

AP Chemistry Summer Assignment 2009

- Obtain a copy of the textbook, Brown, et al: *Chemistry the Central Science*, ninth edition. Review the first four chapters—all of this work was covered in your first year course. You will also be responsible for the material in CH 21. Read and take notes on the chapter and answer the text questions indicated.
- Study your polyatomic ions and solubility rules; it is absolutely imperative that you know these. Review the basic types of chemical reactions and how to write net ionic equations. **There will be a test on this information the first week of school.** A copy of the ions you need to know and the solubility rules can be found in the reference materials section of my wiki: guogas.wikispaces.com.
- Once you have finished reading the chapters, answer the additional problems at the end of this assignment. All math setups are required and must show the factor-label (dimensional analysis) method described in Chapter 1. This portion of the assignment will be collected from each student on **Wednesday, September 2 and will count as your first test grade.**

- **Chapter 1**
- Key concepts (Make sure you understand the following:)
 - metric conversions
 - significant figure calculations
 - dimensional analysis
 - the differences among the three states of matter: gas, liquid and solid.
 - the difference between physical and chemical properties and also between physical and chemical changes.
 - the characteristics of elements, compounds, and mixtures.
 - know the basic SI units and the common metric prefixes and their meanings.

- **Chapter 2**
- Key concepts:
 - arrangement of periodic table including family names
 - formula writing for both ionic and covalent compounds
 - the evidence from studies of radioactivity for the existence of subatomic particles.
 - the experimental evidence for the nuclear nature of the atom.

-the composition of the atom in terms of protons, neutrons, and electrons.

- **Chapter 3**

- Key concepts:
 - percentage composition
 - empirical and molecular formulas
 - mass/mass and mass/volume problems
 - limiting reactant problems

- **Chapter 4**

- Key concepts:
 - molarity
 - dilution problems
 - net ionic equations
 - titration problems
 - characteristics of acids and bases

- **Chapter 21**

- Read and outline the chapter.
- Key concepts:
 - properties of main types of radiation
 - nuclear stability
 - predicting the products of nuclear reactions
 - rate of radioactive decay
 - nuclear binding energy
- Solve the following text problems: P.860 #5, 11, 23, 25, 29, 37, 43.

- **Additional Problems:**

Please complete on a separate sheet of paper. These problems are due on Wednesday, September 2.

- Solve the following solution and stoichiometry problems. All work must be shown:
 1. A certain compound contains only C, H, and N. Combustion of 0.125 g of this compound produces 0.172 g of H₂O and 0.279 g of CO₂.
 - (A) Calculate the number of moles of CO₂ and H₂O.
 - (B) Find the mass percentages of C, H, and N in the formula.
 - (C) Determine the empirical formula of this compound.

2. A stock bottle of phosphoric acid indicates that the solution is 85.0% phosphoric acid by mass and has a density of 1.689 g/mL. Calculate the molarity of the solution.
3. Potassium iodide, a dietary supplement used to prevent goiter, an iodine-deficiency disease, is prepared by the reaction of hydroiodic acid and potassium hydrogen carbonate. Water and carbon dioxide are also produced. In the reaction of 398 g of hydroiodic acid and 318 g of potassium hydrogen carbonate,
- (A) How many grams of potassium iodide are produced?
 - (B) Which reactant is in excess, and how many grams of it remain after the reaction?
4. A paste of sodium hydrogen carbonate and water can be used to relieve the pain of an ant bite. The irritant in the ant bite is formic (methanoic acid). Write a net ionic equation for the reaction that occurs.
5. Resorcinol, used in manufacturing resins, drugs, and other products, is 65.44% carbon, 5.49% hydrogen, and 29.06 % oxygen by mass. Its molecular mass is 110 g/mol. What is the molecular formula of resorcinol?
6. A 0.8150-g sample of the compound MCl_2 reacts with an excess of $AgNO_3(aq)$ to produce 1.8431 g of $AgCl(s)$ and $M(NO_3)_2(aq)$. What is the atomic mass of the element M and what is the identity of element M?
7. A student prepares ammonium bicarbonate by the reaction:
- $$NH_3 + CO_2 + H_2O \rightarrow NH_4HCO_3$$
- She uses 14.8 g NH_3 and 41.3 g CO_2 . Water is present in excess. What is her actual yield of ammonium bicarbonate if she obtains a 74.7% yield in the reaction?
8. A gaseous hydrocarbon sample is completely burned in air, producing 1.80 liters of carbon dioxide at standard temperature and pressure and 2.16 grams of water.
- (A) What is the empirical formula of the hydrocarbon?
 - (B) What was the mass of the hydrocarbon consumed?
 - (C) The hydrocarbon was initially contained in a closed 1.00 liter vessel at a temperature of $32^\circ C$ and a pressure of 760 millimeters of mercury. What is the molecular formula of the hydrocarbon?

(D) Write the balanced equation for the combustion of the hydrocarbon.

9. Determine the simplest formula of gallium bromide if a sample of gallium bromide weighing 0.165 g reacts with silver nitrate, AgNO_3 , giving gallium nitrate and 0.299 g of AgBr .

10. A 10.00 mL sample of NH_3 is titrated with a standard HCl solution.

- ◆ An unknown volume of water is added to the HCl solution.
- ◆ An unknown volume of water is added to the 10.00 mL sample of NH_3 solution.
- ◆ Phenolphthalein is used as the indicator.

For each of these three steps taken during the titration:

- (A) State whether it introduces an error into the titration results.
- (B) For any of the steps that introduce(s) an error, state whether the titration result will be raised or lowered compared to the result obtained if the error had not been made.
- (C) Explain why the result is high or low for each error that you detect.

• Solve the following nuclear problems:

1. The carbon isotope of mass 12 is stable. The carbon isotopes of mass 11 and mass 14 are unstable. However, the type of radioactivity decay is different for these two isotopes. Carbon-12 is not produced in either case.

- (A) Identify a type of decay expected for carbon-11 and write the balanced nuclear reaction for that decay process.
- (B) Identify the type of decay expected for carbon-14 and write the balanced nuclear reaction for that decay process.
- (C) Gamma rays are observed during the radioactive decay of carbon-11. Why is it unnecessary to include the gamma rays in the radioactive decay equation of (A)?
- (D) Explain how the amount of carbon-14 in a piece of wood can be used to determine when the tree died.

2. Answer each of the following questions regarding radioactivity.
- (A) Write the nuclear equation for the decay of Pu-239 by alpha emission.
 - (B) Account for the fact that the total mass of the products of the reaction in part (A) is slightly less than that of the original Pu-239.
 - (C) Describe how α , β , and γ rays each behave when they pass through an electric field.
 - (D) Why is it not possible to eliminate the hazard of nuclear waste by the process of incineration?
3. A sample containing a single radioactive isotope was isolated and placed in a radioactivity detector, where it was found to give 1365 counts per minute. After 3.00 hours its activity under identical conditions was 821 counts per minute. Calculate the half-life of the isotope.

Although this work must be done independently, I urge you to form a study group with a few other students to discuss methods for problem solving.

I look forward to a great AP class next year. Have a wonderful summer!