Unit #5 Review: Chemical Reactions

1. State the Law of Conservation of Mass.
2. Explain why it is necessary to balance chemical equations.
3. Be able to identify chemical and physical changes. Review the examples from our earlier notes.
4. Be able to use the concepts of net nuclear attraction (effective nuclear charge, Z*eff*) and shielding effect to explain the general trends in the reactivity of metals and non-metals.
5. Be able to describe an experiment that could be used to compare the relative reactivity of metals. Be able to interpret the results of such an experiment.
6. Balance and classify the following reactions as synthesis, decomposition, single displacement, double displacement or combustion reactions:

a) $N_2 + H_2 \rightarrow NH_3$ _____

b) $KC\ell O_3 \rightarrow KC\ell O_4 + KC\ell$ _____

c) $N_2 + O_2 \rightarrow N_2O$ _____

d) $H_3PO_4 \rightarrow H_4P_2O_7 + H_2O$ _____

e) $C_{10}H_{16} + C\ell_2 \rightarrow C + HC\ell$ _____

f) $S_8 + O_2 \rightarrow SO_3$ _____

g) $A\ell(OH)_3 + H_2SO_4 \rightarrow A\ell_2(SO_4)_3 + H_2O$ _____

h) $Fe_2(SO_4)_3 + KOH \rightarrow K_2SO_4 + Fe(OH)_3$ _____

i) $C_7H_6O_2 + O_2 \rightarrow CO_2 + H_2O$ _____

j) $A\ell + FeO \rightarrow A\ell_2O_3 + Fe$ _____

k) $Fe_2O_3 + H_2 \rightarrow Fe + H_2O$ _____

l) $P_4 + O_2 \rightarrow P_2O_5$ _____

m) $C_2H_2 + O_2 \rightarrow CO_2 + H_2O$ _____

n) $K_2O + H_2O \rightarrow KOH$ _____

o) $H_2O_2 \rightarrow H_2O + O_2$ _____

p) $C_7H_{16} + O_2 \rightarrow CO_2 + H_2O$ _____

q) $SiO_2 + HF \rightarrow SiF_4 + H_2O$ _____

r) $KC\ell O_3 \rightarrow KC\ell + O_2$ _____

s) $A\ell_4C_3 + HC\ell \rightarrow A\ell C\ell_3 + CH_4$ _____

t) $H_3AsO_4 \rightarrow As_2O_5 + H_2O$ _____

u) $A\ell_2(SO_4)_3 + Ca(OH)_2 \rightarrow A\ell(OH)_3 + CaSO_4$ _____

v) $P_4O_{10} + H_2O \rightarrow H_3PO_4$ _____

w) $FeC\ell_3 + NH_4OH \rightarrow Fe(OH)_3 + NH_4C\ell$ _____

x) $Sb + O_2 \rightarrow Sb_4O_6$ _____

y) $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$ _____

z) $Au_2S_3 + H_2 \rightarrow Au + H_2S$ _____

aa) $Fe_2(C_2O_4)_3 \rightarrow FeC_2O_4 + CO_2$ _____

7. Balance these reactions (some are tricky):

a) $SiC\ell_4 + H_2O \rightarrow H_4SiO_4 + HC\ell$

b) $Na + H_2O \rightarrow NaOH + H_2$

c) $Ca_3(PO_4)_2 + SiO_2 \rightarrow P_4O_{10} + CaSiO_3$

d) $Na_2O_2 + H_2O \rightarrow NaOH + O_2$

e) $Si_2H_3 + O_2 \rightarrow SiO_2 + H_2O$

f) $CO_2 + NH_3 \rightarrow CO(NH_2)_2 + H_2O$

g) $H_2SO_4 + HI \rightarrow H_2S + I_2 + H_2O$

h) $FeS_2 + O_2 \rightarrow Fe_2O_3 + SO_2$

i) $Na_2CO_3 + HC\ell \rightarrow NaC\ell + H_2O + CO_2$

j) $NaBH_4 + A\ell F_3 \rightarrow NaF + BF_3 + A\ell_2H_6$

k) $NH_3 + O_2 \rightarrow NO + H_2O$

l) $PC\ell_5 + H_2O \rightarrow H_3PO_4 + HC\ell$

m) $POC\ell_3 + H_2O \rightarrow H_3PO_4 + HC\ell$

n) $CuC\ell_2 + KI \rightarrow CuI + KC\ell + I_2$

o) $B_2H_6 + O_2 \rightarrow B_2O_3 + H_2O$

8. Review the naming rules for chemical compounds and acids. You must be able to write the chemical formulas of ionic, covalent and acidic compounds from their IUPAC names.

9. Refer to the activity series for metals shown to the right (this is given to you on the test). Predict the products, if any, between the following reactants. If there is no reaction, write "NR". If the reaction will proceed, write the formulas for the products that will form and include their state at SATP. Balance the equations.

Most Reactive

Lithium
Potassium
Barium
Calcium
Sodium
Magnesium
Aluminum
Zinc
Iron
Nickel
Tin
Lead
Hydrogen
Copper
Silver
Gold

a) $Ca\ (s) + Cu(NO_3)_2\ (aq) \rightarrow$

b) $Ni\ (s) + A\ell PO_4\ (aq) \rightarrow$

c) $Ag\ (s) + FeC\ell_2\ (aq) \rightarrow$

d) $K\ (s) + H\text{-}OH\ (l) \rightarrow$

e) $Zn\ (s) + H_2SO_4\ (aq) \rightarrow$

10. Given a pure non-metal element and a compound containing a non-metal (eg. NaCl, KI, MgS), predict whether or not a reaction will occur. If a reaction will occur, predict what the products of the reaction will be and balance the equation. (**You must know the order of the reactivity of the non-metal elements- it is the same order that we learned during the atomic theory unit).

a) $Br_2\ (l) + KC\ell\ (aq) \rightarrow$

b) $Br_2\ (l) + SnI_4\ (aq) \rightarrow$

c) $C\ell_2\ (g) + A\ell Br_3\ (aq) \rightarrow$

d) $I_2\ (s) + BaF_2\ (aq) \rightarrow$

e) $C\ell_2\ (g) + CaS\ (aq) \rightarrow$

11. From a description of a chemical reaction, write its balanced chemical equation, using chemical formulas. Include the state of each reactant and product. Use the solubility rules to predict if a precipitate will form.

a) Propane gas (C_3H_8) burns in air.

b) Sulfur trioxide gas is formed when sulfur is burned in air.

c) Carbonic acid (in pop) decomposes in your stomach to form carbon dioxide (burps) and liquid water.

d) Aluminum oxide is broken down into its elements by electrolysis.

e) Lithium metal reacts with water (H-OH) in a single displacement reaction.

f) Iron (II) sulfide is formed from its elements.

g) When sodium metal is dropped into pure bromine, there is a synthesis reaction.

h) A solution of calcium nitrate is mixed with aqueous sodium sulfide.

i) A solution of silver hypobromite is mixed with a solution of ammonium chloride.

j) A solution of potassium sulfide is mixed with a solution of lead (II) nitrate.

k) Solid calcium carbonate reacts with hydrochloric acid in a double displacement reaction.

l) Sulfur tetrafluoride gas reacts with water to form sulfur dioxide gas and hydrofluoric acid.

m) Solutions of nickel (II) acetate and ammonium phosphate are mixed.

n) When pure sodium cyanide is added to water, it produces toxic hydrogen cyanide gas and a solution of sodium hydroxide. This is the "death chair" reaction that has been used for executing criminals.