Chemistry 116 - Fall 2021
Dr. Audrey Dell Hammerich
3 - Week of September 5
Chemical Reactions, Solution Stoichiometry I, Introduction to Statistics

NOTE: Your lab report for *Online* H_Exp 2 is due this week.

NOTE: Quiz on Friday in discussion.

NOTE: When writing in your laboratory notebook **be sure** to put the cardboard flap immediately under the original + carbon copy sheets.

NOTE: The only difference in submission between in-person and online experiments is that for in-person labs the original copy of data pages are turned in to your TA on the day data is collected in lab.

NOTE: All lab reports contain (in order to appear in **one** pdf document of lab report): 1) cover sheet (when available) with entries typed in, 2) entire PRELAB (even though already submitted before lab period), 3) INLAB, 4) POSTLAB, and 5) copy of data sheets (originals already turned in to TA) for in-person labs.

NOTE: You may omit in Zumdahl, Chapter 4.7 - Selective Precipitation.

NOTE: Reading in the Harris text is necessary to do the statistical analysis for the *Online* H_Exp 5 lab next week. H Ch 3-1 – 3-2 have already been covered in class and should be reviewed. The actual statistics is covered in H Ch 4-1 – 4-3 and 4-4 – 4-6.

LAB ASSIGNMENT: LM_3: A Sequence of Chemical Reactions; submit prelab in Blackboard before lab begins including Pre-Laboratory Assignment. Note that this procedure is **not** in the laboratory manual. We have shortened the experiment considerably. You will also need to boil deionized water for H_Exp 6, the next in-person lab you will perform.

LECTURE ASSIGNMENT: Online OWL assigned homework due on Monday, September 13 at noon except "W" problems are due Friday, September 10 at noon.

Monday, September 6

Labor Day Holiday

Wednesday, September 8

Reading Assignment: finish Z Ch 3.10 - 3.11 [be able to do stoichiometric calculations involving a **limiting reactant**; know **yields: actual, theoretical**, and **percent**]; Z Ch 4.1 - 4.6, 4-8; H Ch 1-2, 1-3 [overview of solutions and chemical reactions - polarity of water; electrolytes: strong, weak, and nonelectrolytes; types of chemical reactions: dissolution, precipitation, acid/base, oxidation/reduction; be able to work with molarity, wt%, and density in describing solution composition including mixing and diluting solutions, know how to do stoichiometric problems in solution; know how to write the molecular equation, the complete ionic equation, and the **net ionic equation** (contains the **CHEMISTRY**) for any reaction; be able to use a solubility table to predict precipitation reactions]

PRACTICE: Molarity Calculations - Conc, Dilution, Chemical Rxs - Problems and Sol'ns

Friday, September 10

Reading Assignment: H Ch 4-1 – 4-6 [know what characterizes a **Gaussian distribution**: **mean** $< x > = \sum x_i/N$, **standard deviation** $s = \sqrt{\sum(x_i - < x >)^2/(N-1)}$; be able to 1) perform a **Grubbs test** on a data set: $G_{\text{calc}} = |\text{ outlier} - \text{mean }|/s$, then compare G_{calc} with G_{table} at 95% confidence; 2) compare the standard deviations of two sets of measurements with the ***F* Test**: $F_{\text{calc}} = s_1^2/s_2^2$, 3) construct a confidence interval $\mu = < x > \pm ts/\sqrt{N}$ using a ***t* table**; 4) determine if two sets of measurements are statistically equivalent by comparing their means with **Student's *t*** (Harris Case 2 on p. 75)]

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Discussion Worksheet - Week 3

1. Write a balanced chemical equation for each of the following:
   a) combustion of gaseous ethane (C_2H_6)

   b) iron(III) chloride and sodium sulfide react in aqueous solution to yield aqueous sodium chloride and solid iron (III) sulfide

   c) solid potassium peroxide is added to water to form a solution of potassium hydroxide and hydrogen peroxide

   d) solid sodium oxide reacts with aqueous ammonium bromide to produce ammonia, water, and aqueous sodium bromide

   e) aqueous potassium dichromate reacts with aqueous HI to give a precipitate of CrI_3, elemental iodine, aqueous potassium iodide and some water

2. Trinitrotolune (TNT), $C_7H_5N_3O_6$, reacts violently with oxygen to produce carbon dioxide, water, and nitrogen.
   a) Write a balanced chemical equation for the explosion.

   b) How much oxygen is required to explode a ton of TNT? [0.7 ton]

   c) What is the theoretical yield of nitrogen from a ton of TNT? [0.2 ton]

3. 0.0320 g of xenon and 0.0304 g of fluorine are used to make XeF_6.
   a) Which reagent is limiting? [Xe]

   b) How many grams and how many moles of XeF_6 can be made? [0.0598 g]

   c) If the yield were 80 percent, how much XeF_6 is formed? [0.048 g]

4. What are the concentrations of Ba^{2+} and OH^- in 0.125 M $Ba(OH)_2$?

5. Write balanced **net ionic** equations for the dissolution in water of

   a) solid sodium sulfate

   b) solid potassium hydroxide

   c) solid manganese(III) dichromate

   d) ethanol, C_2H_5OH (soluble liquid nonelectrolyte)

6. How many grams of methanol (CH_3OH, $M = 32.04$) are contained in 0.100 L of 1.71 M aqueous methanol?

7. Any dilute aqueous solution has a density near 1.00 g/mL. Suppose the solution contains 1 ppm of solute; express the concentration of solute in g/L, µg/L, µg/mL, and mg/L.

8. What is the maximum volume of 0.25 M sodium hypochlorite that can be prepared by dilution of 1.00 L of 0.80 M NaOCl?

9. How many grams of 50 wt% NaOH ($M = 40.00$) should be diluted to 1.00 L to make 0.10 M NaOH?

10. A bottle of concentrated aqueous sulfuric acid, labeled 98.0 wt% H_2SO_4 has a concentration of 18.9 M.

   a) How many milliliters of reagent should be diluted to 1.000 L to give 0.100 M H_2SO_4?

   b) Calculate the density of 98.0 wt% H_2SO_4.

11. The density of 70.5 wt% aqueous perchloric acid is 1.67 g/mL.

   a) How many grams of solution are in 1.000 L?

   b) How many grams of $HClO_4$ are in 1.000 L?

   c) How many moles of $HClO_4$ are in 1.000 L?

12. Barium chloride and ammonium phosphate react to give a precipitate of barium phosphate. What volume of 0.26 M ammonium phosphate is required to react with 40 mL 0.30 M $BaCl_2$? [31 mL]