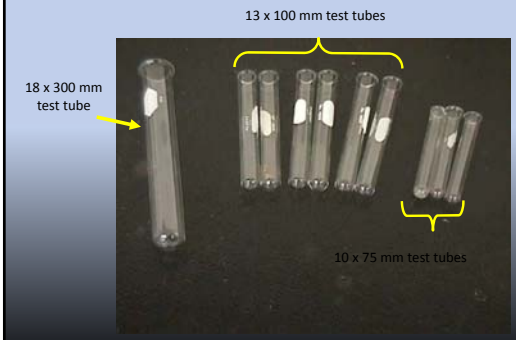
Containers should never be heated when there is a stopper in place.

Pipette

A pipette is used to transfer a small volume of liquid (less than one mL).

On top of some pipettes are a "<u>rubber bulb</u>"

Test Tubes



Experiment #1
The Iodine Clock Reaction

Test Tube Racks

Test tube racks are for holding and organizing test tubes on the laboratory counter. Plastic racks may melt in contact with very hot test tubes.

Reaction Rates

- Reactions may be influenced by several factors. These factors include:
  - Concentrations
  - Temperature
  - Catalysts
- Experiment #1 will look at the influence of:
  - Concentrations
  - Temperature

Watch Glass

A watch glass is used to hold a small amount of solid, such as the product of a reaction.

Reaction Rates

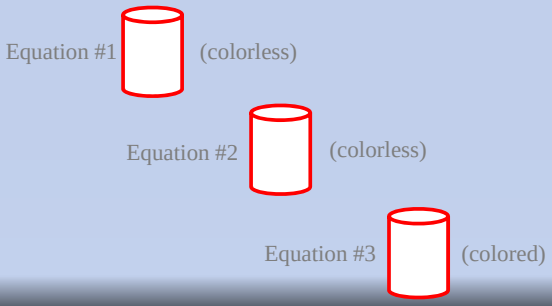
Concentrations

- For any equation, X + 2Y → Z, there is a corresponding reaction rate.
- The reaction rate, **r**, can be described using the concentrations of the components **[X]**, **[Y]**, **[Z]**.
- Simply put: $\boldsymbol{r} = -\frac{\Delta[\boldsymbol{X}]}{\Delta \boldsymbol{t}} = -\frac{\Delta[\boldsymbol{Y}]}{\Delta \boldsymbol{t}} = +\frac{\Delta[\boldsymbol{Z}]}{\Delta \boldsymbol{t}}$

Reaction Rates
Concentrations

- For any equation, xX + yY → zZ.
- Rate: $\boldsymbol{r} = -\frac{\Delta[\boldsymbol{X}]}{\boldsymbol{x}\Delta\boldsymbol{t}} = -\frac{\Delta[\boldsymbol{Y}]}{\boldsymbol{y}\Delta\boldsymbol{t}} = +\frac{\Delta[\boldsymbol{Z}]}{\boldsymbol{z}\Delta\boldsymbol{t}}$
- Simply, rate: $\boldsymbol{r} = \boldsymbol{k}(\boldsymbol{T})[\boldsymbol{X}]^{x'}[\boldsymbol{Y}]^{y'}$
  - Where x and x' AND y and y' are not necessarily the same. x' and y' are called the reaction orders.
  - x' is the reaction order with respect to [X]
  - y' is the reaction order with respect to [Y]

Experiment #1



Reaction Rates
Temperature

- Rate: $\boldsymbol{r} = \boldsymbol{k}(\boldsymbol{T})[\boldsymbol{X}]^{x'}[\boldsymbol{Y}]^{y'}$
- Temperature effects the reaction.
- The formula used is the Arrhenius Equation:
- $k = Ae^{-\frac{E_a}{RT}}$

Constant	Variables
e = 2.718	T = Temperature (K)
R = Gas law constant	Ea = Activation Energy
	A = Reaction constant

Experiment #1

Equation #1 $2I^- + S_2O_8^{2-} \rightarrow I_2 + 2SO_4^{2-}$ Slow Reaction

Equation #2 $I_2 + 2S_2O_3^{2-} \rightarrow I^- + S_4O_6^{2-}$ Fast Reaction

Clock

Equation #3 I_2 + Starch → Blue Complex Fast Reaction

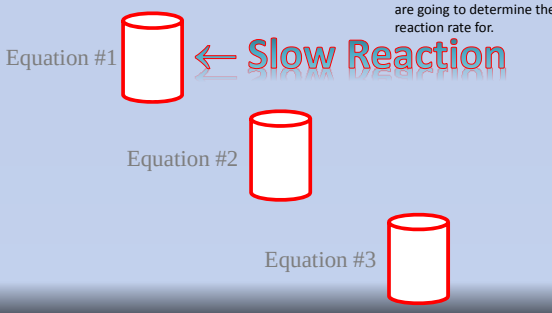
$S_2O_8^{2-}$ = Persulfate
SO_4^{2-} = Sulfate
$S_2O_3^{2-}$ = Thiosulfate
$S_4O_6^{2-}$ = Tetrathionate

Reaction Rates
Temperature

- $k = Ae^{-\frac{E_a}{RT}}$
  - Increase in temperature
  - Decrease in exponent
  - Increase in k
  - ∴ faster reaction

Experiment #1

This is the reaction that we are going to determine the reaction rate for.



Reaction Rates

How to determine the numbers…

- $r = k(T)[X]^{x'}[Y]^{y'}$
  - Vary **only** the concentration of X
  - Vary **only** the concentration of Y
  - x' and y' can be determined

Experiment #1

Run #1 and #2

To solve for m, you will need to take the log

$$\frac{rate_1}{rate_2} = \frac{[I^-]_1^m}{[I^-]_2^m}$$

$$\frac{Log_{10}(rate_1)}{Log_{10}(rate_2)} = \frac{Log_{10}([I^-]_1^m)}{Log_{10}([I^-]_2^m)}$$

Experiment #1

$$2I^- + S_2O_8^{2-} \rightarrow I_2 + 2SO_4^{2-}$$

$$rate = k[I^-]^m[S_2O_8^{2-}]^n$$

Reaction	$[I^-]$	$[S_2O_8^{2-}]$	$[I_2]$ or $[S_2O_3^{2-}]/2$	Time (s)
1				
2				
3				
4				
5				
6				

Experiment #1

Run #1 and #2

$$\frac{Log_{10}(rate_1)}{Log_{10}(rate_2)} = \frac{Log_{10}([I^-]_1^m)}{Log_{10}([I^-]_2^m)}$$

$$\frac{Log_{10}(rate_1)}{Log_{10}(rate_2)} = \frac{m \cdot Log_{10}([I^-]_1)}{m \cdot Log_{10}([I^-]_2)}$$

Experiment #1

Run #1 and #2

These are the same…

These are the same…

$$\frac{rate_1}{rate_2} = \frac{k[I^-]_1^m[S_2O_8^{2-}]_1^n}{k[I^-]_2^m[S_2O_8^{2-}]_2^n}$$

$$\frac{rate_1}{rate_2} = \frac{[I^-]_1^m}{[I^-]_2^m}$$

Experiment #1

Run #1 and #2

$$\frac{Log_{10}(rate_1)}{Log_{10}(rate_2)} = \frac{m \cdot Log_{10}([I^-]_1)}{m \cdot Log_{10}([I^-]_2)}$$

$$\frac{Log_{10}(rate_1)}{Log_{10}(rate_2)} = m \cdot \frac{Log_{10}([I^-]_1)}{Log_{10}([I^-]_2)}$$

Almost there!

Experiment #1

Run #1 and #2

$$\frac{\text{Log}_{10}(\text{rate}_1)}{\text{Log}_{10}(\text{rate}_2)} = m \cdot \frac{\text{Log}_{10}([I^-]_1)}{\text{Log}_{10}([I^-]_2)}$$

$$\frac{\text{Log}_{10}(\text{rate}_1) \cdot \text{Log}_{10}([I^-]_2)}{\text{Log}_{10}(\text{rate}_2) \cdot \text{Log}_{10}([I^-]_1)} = m$$

Finally m…

Experiment #1

Reaction 1: - You do the experiment
Reaction 2: - You do the experiment
Reaction 3: USE $3\overline{0}$ seconds for the time
Reaction 4: USE $6\overline{0}$ seconds for the time
Reaction 5: USE 36 seconds for the time
Reaction 6: - You do the experiment