Mass to Mass Problem Sheet 1

1. Iron (III) oxide is synthesized from metallic iron and oxygen gas, according to the equation:

$$4Fe_{(s)} + 3\ O_{2(g)} \rightarrow 2\ Fe_2O_{3(s)}$$

   a) Determine the masses of the reactants and products involved in the balanced equation.
   b) What mass of iron (III) oxide would be produced by the complete reaction of 1.00 g of iron?
   c) What mass of iron (III) oxide would be produced by the complete reaction of 1.00 g of oxygen gas?
   d) What mass of iron (III) oxide would be produced by the complete reaction of 5.00 g of oxygen gas?
   e) What mass of oxygen would have to be consumed in order to produce 20.0 g of iron (III) oxide?

2. Hydrogen chloride gas and oxygen gas are synthesized from chlorine gas and water, according to the equation:

$$2\ H_2O_{(1)} + 2\ Cl_{2(g)} \rightarrow O_{2(g)} + 4\ HCl_{(g)}$$

   a) Determine the masses of the reactants and products involved in the balanced equation.
   b) What mass of water would be needed for the production of 96.0 g of oxygen gas?
   c) What mass of chlorine gas would be needed to produce 8.00 g of oxygen gas?
   d) What mass of hydrogen chloride gas would be produced by the complete reaction of 71.0 g of chlorine gas?
   e) What mass of oxygen gas could have been made by the complete reaction of 44.0 g of water?

3. If zinc is reacted with sulfuric acid to produce zinc sulfate and hydrogen gas according to the equation:

$$Zn_{(s)} + H_2SO_{4(aq)} \rightarrow ZnSO_{4(aq)} + H_{2(g)}$$

   a) Calculate the mass of zinc required to produce 47.0 g of hydrogen gas.
   b) Calculate the mass of zinc sulfate that could be produced from 784.0 g of sulfuric acid.
   c) Calculate the mass of zinc that would react with 200.0 g of sulfuric acid.
   d) Calculate the mass of zinc sulfate that would be produced along with 14.0 g of hydrogen gas.