AP Chemistry

Stoichiometry Practice Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*Stoichiometry* – From the Greek words “stoicheion” (meaning element) and “metron” (meaning measure) is the branch of chemistry that deals with the quantitative relationships in chemical reactions.

1) Nitroglycerin is the active ingredient in dynamite. It explosively decomposes into several gases.

4C3H5N3O9(l) → 12CO2(g) + 6N2(g) + O2(g) + 10H2O(g) reaction type? \_\_\_\_\_

How many *total liters of gases* *at STP* will be produced by *25g of nitroglycerin*?

(add the coefficients of all the products to determine the total number of moles of gases produced)

2) The Haber process is an important industrial process used to produce ammonia gas. Balance the equation:

\_\_\_N2 (g) + \_\_\_H2 (g) → \_\_\_NH3 (g) reaction type? \_\_\_\_\_

a) Calculate the *liters* *of ammonia* gas at *STP* that can be produced from *350kg* *of nitrogen gas* when it reacts with excess hydrogen gas. (Excess means there is more than enough to react with the nitrogen.)

b) Calculate the *kilograms of hydrogen gas* needed to react with the *350kg of nitrogen gas*.

3) Pure sodium can be produced through the electrolysis of molten sodium chloride. Balance the equation:

\_\_\_NaCl(l) − e− → \_\_\_\_Na(l) + \_\_\_Cl2(g) reaction type? \_\_\_\_\_

a) Calculate the *pounds of NaCl* needed to produce *25lbs of sodium*.

b) Calculate the liters of *chlorine gas at STP* that will be produced. (you may start with either Na or NaCl)

4) Aspirin, C9H8O4, is synthesized by the reaction of salicylic acid, C7H6O3, with acetic anhydride, C4H6O3.

2C7H6O3 + C4H6O3 → 2 C9H8O4 + H2O

a) Calculate the grams of aspirin (C9H8O4) that can be produced (theoretical yield) when 450g of C7H6O3 are reacted with excess C4H6O3.

b) Calculate the percent yield of this process if the actual yield of aspirin is only 520g.

5)Diidodine pentoxide is used in respirators to change harmful carbon monoxide into carbon dioxide:

I2O5 (s) + 5CO(g) → I2(s) + 5 CO2 (g)

a) In a test of the respirator, 4.5 L of CO gas at STP are reacted with 11 g of I2O5. Determine which reactant is *limiting* and which one is in *excess* by calculating the number of grams of I2 produced (theoretical) by each reactant. Label one reactant as LR and the other as ER.

b) Can the respirator absorb all 4.5L of CO? Explain your answer based on the LR and ER calculation.

c) The percent yield of the reaction is found to be 85%. How many grams of I2 would actually be produced? How would this affect the design of the respirator?