AP Chemistry Summer Assignment

This assignment is due the first day of class. Show your work for all problems and use the correct number of significant figures in your answers. Your process is more important than your final answer. You will have a test over this on August 21.

1. Draw molecules/atoms to represent:
   a. a homogeneous mixture of an element and a compound
   b. a gaseous compound
   c. an element in solid form
   d. a heterogeneous mixture of two elements
2. True or False: Color changes always indicate a chemical change
3. Contrast the terms precision and accuracy.
4. Explain how Archimedes might have used the concept of density to determine whether the king's crown was pure gold. (density of gold = 19.32 g/cm^3)
5. When 87.7 is added to 73.841, the result should be reported with_____significant figures. And when 87.7 is divided by 73.841 the result should be reported with_____significant figures.
6. A wavelength of red light is measured at 655 nm. What is this measurement in cm?
7. Convert 0.3980 m to mm.
8. The agreement of a particular value with the true value is called_____.
9. You measure water in two containers: a 10-mL graduated cylinder with marks at every mL, and a 1-mL pipet marked at every 0.1 mL. If you have some water in each of the containers and add them together, to what decimal place could you report the total volume of water?
10. A scientist obtains the number 0.045006700 on a calculator. If this number actually has four (4) significant figures, how should it be written?
11. A sample of chemical X is found to contain 5.0 grams of oxygen, 10.0 grams of carbon, and 20.0 grams of nitrogen. The law of definite proportion would predict that a 70 gram sample of chemical X should contain how many grams of carbon?
12. Write the symbol for a calcium ion. How many electrons does it have? If the mass number is 41, then how many neutrons does it have?
13. You are given a compound with the formula MCl_3, in which M is a metal. You are told that the metal ion has 23 electrons. What is the identity of the metal?
14. Write the names of the following compounds: $FeSO_4$, $NaC_2H_3O_2$, KNO_2, $Ca(OH)_2$
15. The atomic mass of rhenium is 186.2. Given that 37.1% of natural rhenium is rhenium-185 (185 amu), what is the other stable isotope?
16. A sample of ammonia (NH_3) has a mass of 43.5 g. How many molecules are in this sample?
17. Roundup, an herbicide manufactured by Monsanto, has the formula $C_3H_8NO_5P$. How many moles of molecules are there in a 295.1-g sample of Roundup?
18. One molecule of a compound weighs 2.93×10^{-22} g. The molar mass of this compound is:
19. How many grams of potassium are in 27.8 g of K_2CrO_7?
20. A chloride of rhenium contains 63.6% rhenium. What is the formula of this compound?
21. Chlorous acid, $HClO_2$, contains what percent hydrogen by mass?
22. The empirical formula of a group of compounds is CHCl. Lindane, a powerful insecticide, is a member of this group. The molar mass of lindane is 290.8 g/mol. How many atoms of carbon does a molecule of lindane contain?
23. A 7.11-g sample of potassium chlorate was decomposed according to the following equation:
   $2KClO_3 \rightarrow 2KCl + 3O_2$ How many moles of oxygen are formed?
24. How many grams of $Ca(NO_3)_2$ can be produced by reacting excess HNO_3 with 6.33 g of $Ca(OH)_2$?
25. Suppose a reaction with $Ca_3(PO_4)_2$ and H_2SO_4 is carried out starting with 153 g of $Ca_3(PO_4)_2$ and 76.8 g of H_2SO_4. How many grams phosphoric acid will be produced? How many grams of excess reactant remain unreacted after the reaction is complete?

26. The reaction of 11.9 g of $CHCl_3$ with excess chlorine produced 10.2 g of CCl_4, carbon tetrachloride:
    $2CHCl_3 + 2Cl_2 \rightarrow 2CCl_4 + 2HCl$ What is the percent yield?
27. A gas sample is held at constant pressure. The gas occupies 3.62 L of volume when the temperature is 21.6°C. Determine the temperature at which the volume of the gas is 3.42 L.
28. A balloon has a volume of 2.32 liters at 24.0°C. The balloon is heated to 48.0°C. Calculate the new volume of the balloon.
29. A gas sample is heated from -20.0°C to 57.0°C and the volume is increased from 2.00 L to 4.50 L. If the initial pressure is 0.140 atm, what is the final pressure?
30. A sample of oxygen gas has a volume of 1.72 L at 27°C and 800.0 torr. How many oxygen molecules does it contain?
31. Gaseous C_2H_4 reacts with O_2 according to the following equation:
    $C_2H_4 (g) + 3O_2 (g) \rightarrow 2CO_2 + H_2O (g)$ What volume of oxygen gas at STP is needed to react with 5.75 mol of C_2H_4?
32. What volume does 40.5 g of N_2 occupy at STP?
33. Draw the Lewis structures of the molecules below.
    I. BH_3
    II. NO_2
    III. SF_6
    IV. O_3
    V. PCl_5