Name

AP Chemistry Summer Assignment

Directions: Read chapters 1-3 in the AP chemistry textbook. Answer the following questions. If the question is a calculation, you must show all of your work to receive full credit. Study and practice the content in chapters 1-3 until you are comfortable. In the fall, students will move to chapter 4 quickly, and teachers will assume you have mastered chapters' 1-3 content.

AP Chemistry
Chapter 1 Problem Set

1. When making observations, we can state that **macroscopic properties** are the

   result of _____.

2. A substance is defined as **matter** with _____.

3. List three examples of **substances**:
   a.

   b.

   c.

4. Chemists use the **metric system** when conducting measurements or completing calculations. You are responsible for knowing the definition (and resulting calculations) for these metric prefixes. Write the **conversions** to these units from the base unit:
   a. Deci

   b. Centi

   c. Milli

   d. Micro

   e. Nano

   f. Mega

   g. Kilo

5. When taking measurements, **significant figures** are necessary to accurately depict the certainty of the measurements. Keeping this in mind, perform the activities below:
    a. Circle the significant figures in the following values:

250	0.25	250.0	2.50×10^2	0.000025
250.2	0.250	2.5×10^2	2×10^2	0.0000250000

    b. Perform the following calculations. Provide the answer with the correct number of significant figures.
        i. $7.25 \times 1.6 =$
        ii. $(1.0 \times 10^{-3})(6.7 \times 10^4) / (8.29 \times 10^7) =$
        iii. $16.437 + 134 =$
        iv. $0.0009 - 0.0000837 =$
    c. Round the following numbers to 2 significant figures:
        i. 2.85×10^{-2} ANSWER: _____
        ii. 2.35×10^{-6} ANSWER: _____
    d. Round the following numbers to 3 significant figures:
        i. 18.74 ANSWER: _____
        ii. 18.750001 ANSWER: _____
        iii. 18.750 ANSWER: _____
        iv. 18.650 ANSWER: _____
    e. List two examples of **exact numbers**:
        i.
        ii.

6. If your dorm room measures 10.0ft x 8.25ft x 12.5ft, how many cubic meters is your room?

7. When measuring temperature, chemists use either the unit **Celsius or Kelvin**. You are responsible for knowing how to convert between Celsius and Kelvin units.

    a. Convert 25°C into K:

    b. Convert 300. K into °C:

8. The study of chemistry involves the measurements of different quantities, including **mass, volume, and density**.
    a. Write the definition (equation) of density:

    b. Rearrange the equation in a. to solve for mass and volume:

    m = V =

    c. A small cube of a substance has a length of 0.753 inches. It has a density of 11.35 g/cm^3. What is the mass of the cube, in pounds? (1 pound = 453.59g)

9. **States of matter**:

Draw a picture of sample of water in the solid, liquid, and gaseous phases:
SOLID: LIQUID: GAS:

10. You observe a burning candle. With reference to this system, list two examples of a:

    a. **Physical property**:

    b. **Chemical property**:

    c. **Physical change**:

    d. **Chemical change**:

AP Chemistry
Chapter 2 Problem Set

1. According to our current understanding, **atoms** are comprised of **electrons** surrounding a **nucleus**. Within the nucleus, we can find _____, which are positively charged, and _____, which have no charge. Electrons have a _____ charge.

2. We can symbolize atoms using a notation such as: $^{27}_{13}Al$

   In this example, the number 13 represents the number of _____ in an aluminum atom. The number 27 represents the number of _____ + _____. Every atom of a particular element contains the same number of _____, however the number of _____ can vary. Elements with different numbers of neutrons are called _____.

3. Our current understanding of the atom resulted from years of experiments and data analysis. List three experiments, and the major result(s), that led to this current understanding:
   a.

   b.

   c.

4. Briefly summarize **Dalton's Atomic Theory**:

5. Last year we discussed the organization of the periodic table. Using this tool, answer the following questions:
   a. What is the **atomic number** of bromine?

b. Categorize the following as **metal, nonmetal, or metalloid**:
    i. K
    ii. Pd
    iii. Si
    iv. Xe

6. When atoms approach each other, their interactions sometimes result in **bonding**. At this point, we will categorize bonding as either **ionic or covalent** (understanding that, in truth, a gradient exists between these two ends of the spectrum). During ionic bonding,

   electrons are _____, and the electrostatic attraction of the opposite

   charges creates a bond. When atoms covalently bond, electrons are _____ when the positively charged nucleus of one atom attracts the electrons of another, and vice versa.

7. The simplest unit of a covalently bonded substance (except for network covalently

   bonded substances) is called a _____. List an example of a molecular formula:

   The simplest unit of an ionically bonded substance is called a _____. List an example of this:

8. Certain **naming** conventions apply to ionic and covalent substances.
    a. Provide the names for the following formulae:
        i. LiCl
        ii. CaO
        iii. $BaBr_2$
        iv. FeI_2
        v. NH_4Cl

vi. $Sr_3(PO_4)_2$

vii. HNO_3

viii. SO_2

ix. H_2O

x. N_2O_4

b. Provide the formulae for the following names:
   i. Sodium sulfide

   ii. Rubidium fluoride

   iii. Magnesium iodide

   iv. Ferric bromide

   v. Magnesium hydroxide

   vi. Barium cyanide

   vii. Magnesium nitrite trihydrate

   viii. Hydrofluoric acid

   ix. Phosphoric acid

   x. Sulfur hexafluoride

AP Chemistry
Chapter 3 Problem Set

1. If the **average atomic mass** of neon (value found on the periodic table) is 20.1797 amu, calculate the isotopic mass of Neon-21:

Isotope:	Isotopic Mass:	%Abundance:
Neon-20	19.9924 amu	90.480
Neon-21	?	0.270
Neon-22	21.9914 amu	9.250

2. Calculate the formula/**molar masses** for the following:
   a. $KClO_2$
   b. $Pb(NO_3)_2$
   c. $MgSO_4 * 7H_2O$

3. The **mole** is a frequently used unit in chemistry. For a fixed mass (relative to 12 grams of carbon-12), one mole of a substance has _____ entities. This number is called _____.

4. Practice with the mole:
   a. 1 Hg atom has a mass of _____ amu.
   b. 1 mol of Hg atoms has a mass of _____ g. This ratio of grams:moles is called the _____ of a substance.
   c. 1 mol of Hg has _____ atoms.

d. 1 mol of CCl_4 molecules has _____ moles of Cl atoms.

e. 1 mol of CCl_4 has a mass of _____g.

f. The number of molecules in 153.81g of CCl_4 is _____.

g. The number of Cl atoms in 153.81g of CCl_4 is _____.

h. The moles of CCl_4 in a 4.27g sample is _____.

i. The number of molecules of CCl_4 in a 4.27g sample is _____.

5. **Mass % and the Mole**:
   The mass % of an element X in a compound XY is = [( )/( )] *100
   a. What is the mass % of S in H_2SO_4?

   b. What is the mass % of O in H_2SO_4?

   c. What is the mass % of H in H_2SO_4?

   d. The total mass percentages of all elements in a compound should equal _____.

6. More Practice:
   a. How many moles of sodium are present in 1.263g Na_3PO_4?

   b. How many atoms of hydrogen are present in 5.88g H_2O_2 (hydrogen peroxide)?

   c. What is the percent, by mass, of hydrogen in H_3PO_4?

7. Determining the formula of an unknown compound: **empirical and molecular formulas**

   Eugenol is the major component in oil of cloves. It has a molar mass of 164.2g/mol and is 73.14% by mass C and 7.37% by mass H; the remainder is oxygen. What are the empirical and molecular formulas of eugenol?

**Hint: You can solve a problem like this by following these steps:

a. Assume 100.00g sample (in this case, eugenol)
b. Calculate the moles of element from the mass (determined from %)
c. Divide the moles of each element by the smallest mole value
d. Determine the whole number mole ratio of each element to the other. You may need to multiply by a whole number to complete this step.
e. Use the who number values as the subscripts in a formula. This is the empirical formula.
f. Divide the molar mass of the compound by the empirical molar mass. This should produce a whole number.
g. Multiply each subscript in the empirical formula by the number determined in step f. This is the molecular formula.

8. Chemical Equations

In your car, octane combusts with oxygen to produce carbon dioxide and water.

a. Write a chemical equation based on the statement above:

b. **Balance** the equation in part a. The numbers in front of each substance are called **stoichiometric coefficients**.

c. Add states of matter to the equation in part b.

d. For the equation in part b. & c., answer the following questions:

i. 1 mole of octane produces _____ moles of CO_2.

ii. _____ moles of oxygen are required to produce _____ moles of water.

iii. If your car burns 1.00kg of octane, how many liters of CO_2 is produced? (24.5L = 1 mol of gas at 25°C and 1atm)

9. Reactions with Limiting Reagents:

a. A small pepperoni pizza requires one crust, 1 cup of shredded cheese, ½ cup of sauce, and 12 slices of pepperoni. If the following are available: 10 crusts, 200 slices of pepperoni, 10 cups of sauce, and 7 cups of cheese, how many pizzas can be made? Explain how you arrived at your answer.

b. Given the following balanced chemical equation:

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

What is the limiting reagent when 3.2mol $H_2(g)$ reacts with 1.7mol O_2?

c. How many grams of water can be produced when 30.6g H_2 reacts with 75.0g O_2?

d. If 80.7g H_2O were actually produced, what is the percent yield?