Review #5: Chemical Equations and Stoichiometry

1. Define limiting factor. Why is it significant?
The limiting factor is the reactant that runs out first in a chemical reaction. The limiting factor is significant because once it is gone, the reaction stops. It is the amount of the limiting factor that determines how much product can be produced.

2. Balance these expressions. Type of Reaction

a) $\mathbf{4}\ Al + \mathbf{3}\ O_2 \rightarrow \mathbf{2}\ Al_2O_3$ **synthesis**

b) $\mathbf{2}\ C_2H_6 + \mathbf{7}\ O_2 \rightarrow \mathbf{4}\ CO_2 + \mathbf{6}\ H_2O$ **combustion**

c) $\mathbf{3}\ MgO + \mathbf{2}\ H_3PO_4 \rightarrow Mg_3(PO_4)_2 + \mathbf{3}\ H_2O$ **double displacement**

d) $\mathbf{2}\ PbO_2 \rightarrow \mathbf{2}\ PbO + O_2$ **decomposition**

e) $SiO_2 + \mathbf{4}\ HF \rightarrow SiF_4 + \mathbf{2}\ H_2O$ **double displacement**

f) $\mathbf{2}\ C_{10}H_{22} + \mathbf{31}\ O_2 \rightarrow \mathbf{20}\ CO_2 + \mathbf{22}\ H_2O$ **combustion**

g) $Mg + H_2SO_4 \rightarrow H_2 + MgSO_4$ **single displacement**

h) $Sb_2S_3 + \mathbf{12}\ HCl \rightarrow \mathbf{2}\ H_3SbCl_6 + \mathbf{3}\ H_2S$ **Can't classify**

3. For the reaction: $2\ Fe_2O_3\ (s) + 3\ C\ (s) \rightarrow 4\ Fe\ (s) + 3\ CO_2\ (g)$

What mass of iron will be produced when 50.0 g of iron(III) oxide react with an excess of carbon? (35.0 g)

4. For the reaction: $2\ KClO_3\ (s) \rightarrow 2\ KCl\ (s) + 3\ O_2\ (g)$

a) What volume of oxygen gas, measured at STP, is formed by the reaction of 75.0 g of potassium chlorate? (20.6 L)
b) How many moles of potassium chlorate must react in order to form 2.5 g of potassium chloride? (0.034 mol)

5. For the reaction: $6\ CO_2\ (g) + 6\ H_2O\ (l) \rightarrow C_6H_{12}O_6\ (s) + 6\ O_2\ (g)$

a) Which substance is in excess when 100.0 g of carbon dioxide and 50.0 g of water are reacted? (water)
b) How much glucose will be produced by the reaction in part (a)? (68.2 g)

6. Octane burns according to the reaction:

$$2\ C_8H_{18}\ (l) + 25\ O_2\ (g) \rightarrow 16\ CO_2\ (g) + 18\ H_2O\ (v)$$

a) What mass of carbon dioxide will be produced when 180.0 g of octane are completely burned? (554.7 g)
b) What volume of carbon dioxide, at STP, will be produced when 62.7 g of oxygen are completely reacted? (28.1 L)

7. Predict the products of the following reactions. Balance the equations. Indicate the states of all products by referring to the solubility rules to predict if a precipitate will form.

a) $2\ NaOH\ (aq) + Cd(NO_3)_2\ (aq) \rightarrow 2\ NaNO_3\ (aq) + Cd(OH)_2\ (s)$

b) $2\ AgClO_3\ (aq) + MgCl_2\ (aq) \rightarrow 2\ AgCl\ (s) + Mg(ClO_3)_2\ (aq)$

c) $3\ K_2S\ (aq) + 2\ Fe(CH_3COO)_3\ (aq) \rightarrow Fe_2S_3\ (s) + 6\ KCH_3COO\ (aq)$

8. Referring to the activity series to the right, which of the following reactions will proceed (take place)? If a reaction will occur, write the products (including their states) and balance the equation. If a reaction will not proceed, write "NR" (no reaction):

A reaction will only proceed if the pure metal is more reactive than the metal that is part of the compound:

- If the free (pure) metal is above the metal in the compound on the activity series, than a reaction will take place because the free (pure) metal is reactive enough to replace the metal from the compound.
- If the free (pure) metal is below the metal in the compound on the activity series, then no reaction will occur.

Activity Series for Metals:

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

a) $Na\ (s) + KNO_3\ (aq) \rightarrow NR$ (sodium is below potassium on the series)

b) $2\ Li\ (s) + MgCl_2\ (aq) \rightarrow 2\ LiCl\ (aq) + Mg\ (s)$

c) $2\ Al\ (s) + 3\ Cu(NO_3)_2\ (aq) \rightarrow 2\ Al(NO_3)_3\ (aq) + 3\ Cu\ (s)$

d) $Pb\ (s) + Na_2SO_4\ (aq) \rightarrow NR$

e) $Ba\ (s) + H_2SO_4\ (aq) \rightarrow BaSO_4\ (s) + H_2\ (g)$