AP Chemistry Summer 2015 Assignment

Completed work must be submitted by the indicated dates.

Date Due: August 11, 2015

1. When is a zero considered significant in a measurement? When is it not significant? What are the guidelines rounding off answers to operations on measurements?

2. Using dimensional analysis, convert the following:
   a. 20.0 miles to meters
   b. 65.0 inches to cm
   c. 4.0 years to seconds
   d. 200. liters to liters

3. Classify each of the following as units of mass, volume, length, density, energy, or pressure.
   a. kilogram
   b. millimeter
   c. atm
   d. g/ml
   e. liter
   f. kg/m³
   g. cal.
   h. cubic meter
   i. Joule
   j. Torr

4. How many significant figures are in each of the following?
   a. 1.9200 mm
   b. 460.000 L
   c. 1001
   d. 3.02 x 10⁴
   e. 0.030100 kJ
   f. 0.000036 cm³
   g. 0.001345
   h. 3.21 x 10⁻²
   i. 6.022 x10²³ atoms
   j. 10000
   k. 0.0101

5. Convert the following to proper scientific notation:
   a. 4050,000,000 cal
   b. 0.00345 Å
   c. 0.000123 mol
   d. 700,000,000 atoms

6. Perform the indicated operation and round off answers properly.
   a. 1.270 g / 5.296 cm³
   b. 12.235 g / 1.010 L
   c. 12 g + 0.38 g
   d. 170g + 2.785 g
   e. 2.1 x 3.2102
   f. 200.1 x 120
   g. 17.6 + 2.838 + 2.3 + 200
7. A solid white substance A is heated strongly in the absence of air. It decomposes to form a new white substance B and a gas C. The gas has exactly the same properties as the product obtained when carbon is burned in an excess of oxygen. Based on these observations, can we determine whether solids A and B and the gas C are elements or compounds? Explain your conclusions for each substance.

8. Label each of the following as either a physical process (PP) or a chemical process (CP).
   b. Pulverizing an aspirin.          g. Digesting a candy bar.
   c. Explosion of nitroglycerin.      h. Milk turning sour.
   d. Burning of paper.               i. Forming of frost on a cold night.
   e. Bleaching of hair with hydrogen peroxide.  j. A copper wire is hammered flat.

9. You may notice when water boils, you can see bubbles that rise to the surface of the water. Is the boiling of water a chemical or physical change? Explain.

10. Dalton assumed that all atoms of the same element were identical in all their properties. Explain why this assumption is not valid.

11. Draw the radioactive isotope hydrogen-3 (tritium) using the atomic models of Dalton, Thomson, Rutherford and Bohr.
1. Why do we call Ba(NO$_3$)$_2$ barium nitrate, but we call Fe(NO$_3$)$_2$ iron(II) nitrate?

2. Calculate the mass of O$_2$ produced if 3.450 g potassium chlorate is completely decomposed by heating in presence of a catalyst (Manganese dioxide).

3. Write the formula of the following compounds?
   a. Calcium sulfate.  
   b. potassium perchlorate.  
   c. Sodium bromate  
   d. Ammonium Phosphate  
   e. Barium Oxide  
   f. Calcium Iodide  
   g. Lithium Nitrite  
   h. Zinc sulfide.  
   i. Aluminum Carbonate.  

4. Give three possible isotopes of a. carbon  
   b. the element in group 3 period 2  
   c. neon  
   d. the element in period 2 group 3

5. For each of the following, list down the number of protons, electrons and neutrons:
   a. K$_{19}^{39}$  
   b. $^{208}_{82}$Pb  
   c. $^{23}_{11}$Na.  
   d. $^{33}_{15}$P

6. White gold is an alloy that typically contains 45.0% by mass gold and the remainder is platinum. If 154 g of gold are available, how many grams of platinum are required to combine with the gold to form this alloy?
7. What is the empirical formula of a compound that contains 53.73% Fe and 46.27% of S?

8. Determine the number of molecules present in 4.56 mol of nitrogen (N₂).

9. List the following has diatomic molecule, molecular compound, ionic compound, Atomic element.
   a. F₂          e. Cl₂          i. C          l. NaCl
   b. KF          f. CO₂         j. H₂         m. Ag
   c. Rust (Fe₂O₃) g. MgO         k. O₂         n. I₂
   d. CO          h. K₂CO₃

10. What is the empirical formula of a compound that contains 53.73% Fe and 46.27% of S?

11. What is the difference between

12. How many grams of methane (CH₄) are present in 5.6 moles of methane gas? (USE dimensional analysis)
Date Due: August 13, 2015

1. Why do we call Ba(NO\textsubscript{3})\textsubscript{2} barium nitrate, but we call Fe(NO\textsubscript{3})\textsubscript{2} iron(II) nitrate?

2. Calculate the mass in grams of each of the following:
   a. 6.02 \times 10^{23} \text{ atoms} of Mg.

   b. 3.01 \times 10^{23} \text{ Formula units} of CaCl\textsubscript{2}.

   c. 1.24 \times 10^{15} \text{ atoms} of neon.

3. Compare and contrast the following:
   a. An element from a compound.

   b. An element from a mixture.

   c. A true solution from a heterogeneous mixture.

   d. Distillation from filtration.

4. Define Acid, base and salt? Give some examples of each.

5. What mass of copper is required to replace silver from 4.00g of silver nitrate dissolved in water? \text{Cu(s)} + AgNO\textsubscript{3} \rightarrow Cu(NO\textsubscript{3})\textsubscript{2} + Ag.
6. Write the chemical formulas for the following compounds:
   a. Calcium Carbonate  
   b. Sodium Chloride  
   c. Calcium Sulfate  
   d. Magnesium Acetate  
   e. Zinc(II) Nitrate  
   f. Nickel (II) Fluoride  
   g. Ammonium Phosphate  
   h. Sodium Oxide  
   i. Sodium Nitrite  
   j. Potassium cyanide  
   k. Iron(III) Phosphate

7. Strontium consists of four isotopes with masses and their percent abundance of 83.9134 amu (0.5%), 85.9094 amu (9.9%), 86.9089 amu (7.0%), and 87.9056 amu (82.6%). Calculate the atomic mass of Sr?

8. Write the number of protons and electrons for the following:
   a. P₄ molecule  
   b. a PCl₅ molecule  
   c. a P³⁻ Ion  
   d. P⁵⁺ ion.

9. Calculate the molar masses (g/mol) of
   a. Ammonia (NH₃)  
   b. Baking soda (NaHCO₃)  
   c. Osmium Metal (Os)

10. Convert the following to moles
   a. 3.86 grams of Carbon dioxide.  
   b. 6.0 x 10⁵g of Hydrazine (N₂H₄), a rocket propellant.

11. The molecular formula of morphine, a pain-killing narcotic, is C₁₇H₁₉NO₃. What is the molar mass? What is the mass of 6.02 x 10²⁴ molecules of morphine?

12. Complete the list ionic compounds (name or formula)
   a. Cupric Hydroxide  
   b. Ammonium Per chlorate  
   c. Fe₂(CO₃)₃  
   d. Potassium Chloride.
   e. Strontium Chromate
   f. NaHCO₃  
   g. Sodium Hydroxide.
1. The hormone, thyroxine is secreted by the thyroid gland, and has the formula: \( C_{15}H_{17}NO_4I_4 \). How many milligrams of Iodine can be extracted from 15.0 Grams of thyroxine?

2. Determine the **formula weight** for the following:
   a. \( N_2O_5 \)  
   b. \( CuSO_4 \)  
   c. \( Ca(HCO_3)_2 \)  
   d. \( CaSO_4 \cdot 2H_2O \)

3. Determine the empirical and molecular formula of each of the following substances:
   a. Ibufuren, a headache remedy contains 75.6 % C, 8.80 % H, and 15.5 % O by mass and has a molar mass about 206 g/mol.
   b. Epinerphine (adrenaline) a hormone secreted into the bloodstream in times of danger or stress contains 59% C, 7.1% H, 26.2% O, and 7.7% N by mass, its MW is about 180 amu.

4. Write Lewis Electron Dot Diagram of the compound formed between sodium and the following nonmetals to form ionic solids.
   a. Nitrogen  
   b. Oxygen  
   c. Sulfur  
   d. Bromine

5. For each of the following reactions, write a balanced equation and identify the reaction type:
   a. the reaction of boron trifluoride gas with water to give liquid hydrogen fluoride and solid boric acid, \( (H_3BO_3) \).
b. Reaction of magnesium Oxide with Iron to form Iron (III) Oxide and Magnesium.

c. The decomposition of dinitrogen Oxide gas to its elements.

d. The reaction of Calcium Carbide solid with water to form calcium hydroxide and acetylene ($C_2H_2$) gas.

e. The reaction of solid calcium cyan amide ($CaCN_2$) with water to form calcium carbonate and ammonia gas. Ethane burns in air (Oxygen).

f. Conc. Hydrochloric acid reacts with Conc. Sodium hydroxide to form sodium chloride and water.

6. Define limiting reagent, theoretical yield, and actual yield?

7. Sodium hydroxide reacts with carbon dioxide as follows:
   \[ 2 \text{NaOH(s)} + \text{CO}_2 (g) \rightarrow \text{Na}_2\text{CO}_3 (s) + \text{H}_2\text{O(l)} \]

   Which reagent is the limiting reactant when 1.85 mol of sodium hydroxide and 1.00 mol carbon dioxide are allowed to react? How many moles of sodium carbonate can be produced? How many moles of the excess reactant remain after the completion of the reaction?
8. WHEN benzene \((C_6H_6)\) reacts with bromine \((Br_2)\) bromobenzene\((C_6H_5Br)\) is obtained:
\[
C_6H_6 + Br_2 \rightarrow C_6H_5Br + HBr
\]
a. What is the theoretical yield of bromobenzene in this reaction when 30.0g of benzene reacts with 65.0 g of bromine?

b. If the actual yield of bromobenzene was 56.7 g what was the percentage yield?

9. Chlorine and Fluorine react to form gaseous chlorine trifluoride. You start with 1.75 mol of chlorine and 3.68 mol of fluorine.
   a. Write the balanced equation for the reaction.

   b. What is the limiting reactant?

10. A bedroom 11 ft x 12 ft x 8.0 ft contains 35.41 kg of air at 25˚C. Express the volume of the room in liters, the amount of air in moles (molar mass of air is 29.0 g/mol) and the temperature in Kelvin.

11. A sample of carbon dioxide gas, \(CO_2\) \((g)\), occupies a volume of 5.75 L at 0.890 atm. If the temperature and the number of moles remain constant, calculate the volume when the pressure
   a. increased to 1.25 atm

   b. decrease to 0.350 atm
12. A nitrogen sample at 30°C has a volume of 1.75L. If the pressure and the amount of gas remain unchanged, determine the volume when the Celsius temperature is doubled. How will it change if the Kelvin temperature was doubled?

13. An open flask contains 0.200 mol of air. Atmospheric pressure is 745 mmHg and room temperature is 68°F. How many moles are present in the flask when the pressure is 1.10 atm and the temperature is 33°C?

14. A piece of unknown metal with mass 14.9 g is heated to 100°C and dropped into 75.0 g of water at 20°C. The final temperature of the system is 28 degree Celsius. What is the specific heat of the metal?

15. What is a solute and solvent? Define Molarity, Molality, mole-fraction and Mass percent of a solution?

16. Calculate the molarity of a solution that contains 0.0345 mol NH₄Cl in exactly 400 ml of solution?

17. How many grams of solute are present in 50.0 ml of 0.360 M sodium chloride?