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.

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 dioxide gas into molecules.

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

c. 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 above sample (in c/d)

II. Protons, Neutrons, Electrons, Periodic Table

5a. 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? _____

6a. Which column on the periodic table contains elements that don't tend to bond?_____

b. Which elements in column IA form ions, what is the charge on the ion?_____

What about elements in IIA?_____ IIIA?_____ VA_____ VIA_____ VIIA_____

c. What is the name of the family of elements in:

IA(except H)_____ IIA_____VIIA_____ VIIIA_____

8.	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 (same style as in a-d).

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

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

9a. Identify each element as a metal or a nonmetal, and indicate whether the element will be more likely to gain or lose electron(s) when it forms an ion. P Li Zn Cl Ca

b. Of the above elements, which one is LEAST likely to obtain a noble gas configuration when it forms an ion?

c. Find a pair of ions in 9a that could bond together to form an ionic compound.

d. Find a pair of ions in 9a that could bond together to form a covalent compound.

III Isotopes.

10. Chlorine has two common isotopes. 75.77% of chlorine atoms have a mass of 34.968853 amu, and the remainder of Cl atoms have a mass of 36.965903 amu.

a. What is the "natural abundance" of the Cl-37 isotope?

b. Calculate the atomic mass of chlorine.

c. Write the symbol for each of these chlorine isotope, in the same style as in #8.

d. How are the two isotopes of chlorine the same? Give at least two answers.

e. How are the two isotopes of chlorine different? Give at least two answers.

11. 99.63% of nitrogen atoms have a mass of 14.003074, and the remainder have a mass of 15.000108 amu. Calculate the atomic mass of nitrogen.

12. (This type of question would be in the extra credit section if given on a test.)
Boron has only two isotopes: B-10 (10.012936 amu), and B-11 (11.009305 amu). Use these masses, along with info from the periodic table, to determine the natural abundance percents for each boron isotope.

IV. Percent Composition
13a. Determine the percent composition of iron in $Fe_2(CO_3)_3$.

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

14. a. A chemist has 150.2 grams of silver nitrate. He plans to extract the silver from the silver nitrate using a physical/chemical change (which is it?). How many grams of silver can be extracted from this silver nitrate?

b. Pick two metals that could react with silver in order to separate the silver from the nitrate.

15. A different chemist has a sample of gold (III) nitrate, from which she plans to extract gold. If she plans to extract 50.0 grams of gold, what mass of gold nitrate would she need to start with?

V. Empirical Formula
16. What is the empirical formula of C_4H_8_____ C_4H_{10}_____ $C_6H_{14}O_4$_____
17. "Hexane" is an organic liquid that contains only carbon and hydrogen. It is 83.6% carbon by mass. The molar mass of the compound is between 75 and 100 amu.
Determine a) the empirical formula of hexane

b) the molecular formula of hexane

c) the molar mass of hexane.

18. Phenolphthalein is an acid-base indicator; it is pink in basic solutions and colorless in acidic and neutral solutions. Phenolphthalein is 75.5% carbon, 4.43 % hydrogen, and 20.1 % oxygen, by mass. It has a molar mass of roughly 300 amu. Determine a) the empirical formula, and b) the molecular formula of phenolphthalein.

VI. Formula Writing and Naming

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

lead (IV) sulfate	$Li_2Cr_2O_7$	helium
$Ca(ClO_2)_2$	Iodine	Ferric hydroxide
magnesium phosphide	potassium nitride	silver carbonate
Iron (II) peroxide	SnO	Na_2O
$CuC_2H_3O_2$	copper (II) nitrate	Na_2O_2
NH_4NO_2	ferric chromate	bromine

20. Problem 19 lists some compounds and some elements. Are the compounds listed ionic or covalent? (which one?)

Are the compounds in #16-18 ionic or covalent? (which one?)

VII Balancing Chemical Equations

21. Balance these!

a. $Fe + HCl \text{ -----> } H_2 + FeCl_3$

b. $IrCl_3 + Ca(OH)_2 \text{ -----> } CaCl_2 + Ir_2O_3 + HCl$

c. $NO_2 + H_2O \text{ ------> } HNO_3 + NO$

d. Ag_2CO_3 + H_3PO_4 -----> Ag_3PO_4 + H_2O + CO_2

e. C_3H_8 + O_2 -----> CO_2 + H_2O

f. C_3H_6 + O_2 -----> CO_2 + H_2O

h. $MgBr_2$ + K_3PO_4 ----> $Mg_3(PO_4)_2$ + KBr

i. $C_7H_{12}O$ + O_2 -----> CO_2 + H_2O

j. H_2SiCl_2 + H_2O ----> $H_8Si_4O_4$ + HCl

k. $Ca_{10}F_2(PO_4)_6$ + H_2SO_4 ---> $Ca(H_2PO_4)_2$ + $CaSO_4$ + HF

l. FeS + O_2 ---> Fe_2O_3 + SO_2

m. NH_3 + O_2 ---> NO + H_2O

n. Al + H_2O -----> $Al(OH)_3$ + H_2

VIII. Hydrates

22. SCl_2 $BaCl_2$ $SCl_2 \cdot 2H_2O$ $BaCl_2 \cdot 2H_2O$

a. Which of the above shows a formula for a hydrate?

b. Which of the above shows a formula for an anhydrous salt?

23. An experiment was done to determine the value of x in the hydrate $FeCl_3 \cdot xH_2O$.

Use the following data to determine the value of x.

Mass of empty evaporating dish: 57.00 g

Mass of evaporating dish and hydrate (before heating): 59.00g

Mass of evaporating dish and anhydrous salt (after heating): 58.20 g

Remember: These practice problems did not cover reactions or stoichiometry. See 8.1-8.7, 9.1-9.4, and the rxns practice quiz.