Stoichiometry Worksheet #2

1. A chemist describes a particular experiment in this way: "0.0400 mol of H_2O_2 decomposed into 0.0400 mol of H_2O and 0.0200 mol of O_2." Express the chemistry of this reaction by a conventional equation.

2. The octane present in gasoline burns according to the following equation:

$$2\ C_8H_{18} + 25\ O_2 \rightarrow 16\ CO_2 + 18\ H_2O$$

   a) How many moles of O_2 are needed to react fully with 4 moles of octane?
   b) How many moles of CO_2 can form from 1 mole of octane?
   c) How many moles of water are produced by the combustion of 6 moles of octane?
   d) If this reaction is to be used to synthesize 8 mole of CO_2, how many moles of oxygen are needed? How many moles of octane?

3. The alcohol in "gasohol" burns according to the following equation.

$$C_2H_6O + 3\ O_2 \rightarrow 2\ CO_2 + 3\ H_2O$$

   a) If 25 moles of ethyl alcohol burns this way, how many moles of oxygen are needed?
   b) If 30 moles of oxygen is consumed by this reaction, how many moles of alcohol are used up? How many moles of carbon dioxide are formed?
   c) In one test, 23 moles of carbon dioxide was produced by this reaction. How many moles of oxygen were consumed?
   d) In another test, 41 moles of water is collected from this reaction. How many moles of alcohol had been consumed? How many moles of oxygen were used up? How many moles of CO_2 also formed?

4. One way to change iron ore, Fe2O3, into metallic iron is to heat it together with hydrogen.

$$Fe_2O_3 + 3\ H_2 \rightarrow 2\ Fe + 3\ H_2O$$

   a) How many moles of iron are made from 25 moles of Fe_2O_3?
   b) How many moles of hydrogen are needed to make 30 moles of Fe?

5. The Solvay process is used to make sodium carbonate, Na_2CO_3, a chemical that ranked 11th among all chemicals in annual production in 1986. The process begins with the passing of ammonia and carbon dioxide through a solution of sodium chloride. This makes sodium bicarbonate and ammonium chloride:

$$H_2O + NaCl + NH_3 + CO_2 \rightarrow NH_4Cl + NaHCO_3$$

   How many moles of sodium bicarbonate could, in theory, be made from 100 moles of NaCl?

6. How many moles of iron, Fe, can be made from Fe_2O_3 by the use of 18 moles of carbon monoxide, CO, in the following reaction: $Fe_2O_3 + 3\ CO \rightarrow 2\ Fe + 3\ CO_2$?

7. How many moles of H_2O are produced when 6 moles of O_2 is consumed in burning methyl alcohol, CH_3OH, according to the following equation: $2\ CH_3OH + 3\ O_2 \rightarrow 2\ CO_2 + 4\ H_2O$?

8. Solution of iron(III) chloride, $FeCl_3$, are used in photoengraving and to make ink. This compound can be made by the following reaction.

$$2\ Fe + 3\ Cl_2 \rightarrow 2\ FeCl_3$$

   a) How many moles of $FeCl_3$ form from 24 moles of Cl_2?
   b) How many moles of Fe are needed to combine with 24 moles of Cl_2 by this reaction?
   c) If 0.5000 mole of Fe is to be used by this reaction, how many moles of Cl_2 are needed and how many moles of $FeCl_3$ form?

9. How many moles of nitric acid, HNO_3, are needed to react with 2.56 moles of Cu in the following reaction: $3\ Cu + 8\ HNO_3 \rightarrow 3\ Cu(NO_3)_2 + 2\ NO + H_2O$?

10. How many moles of carbon dioxide are produced by burning 1.50 moles of C_2H_5OH?

11. The questions below refer to the equation:

$$3\ Cu(s) + 8\ HNO_3(aq) \rightarrow 3\ Cu(NO_3)_2(aq) + 2\ NO(g) + 4\ H_2O(l)$$

   a) How many moles of NO are produced by the reaction of 4.0 moles of copper with excess HNO_3?
   b) How many moles of HNO_3 are required to react completely with 5.0 moles of copper?
   c) How many moles of NO are produced by the reaction of 6.35 grams of Cu with excess HNO_3?

12. Ammonia is produced synthetically by the reaction:

$$N_2(g) + 3\ H_2(g) \rightarrow 2\ NH_3(g)$$

Assume the reaction is complete and answer these questions:

   a) How many moles of NH_3 are formed when one mole of N_2 reacts with excess hydrogen?
   b) If 18.0×10^{23} molecules of H_2 react with sufficient nitrogen, how many moles of NH_3 are produced?
   c) When 0.1 mole of N_2 combines with 0.3 moles of H_2, how many moles of NH_3 are produced?