moles H_2 : 4.96 moles
moles O_2 : 0.313 moles

If you are having difficulty getting these numbers, review molar mass in Chapter 8 of your text or talk with an instructor.

Now that we know the number of moles of each reactant, we can solve the questions which were asked in the problem. You should be able to calculate the following:

mass of water formed: 11.3 g
mass hydrogen left over: 8.74 g

If you are having difficulty with this, review the various solutions to the previous problem in this Study Guide.

Learning Review

1. Rewrite the equation below in terms of moles of reactants and products.

   6.022×10^{23} molecules $H_2(g) + 6.022 \times 10^{23}$ molecules $I_2(g) \rightarrow 1.204 \times 10^{24}$ molecules HI(g)

2. How many moles of hydrogen gas could be produced from 0.8 mol sodium and an excess of water? Solve this problem by writing the equation using moles and by using the mole ratio for sodium and hydrogen.

   $$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$$

3. How many moles of aluminum oxide could be produced from 0.12 mol Al?

   $$4Al(s) + 3O_2(g) \rightarrow 2Al_2O_3(s)$$

4. How many moles of zinc chloride would be formed from the reaction of 1.38 mol Zn with HCl?

   $$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$$

5. Solid silver carbonate decomposes to produce silver metal, oxygen gas and carbon dioxide.

   a. Write a balanced chemical equation for this reaction.

   b. What mass of silver will be produced by the decomposition of 6.32 g silver carbonate?

6. When aqueous solutions of sodium sulfate and lead(II) nitrate are mixed, a solid white precipitate is formed. How much solid lead(II) sulfate could be produced from 12.0 g Na_2SO_4 if $Pb(NO_3)_2$ is in excess?

   $$Na_2SO_4(aq) + Pb(NO_3)_2(aq) \rightarrow PbSO_4(s) + 2NaNO_3(aq)$$

7. Hydrogen gas and chlorine gas will combine to produce gaseous hydrogen chloride. How many molecules of hydrogen chloride can be produced from 20.1 g hydrogen gas and excess chlorine gas?

8. Some lightweight backpacking stoves use kerosene as a fuel. Kerosene is composed of carbon and hydrogen, and although it is a mixture of molecules, we can represent the formula of kerosene as $C_{11}H_{24}$. When a kerosene stove is lit, the fuel reacts with oxygen in the air to produce carbon dioxide gas and water vapor. If it takes 15 g of kerosene to fry a trout for dinner, how many grams of water are produced?

$$C_{11}H_{24}(l) + 17O_2(g) \rightarrow 11CO_2(g) + 12H_2O(g)$$

9. You are trying to prepare 6 copies of a three-page report. If you have on hand 6 copies of pages one and two, and 4 copies of page three

   a. How many complete reports can you produce?

   b. Which page limits the number of complete reports you can produce?

10. Manganese(IV) oxide reacts with hydrochloric acid to produce chlorine gas, manganese(II) chloride and water.

$$MnO_2(s) + 4HCl(aq) \rightarrow Cl_2(g) + MnCl_2(aq) + 2H_2O(l)$$

   a. When 10.2 g MnO_2 react with 18.3 g HCl, which is the limiting reactant?

   b. What mass of chlorine gas can be produced?

   c. How many molecules of water can be produced?

11. The acid-base reaction between phosphoric acid and magnesium hydroxide produces solid magnesium phosphate and liquid water. If 121.0 g of phosphoric acid reacts with 89.70 g magnesium hydroxide, how many grams of magnesium phosphate will be produced?

12. If 85.6 g of potassium iodide reacts with 2.41×10^{24} molecules of chlorine gas, how many grams of iodine can be produced?

$$Cl_2(g) + 2KI(s) \rightarrow 2KCl(s) + I_2(s)$$

13. Aqueous sodium iodide reacts with aqueous lead (II) nitrate to produce the yellow precipitate lead(II) iodide and aqueous sodium nitrate.

   a. What is the theoretical yield of lead iodide if 125.5 g of sodium iodide reacts with 205.6 g of lead nitrate?

   b. If the actual yield from this reaction is 197.5 g lead iodide, what is the percent yield?