AP CHEMISTRY SUMMER ASSIGNMENTS 2011-2012

GOAL

The goal of this assignment is to help you to review the content from the Honors Chemistry and to sharpen your lab skills. The assignments will offer challenges on many levels: understanding abstract concepts, applying math concepts, demonstrating lab skills, practicing procedure writing, adjusting to various lab formats, preparing a lab notebook, developing a lab procedure and performing the lab individually. Even if you have previously seen some of the questions or labs, you should assess your work critically for strengths and weaknesses.

PREVIEW

The first two and a half weeks of class will be spent reviewing the Honors Chemistry material and performing the labs. The selected material focuses on the important content from the Honors Chemistry course as well as the labs that are expected to be completed by AP Chemistry students. The text questions and lab work are two excellent means of review. After this time, the students will have a common background with which to begin the new material of the AP Chemistry course.

REQUIRED SUMMER MATERIALS

Brown, LeMay, and Bursten text (your Honors Chemistry textbook)

Keep your Brown, LeMay, and Bursten text at the end of the Honors Chemistry course. This text is the property of the school district and it must be brought to the AP Chemistry class and returned at the end of the course (*i.e.* it is an obligation).

If you do not have this chemistry text, please see me before the last day of school in Room 509 to sign out a text to use for the summer.

ASSIGNMENT 1:

A.

Complete the problems listed below. Show all work for the problems and answer any questions with complete sentences. You may put them in your class notebook or on separate paper kept in a folder. They will not be collected. All questions are due on **the *first day of class*** and will be checked then for completion. Selected questions will be reviewed during the first two and a half weeks of class. Answer keys will be provided after the questions are discussed.

HONORS CHEMISTRY REVIEW QUESTIONS:

CHAPTER 2	**CHAPTER 6**	**CHAPTER 9**
P.66-72: #5, 6, 10, 30, 86, 88, 90, 92	P. 230-234: #22, 42, 46, 60, 62, 64, 68, 80, 84	P. 356-362: #36, 48, 65, 67, 69, 76, 82, 84
CHAPTER 3	**CHAPTER 7**	**CHAPTER 10**
P.104-110: #12, 14, 34, 62, 74, 79, 84, 92	P. 266-271: #18, 24, 36, 46, 49, 58, 60, 68, 75, 82, 90, 91, 92	P. 398-405: #84, 85, 86, 88, 90, 92, 93, 94, 96, 98
CHAPTER 4	**CHAPTER 8**	**CHAPTER 11**
P. 145-150:#28, 62, 64, 68, 78, 80, 82, 85, 90, 94, 95, 98, 102	P. 307-313: #6, 14, 20, 32, 36, 44, 46, 58, 62, 88, 93	P. 442-448: #77, 78, 80, 83, 86, 88, 91, 92, 98, 104
CHAPTER 5		
P. 188-196: #62, 48, 50, 76, 90, 96, 100, 106, 110, 112, 114		

It is more important that you make an honest effort to understand the questions rather than having them completed without understanding the problems. The problems will serve as a starting point for discussing the material, so prepare questions for the class discussion.

B.

There will be an evaluation on the material from the summer assignment ***during the third week of class***. It will consist of free response questions similar in format to those on the AP Chemistry exam. **Penalty points received for poor effort on the summer assignment questions will be reflected in this first quarter quiz grade.**

ASSIGNMENT 2:

Prepare your lab notebook using the criteria for the Lab Notebook Requirements 2011-2012 (Pgs. 7-10 of this document) for **both of the labs** that follow (Pgs. 3-6 of this document). Leave a reasonable amount of space for the required post lab sections. ***Three pages (front and back) should be sufficient.***
All pre lab requirements for each lab are due on ***the first day of class***. Refer to each lab for additional information and exceptions. Each lab is worth 50 points.

ASSIGNMENT 3:

You will perform 3 spontaneous labs during three of our double class periods during the first three weeks of school (Note: If the first day of class is a double period, no spontaneous lab will be conducted on this day). You will be required to prepare a procedure, perform a lab and write an abbreviated version of a lab report in your lab notebook during the 90 minutes of class. The topics covered will be from **chapters 1 through 5** of your text and they will not be announced prior to the lab. Each lab is worth 50 points. The Spontaneous Lab Rubric follows on pages 11-12 of this document.

The 2011-2012 Lab Notebook Requirements and Rubric, Spontaneous Lab Requirements and Rubric, Course Guidelines and Tentative Syllabus can be found on my website on the AP Chemistry page http://www.ahsd.org/science/siwak/siwak.htm

SUGGESTIONS

Answer the questions or solve the problems and if you have difficulty, read the corresponding text sections and attempt to solve them again.

Email any questions you may have to **siwakc@ahsd.org.** I check my email twice a week.

SUMMER PURCHASES:

1. A marble composition notebook (bound, no spirals) for labs. It can be either wide-ruled or college-ruled, it's your choice.
2. (OPTIONAL) Any AP Chemistry Review Book (Princeton Review, Cliff's, Barron's, Peterson's, Kaplan)

*** This could be helpful for reviewing old information and for previewing information from the summer reading assignment.**

CHEMICAL REACTIONS OF COPPER AND PERCENT YIELD LAB

Objective

To gain familiarity with basic laboratory procedures, some chemistry of a typical transition element, and the concept of percent yield.

Pre-lab Questions

1. Give an example, other than the ones listed in this experiment, of redox and metathesis reactions.
2. When will reactions proceed to completion?
3. Define percent yield in general terms.
4. Name six methods of separating materials.
5. Give criteria in terms of temperature changes for exothermic and endothermic reactions.
6. If 1.65 g of $Cu(NO_3)_2$ are obtained from allowing 0.93 g of Cu to react with excess HNO_3, what is the percent yield of the reaction?
7. What is the maximum percent yield in any reaction?
8. What is meant by the terms *decantation* and *filtration*?

Apparatus and Chemicals

0.5 g piece of no. 16 or no. 18 copper wire	evaporating dish
250 mL beaker (2)	weighing paper
concentrated HNO_3 (4 – 6 mL)	6.0 M H_2SO_4 (15 mL)
graduated cylinder	granular zinc
3.0 M NaOH (30 mL)	balance
carborundum boiling chips	concentrated HCl (drops)
stirring rod	wire gauze
iron ring and ring stand	Bunsen burner

Background

Most chemical synthesis involves separation and purification of the desired product from unwanted side products. Some methods of separation, such as filtration, sedimentation, decantation, extraction, and sublimation were discussed earlier. This experiment is designed as a quantitative evaluation of your individual laboratory skills in carrying out some of these operations. At the same time you will become more acquainted with two fundamental types of chemical reactions -- redox reactions and metathesis (double-displacement) reactions. By means of these reactions, you will finally recover the copper sample with *maximum efficiency*. The chemical reactions involved are the following.

$Cu_{(s)} + 4\ HNO_{3(aq)} \text{ -----> } Cu(NO_3)_{2(aq)} + 2\ NO_{2(g)} + 2\ H_2O_{(l)}$	Redox	[1]
$Cu(NO_3)_{2(aq)} + 2\ NaOH_{(aq)} \text{ -----> } Cu(OH)_{2(s)} + 2\ NaNO_{3(aq)}$	Metathesis	[2]
$Cu(OH)_{2(s)} \text{ -----> } CuO_{(s)} + H_2O_{(g)}$	Dehydration	[3]
$CuO_{(s)} + H_2SO_{4(aq)} \text{ -----> } CuSO_{4(aq)} + H_2O_{(l)}$	Metathesis	[4]
$CuSO_{4(aq)} + Zn_{(s)} \text{ -----> } ZnSO_{4(aq)} + Cu_{(s)}$	Redox	[5]

Each of these reactions proceeds to completion. Metathesis reactions proceed to completion whenever one of the components is removed from the solution, such as in the formation of a gas or an insoluble precipitate (driving forces). This is the case for reaction [1], [2], and [3], where in reactions [1] and [3] a gas and in

reaction [2] an insoluble precipitate are formed. Reaction [5] proceeds to completion because zinc has a lower ionization energy or oxidation potential that copper.

The objective in this experiment is to recover all of the copper you begin with in analytically pure form. This is the test of your laboratory skills.

The percent yield of the copper can be expressed as the ratio of the recovered weight to initial weight, multiplied by 100:

$$\% \text{ yield} = \frac{\textit{recovered mass of Cu}}{\textit{initial mass of Cu}} \text{ X } 100$$

Procedure

Weight approximately 0.500 g of no. 16 or no. 18 copper wire (1) to the nearest 0.0001 g and place it in a 250 mL beaker. Add 4-5 mL of concentrated HNO_3 to the beaker, IN THE FUME HOOD. After the reaction is complete, add 100 mL distilled H_2O.

Add 30 mL of 3.0 *M* NaOH to the solution in your beaker. Add two or three boiling chips and carefully heat the solution -- while stirring with a glass stirring rod -- just to the boiling point. *Remove the boiling chips.*

Allow the black CuO to settle; then decant the supernantant liquid. Add about 200 mL of very hot distilled water and allow the CuO to settle. Decant once more.

Add 15 mL of 6.0 *M* H_2SO_4.

In the fume hood, add 2.0 g of 30-mesh zinc metal all at once and stir until the supernatant liquid is colorless. When gas evolution has become *very* slow, heat the solution gently (but do not boil) and allow it to cool.

When gas evolution has ceased, decant the solution and transfer the precipitate to a pre-weighed porcelain evaporating dish. Wash the precipitated copper with about 5 mL of distilled water, allow to settle, decant the solution, and repeat the process at least two more times. Allow the solid to air dry. Weigh the evaporating dish and solid copper.

Post Lab Questions

1. If your percent yield of copper was greater than 100%, what are two plausible errors you may have made?

2. Consider the combustion of methane, CH_4:

$CH_4(g) + 2\ O_2(g) \text{ -----> } CO_2(g) + 2\ H_2O(g)$

Suppose 2 mole of methane is allowed to react with 3 mol of oxygen.

a) What is the limiting reagent? (show work)
b) How many moles of CO_2 can be made from this mixture? How many grams of CO_2?

3. Suppose 8.00 g of CH_4 is allowed to burn in the presence of 6.00 g of oxygen.
How much (in grams) CH_4, O_2, CO_2, and H_2O remain after the reaction is complete?

4. How many milliliters of 6.0 *M* H_2SO_4 are required to react with 0.80 g of CuO according to Equation [4]?

Continued →

5. If 2.00 g of Zn is allowed to react with 1.75 g of $CuSO_4$ according to Equation [5], how many grams of Zn will remain after the reaction is complete?

6. What is meant by the term limiting reagent? Explain

TITRATION OF ACIDS AND BASES LAB

Text: Chapter 4

Source: Nelson, et. al.

The 50.00mL of NaOH in the buret is more than enough for you to complete 3 KHP titrations and 3 HCl titrations.

You will develop a procedure for the standardization of a NaOH solution with a primary standard, potassium hydrogen phthalate. You will then use the standardized NaOH as a secondary standard to determine the molarity of a HCl solution. Relevant statistics will be taught in class and include in your analysis and data section. There are no pre-lab or post-lab questions. Include all other parts of the lab notebook requirements as usual.

GENERAL PROCEDURE INFORMATION

A: STANDARDIZATION OF THE NaOH SOLUTION

Research the procedure for the standardization of a NaOH solution. Include the information below and develop a procedure in your notebook. Include relevant data tables.

- The approximately .1g KHP (Potassium hydrogen phthalate) sample will be in solution in a labeled Erlenmeyer flask on the front lab table. Record the mass, add indicator and begin titrating.
- Phenolphthalein will be the indicator for this titration
- When you finish titrating, clean the flask with SOAP AND WATER, inside and outside, and return it to the front table
- **3 titrations must be completed**. Acceptable titrations result in a molarity for the NaOH that is within the acceptable range according to the 2S test.

General precaution: Avoid cross contamination! Do not touch the tip of the water bottle or the buret to the glassware.

B: ANALYSIS OF AN UNKNOWN ACID

Research the procedure for the titration of a strong acid and a strong base. Include the information below and develop a procedure in your notebook. Include relevant data tables.

- A buret filled with the unknown acid will be provided for you; release 5.00mL of the acid into a clean Erlenmeyer (record the volume accurately), add 25 mL of distilled water, add indicator and titrate as you did in part A.
- Phenolphthalein will be the indicator for this titration
- **3 titrations must be completed**. Acceptable titrations result in a molarity for the HCl that is within the acceptable range according to the 2S test.

AP CHEMISTRY LAB NOTEBOOK REQUIREMENTS
2011 - 2012

Your lab notebook serves as a record of the work completed in the AP Chemistry laboratory. You may need to reference it in college or submit it for review for college credit if that is the policy of the school you are attending. With that in mind, use the following guidelines to prepare your lab notebook:

1. The notebook must be a bound notebook (no spirals, college ruled preferred). Write your name in permanent marker on the cover of the notebook. Write only **in blue or black ink**. Number every page of the notebook (you will use both sides of a sheet). Use pages 1 and 2 for a table of contents. Never remove pages from the lab notebook. **Label each section** of the lab (equations, cleanup, questions, etc.).

2. Mistakes happen, even in lab notebooks. Do not use Wite-out®, erase or obliterate mistakes; Just draw a single line through the error (even if it is a large error!).

3. Nothing may be taped or stapled into the notebook except for graphs that are computer generated.

4. Lab notebooks must be prepared **prior** to coming to class. Points will be lost for each day the notebook is not prepared. Items required in the notebook for the first day of lab are: prelab questions, the date of your work, title of the lab, purpose, equations, reference, table of quantities and physical constants, hazards/safety, materials list, procedure and data tables. The following items (#5-14) explain these requirements.

**********PRIOR TO LAB*********

5. Title the first page of the lab as "**Prelab Questions** for <name of the lab>". It is not necessary to copy the questions into your notebook. Answer the questions using complete sentences and show all work for the math problems.

6. Write the **title** on the first line of the first page of the actual lab and **date** it. Remember to record the title and page number of the lab in the table of contents.

7. State the **purpose** of the lab in one concise statement.

8. Write **balanced chemical reactions** (if necessary). These are the reactions performed in the lab. Write complete equations, not net ionic (unless otherwise stated).

9. Write the **reference(s)** for the experiment (you will be told which one it is). The three sources of labs are:

Nelson, John H. and Kemp, Kenneth C. Laboratory Experiments to accompany Chemistry: The Central Science, 9th ed. Upper Saddle River, NJ: Pearson Education, Inc., 2003.

Bishop, Carl B., Bishop, Muriel B. and Whitten, Kenneth W. Standard and Microscale Experiments to Accompany General Chemistry with Qualitative Analysis, 5th ed. Florida: Saunders College Publishing, 1996.

Vonderbrink, Sally A. Laboratory Experiments for Advanced Placement Chemistry. Flinn, 1995.

10. Prepare a **table of quantities and physical constants**. Look up the necessary data (melting point, boiling point, solubility (hot water, cold water and other substances (no abbreviations)), formula, name, molecular weight) in the *CRC Handbook of Chemistry and Physics* or online from a reputable site. ALL reactants used in lab must be included in the table (even water!).

11. List any **hazards** that are present as well as any specific **safety precautions** that must be taken in the lab (attire, goggles, flammability, disposal, etc.). A minimum of **3** are expected.

12. List the **materials** you used during the lab. **Group them** as either hardware or glassware.

13. Write a **procedure** for the lab. It describes what will be done in lab and what equipment was used to perform the experiment (this may differ from the procedure in the lab hand out, so check the website for lab procedure updates!). This section should be in prose and should include sufficient detail and formatting so that anyone using your notebook could easily replicate the activity (include the amounts and concentrations of solutions, size and variety of glassware and the name of any software applications). Pronouns **ARE NOT** to be used. It is not necessary to explain how to use the software applications. It is sufficient to state that "Graphical Analysis was used to…" The one thing that you MAY NOT do is rewrite the procedure verbatim from the lab hand out.
    Thought must be given to what you will be doing in lab because **no lab handouts will be used during the lab**.

14. Prepare any **data tables** that are recommended in the lab so that you can record data in them during lab. Remember that data is what is collected **during** the lab.

********** DURING LAB**********

15. Fill in the data tables with data collected in lab.

16. On the page(s) after the data table(s), write your ORGANIZED **observations** during lab. Make notes of your quantitative and/or qualitative observations in addition to the information in your data table(s). Include a reference to the procedure (i.e. when we heated the beaker, a white gas evolved and stuck to the walls of the beaker).

NOTE: Data and observations will be **signed** after every lab period. It is **your** responsibility to ask the teacher to sign the notebook at the end of class. Notebooks will not be signed later in the day.

**********POST LAB**********

17. You may complete parts of the **analysis and data section** while you are conducting the lab. Show **all** calculations. It may be necessary to **graph** the data as well (use a graphing program). Any **statistical analysis** that is required will be included in this section. Always apply the rules for significant figures.

18. Complete a **calculations table** where the answers to all of your calculations are neatly and logically organized. Remember that calculations are any quantities that must be determined through mathematical computations.

19. Write a **discussion** for the lab. This requires a description of the **background information** on the theory related to the lab activity itself (terms and concepts). There should be no pronouns in this section.

You must also include a description (in your own words) of how the previously discussed theory is **related to the lab**. You are not to refer to the procedure in this section. Any references used to gather information for this section must be appropriately cited at the end of this section using MLA format (References typically are not needed as you are summarizing and applying general chemical principles). Do not exceed **one page**…be thorough yet succinct!

20. In the **conclusion** section, write **<u>one</u>** sentence to **explain** how your observations and data **match, model and support** the accepted theory. Use your procedure, data and observations to draw conclusions about the theory that is being studied in the lab (Was the purpose of the lab achieved?).

21. In a separate **error analysis** section, include a description of any technical or physical mistakes made inadvertently or any difficulties with instrumentation or apparatus. If you are given accepted values, perform a **percent error calculation**.

22. In the **clean up** section, you will briefly list **disposal methods** for all of the chemicals used in lab as well as **general lab cleanup items** (a minimum of **3**) for the lab.

23. The last section is the **post lab questions**. It is not necessary to copy the questions into your notebook. Answer the question using complete sentences and show all work for the math problems.

Other items…
~ Use the past tense in your report.
~ Avoid the use of abbreviations and contractions.
~ Remember that research does not mean copying information from the Internet, even if you cite it at the end of the report. Read it, think about it, and restate the research in your own words. If you can not do this, use proper formatting for the use of more than one sentence in your report, then cite the source.

A general note about lab…
Once a lab is begun, no new lab materials will be supplied. In other words, there is no starting over once you have begun a lab. If you don't get the desired results or your error results in the loss of product, you will have to complete the calculations and post lab requirements to the best of your ability with the data you have. This does not automatically mean you will fail the lab; you will lose points for not having completed the lab provided you make the attempt to perform some calculations and finish the lab notebook entry. Each case will be dealt with individually.

Lastly…
Since this is a small class, it is only logical that you will share data and generate ideas together. However, you are each to do your own lab write up. Rather than writing things down as a group of study partners thinks of them or trying to alter phrases so the sentences aren't exactly alike, think about what you talked about or observed and then just write it in your own words. If there is reason to suspect that the labs have been copied, the penalties outlined in the cheating policy will be implemented.

AP CHEMISTRY LAB NOTEBOOK RUBRIC

GRADED ITEMS	0	1	2	3	4	NA
BASICS						
Proper Format						
Appearance						
REQUIRED ELEMENTS						
Purpose						
Reference						
Balanced Chemical Equations						
Table of Quantities & Physical Constants						
Signatures						
LAB PROCESS						
Materials						
Procedure						
Hazards/Safety/Clean Up						
ANALYSIS AND DATA						
Detailed Observations						
Appropriate Organization of Data						
Statistics						
Sample Calculations						
DISCUSSION						
Background/History						
Connection of Theory to Experiment						
RESULTS						
Reasonable Data Results						
Conclusion						
APPLICATION OF KNOWLEDGE						
Sources of Error						
Complete/Correct Answers to Lab Questions						
POINT TOTALS						

COMMENTS:

LAB GRADE:

Key to Earned Points:

0 = not complete
1 = complete but poor
2 = complete but fair
3 = well completed
4 = completed with excellence

* Labs can be worth between 25 and 100 points depending on the activity

AP CHEMISTRY SPONTANEOUS LAB

Goal:

To provide students with an opportunity to develop critical thinking skills while applying chemical principles and laboratory techniques learned in this course.

FORMAT:

Students will have 90 minutes to develop a procedure, conduct an experiment, analyze data and write a discussion about the scientific principles applied to the experiment. They may use only the materials available at the lab desk. No texts or reference sheets can be used during the lab.

The proposed laboratory procedure must be approved by the instructor prior to commencement of the experiment.

ITEMS SUBMITTED FOR GRADING:

After 90 minutes, the following must be included in a written report in the student's laboratory notebook:
statement of purpose
hypothesis
approved procedure
list of materials
qualitative observation statements
quantitative data tables
safety statements (at least 2 statements about hazards and safety precautions)
sample calculations
discussion
error analysis (at least 2 statements about possible sources of error)
conclusion

Refer to the Lab Notebook Requirements (used for every lab) and the Spontaneous Lab Grading Rubric for more details.

POINT VALUE:

This lab will be worth 50 points.

ABSENCES:

Students absent on the day that a spontaneous lab is conducted will be given a different lab of comparable difficulty that focuses on related concepts during the next 90 minute chemistry/lab class.

Over →

AP CHEMISTRY SPONTANEOUS LAB RUBRIC

GRADED ITEMS	0	1	2	3	4	NA
BASICS						
Proper Format						
Appearance/Order of Items in Report						
Completion of the Lab in 90 minutes						
REQUIRED ELEMENTS						
Purpose						
Hypothesis						
Signature of Approval for Procedure						
LAB PROCESS						
Materials List						
Procedure						
Hazards/Safety Statements						
ANALYSIS AND DATA						
Detailed Qual. Observations						
Appropriate Organization of Quant. Data						
Sample Calculations						
DISCUSSION						
Background/History						
Connection of Theory to Experiment						
RESULTS						
Reasonable Data Results						
Error Analysis						
Conclusion						
POINT TOTALS						

COMMENTS:

LAB GRADE:

Key to Earned Points:

0 = not complete
1 = complete but poor
2 = complete but fair
3 = well completed
4 = completed with excellence