Unit 10 – Chapter 5: Gases **Name _____**

Assignment #2: Gas Stoichiometry **Period _____**

1) A student adds 4.00 g of dry ice (solid CO_2) to an empty balloon. What will be the volume of the balloon at STP after all the dry ice sublimes (converts to gaseous CO_2)?

2) Air bags are activated when a severe impact causes a steel ball to compress a spring and electrically ignite a detonator cap. This causes sodium azide (NaN_3) to decompose explosively according to the following reaction:

$$2\ NaN_{3(s)} \rightarrow 2\ Na_{(s)} + 3\ N_{2(g)}$$

What mass of $NaN_{3(s)}$ must be reacted to inflate an air bag to 70.0 L at STP?

3) Concentrated hydrogen peroxide solutions are explosively decomposed by traces of transition metal ions (such as Mn or Fe):

$$2\ H_2O_{2(aq)} \rightarrow 2\ H_2O_{(l)} + O_{2(g)}$$

What volume of pure $O_{2(g)}$, collected at 27^0C and 746 torr, would be generated by decomposition of 125 g of a 50.0% by mass hydrogen peroxide solution? Ignore any water vapor that may be present.

4) Consider the reaction between 50.0 mL of liquid methyl alcohol, CH_3OH (density = 0.850 g/mL), and 22.8 L of O_2 at 27^0C and a pressure of 2.00 atm. The products of the reaction are $CO_{2(g)}$ and $H_2O_{(g)}$. Calculate the number of moles of H_2O formed if the reaction goes to completion.

5) Urea (H_2NCONH_2) is used extensively as a nitrogen source in fertilizers. It is produced commercially from the reaction of ammonia and carbon dioxide using both heat and pressure as catalysts:

$$2\ NH_{3(g)} + CO_{2(g)} \rightarrow H_2NCONH_{2(s)} + H_2O_{(g)}$$

Ammonia gas at 223^0C and 90.0 atm flows into a reactor at a rate of 500.0 L/min. Carbon dioxide at 223^0C and 45 atm flows into the reactor at a rate of 600.0 L/min. What mass of urea is produced **per minute** by this reaction assuming 100% yield?

6) Methanol, CH_3OH, can be produced by the following reaction:

$$CO_{(g)} + 2\ H_{2(g)} \rightarrow CH_3OH_{(g)}$$

Hydrogen at STP flows into a reactor at a rate of 16.0 L/min. Carbon monoxide at STP flows into the reactor at a rate of 25.0 L/min. If 5.30 g of methanol is produced per minute, what is the percent yield of the reaction?