Practice Problems for the Chapter 2-7 Test!

I. Mole Conversions

1a. What is the molar mass of Calcium phosphate; $Ca_3(PO_4)_2$?

b. What is the mass of 0.123 moles of calcium phosphate?

c. Convert 5.0 grams of calcium phosphate into moles.

2a. Convert 100.0 grams of copper (II) nitrate to moles.

b. Convert 1.0×10^{22} chlorine molecules into moles of chlorine gas.

c. Find the mass of 1.0×10^{22} chlorine molecules.

d. How many atoms are in 1.0×10^{22} chlorine molecules?

3. What is the mass of one Cobalt atom, in grams?

4a. Convert 8.4 grams of sulfur trioxide gas into molecules.

b. How many total atoms are in the 8.4 grams of sulfur trioxide?

4c. What is the mass of 4.0×10^{23} molecules of P_2O_5?

d. How many atoms are in the above sample (in c)?

e. How many moles of P_2O_5 are in the sample (in c)?

II. Percent Composition

5a. Determine the percent sulfur (by mass) in $K_2S_2O_3$.

b. What mass of $K_2S_2O_3$ would contain 75 grams of sulfur?

c. Determine the percent iron (by mass) in $Fe_2(CO_3)_3$.

d. How many milligrams of iron are in a 250 mg sample of iron (III) carbonate?

6. A chemist has a sample of gold (III) nitrate, from which she plans to extract gold.

a. What mass of gold could she extract from 80.0 grams of gold III nitrate?

b. If she plans to extract 50.0 grams of gold, what mass of gold III nitrate would she need to start with?

7. Another chemist did an experiment to determine the percent gold in gold (III)nitrate. Gold nitrate was added to water and dissolved, and then reacted with zinc in order to extract the gold from gold (III) nitrate.

Data was as follows: Mass of empty flask: 23.22 g
Mass of flask and gold nitrate (before adding water): 25.12 g
Mass of empty beaker: 33.30 g
Mass of beaker and dry gold crystals collected after the reaction: 34.26 g

Use the lab data to determine the percent gold (by mass) in the compound gold nitrate.

8. Some iron powder is burning in a crucible and the following lab data is obtained.

Mass of crucible:	16.78 g
Mass of crucible and iron powder (before burning):	18.14 g
Mass of crucible and iron oxide (after burning):	18.50 g

Calculate the percent iron in the iron oxide that formed, according to this lab data.

III. Empirical and Molecular Formula:
9. What is the empirical formula of each compound here:

C_4H_8_____ C_4H_{10}_____ $C_6H_{14}O_4$_____ $C_6H_{12}N_6O_9$_____

10. "Hexane" is an organic liquid that contains only carbon and hydrogen. It is 83.6% carbon by mass.
a. Calculate the the empirical formula of hexane.

10b. The molar mass of hexane is between 75 and 100 amu. Determine the molecular formula of hexane.

11. A compound is 60.9 % carbon, 4.38 % hydrogen, and 34.8 % oxygen (by mass).
a. Determine the empirical formula of the compound.

b. Determine the molecular formula of the compound, if the molar mass is between 500 and 600 g/mole.

12. A compound contains 11.7 grams iron per 10.1 grams sulfur and 20.2 grams oxygen.

a. Calculate the empirical formula of the compound.

b. This compound has the (incomplete) name of "iron sulfate." Is it iron II sulfate or iron III sulfate?

IV. Protons, Neutrons, Electrons, Periodic Table

You should be able to do all of #13 and #14 without an ion sheet. You will need a periodic table.
(Use a periodic table that doesn't show any ion charges, like the one on the yellow data sheet or the tables on our classroom walls.)

13a. What is the difference between an atom and an ion?

b. How many electrons are lost/gained when a calcium atom forms an ion?_____

c. How many electrons are lost/gained when a phosphorus atom forms an ion? _____

d. How many electrons must an aluminum ion gain or lose in order to become an aluminum atom? _____

14a. Which column on the periodic table contains elements that don't tend to bond?_____

b. For each column/family on the periodic table, indicate what charge of ion the elements typically form:

IA	IIA	IIIA	VA	VIA	VIIA
_____	_____	_____	_____	_____	_____

15.	Mass #	Symbol	# of protons	# of electrons	# of neutrons	Charge
a.	_____	$^{192}Ir^{+3}$	_____	_____	_____	_____
b.	80	_____	_____	36	_____	-2
c.	_____	_____	_____	74	115	+4
d.	131	_____	_____	54	78	_____

e. An ion has a mass number of 140, and has 83 neutrons and 54 electrons.
Write the symbol of the ion (in the same style as in a-d, above.)

f. A lead atom lost two electrons to form an ion. It has 128 neutrons.
Write the symbol of the ion.

g. If a tellurium natom with 73 neutrons gains 2 electrons, write the symbol for what forms.

V. Ionic and Covalent Bonding, Formulas, Names

16a. Identify each element as a metal or a nonmetal, and indicate whether the element will be more likely to <u>gain</u> or <u>lose</u> electron(s) when it forms an ion.

P   Li   Zn   Cl   Ca

b. When the above atoms form ions, which one will NOT form an ion with the same number of elctrons as a noble gas?

c. Identify a pair of atoms from part (a) that could bond together to form an <u>ionic</u> compound.

d. Identify a pair of atoms from part (a) that could bond together to form a <u>covalent</u> compound.

17. Determine the name (if the formula is given) or formula (if the name is given) of the following substances.

potassium nitride   lead (IV) sulfate NH_4NO_2 helium

CS_2 $Ca(ClO_2)_2$ Iodine   silver carbonate

BaI_2 magnesium phosphide   SnO B_2Br_4

PI_3 Iron (II) peroxide   phosphorus pentabromide Na_2O

aluminum sulfide $CuC_2H_3O_2$ S_2F_{10} Cu_2O

Cl_2O_7 $Li_2Cr_2O_7$ ferric chromate   bromine

aluminum thiosulfate I_2S B_3P_5 As_4O_6

18. For each of the first six compounds in #17 (the first 6 in the left hand column), answer these questions:
a. Is the compound ionic or covalent?
b. When elements bond to form the compound, will the elements need to gain, lose, or share electrons to form the bond?
c. If the elements must gain or lose electrons to form the compound, which element will <u>lose</u> electrons in order to bond, and which will <u>gain</u> electrons in order to bond?

More Mole Conversion Practice!

1. Propane has the formula C_3H_8.
a. Find the molar mass of propane. Report units in two possible ways.

b. If a propane tank contains 13500 grams of propane, how many molecules of propane are in the tank?

c. Convert 4.0 x 10^{22} propane molecules to moles.

d. How many total atoms are in the 4.0 x 10^{22} molecules of propane?

2. a. What is the mass of 3.00 x 10^{21} uranium atoms?

b. Convert 345 grams of bromine to molecules.

c. How many hydrogen peroxide molecules are in 0.0015 moles of hydrogen peroxide?

d. 1 cup of table sugar (sucrose; $C_{12}H_{22}O_{11}$) has a mass of approximately 290 grams. How many sucrose molecules are in this mass?

e. How many atoms are in 1.00×10^{20} sucrose molecules?

f. What is the mass (in grams) of 1 molecule of sucrose?

3. a. Determine the molar mass of copper (II) phosphate; $Cu_3(PO_4)_2$

b. Convert 32.21 grams of copper (II) phosphate to moles.

c. What is the percent composition (by weight) of phosphorus in this compound?

d. If 3.00 grams of phosphorus were extracted from copper (II) phosphate, how many grams of copper (II) phosphate were initially present?

e. How many grams of phosphorus can be extracted from 30.0 grams of copper (II) phosphate?

4. Determine the empirical formula of $C_{20}H_{36}O_8$

5. A compound is 53.31% carbon, 35.51% oxygen, and 11.12% hydrogen, by weight. Determine the empirical formula.

6. A compund is 39.34% carbon, 8.25% hydrogen, and 52.41% oxygen by weight. The molar mass of the compound is between 225 and 250 amu.

  a. Determine the empirical formula.

b. Determine the molecular formula.

Answers to the mole conversion practice:
1a. 44.096 amu or 44.096 g/mole <---- notice it is g/mole, not just g.
      1b. 1.84 x 10^{26} molecules   c. 0.066 moles   d. 4.4 x 10^{23} atoms
2. a. 1.19 g   b. 1.30 x 10^{24} molecules   c. 9.0 x 10^{20} molecules   d. 5.1 x 10^{23} molecules.
       2e. 4.5 x 10^{21} atoms   2f. 5.69 x 10^{-22} g
3. a. 380.581 amu or g/mole   b. 0.08463 moles   c. 16.2771% P   d. 18.4 g   e. 4.88 g
4. $C_5H_9O_2$ 5. C_2H_5O 6a. $C_2H_5O_2$ b. $C_8H_{20}O_8$