Name _____

Mixed Stoichiometry

1) A sample of solid $KClO_3$ was heated in a test tube and decomposed according to the following reaction:
   $2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$
   The oxygen produced was collected by water displacement at 22.0°C at a total pressure of 754mmHg. The volume of the gas collected was 0.650L. The water vapor pressure at 22.0°C is 21.0mmHg.
   a. Calculate the partial pressure of O_2 in the gas collected. **733mmHg**
   b. Calculate the moles of oxygen produced. **0.0259 moles O2**
   c. Calculate the mass of $KClO_3$ that was decomposed. **2.12g KClO3**

2) A sample of methane gas (CH_4) having a volume of 2.80L at 25.0°C and 1.65atm was mixed with excess oxygen. The mixture was then ignited to form CO_2 and water. Calculate the volume of CO_2 formed at a pressure of 2.50atm and a temperature of 125°C.

   2.47L

3) Every year thousands of tons of limestone ($CaCO_3$) are decomposed by heating into CO_2 and CaO (quicklime) according to the following reaction:

   $$CaCO_3(s) \rightarrow CO_2(g) + CaO(s)$$

   How many liters of CO_2 at 1.03atm and a temperature of 950◦C will be produced if 1.00kg of $CaCO_3$ is decomposed?

   974L

4) If 6.32g of barium sulfate is produced from the reaction of sulfuric acid with barium chloride, then what was the molarity of the sulfuric acid solution if only 50.0mL was used?

   0.541M

5) If 98.2mL of a 1.50M hydrochloric acid solution is reacted with excess aluminum hydroxide, then how many grams of aluminum chloride would be your theoretical yield?

   $$Al(OH)_3 + 3HCl \rightarrow AlCl_3 + 3H_2O$$

   6.55g

6) If 25.2mL of a 2.50M sodium bromide solution reacts with excess chlorine gas, then how many liters of bromine gas would you expect to collect at 1.03atm and 295K?

   0.741L

7) When a 45.3g sample of KI dissolves in 85g of water, the temperature drops from 23.5°C to 7.9°C. calculate the heat of reaction for the process in kJ. (hint: calculate kJ/mol)

   $$KI_{(s)} \rightarrow K^+_{(aq)} + I^-_{(aq)} \quad \Delta H=?$$

   20. kJ

8) When a 52.99g sample of sodium iodide dissolves in 50.0g of water, the temperature rises from 22.8°C to 32.8°C. Calculate the heat of reaction for the process in kJ. (hint: calculate kJ/mol)

   $$NaI_{(s)} \rightarrow Na^+_{(aq)} + I^-_{(aq)} \quad \Delta H= ?$$

   -5.92 kJ

Hard!

9) 43.8g of liquid pentane was combusted in a 15.38L container containing pure oxygen gas under 8.93atm of pressure at 299K. What is the final pressure of the container after the reaction occurs if the final temperature was 426K?

   16.9atm

10) 1.83g of sodium chloride is dissolved in 36.5mL of water and is mixed with 23.4mL of a 0.64M silver nitrate solution. How many grams of solid could be recovered at the conclusion of the reaction? What is the concentration of each ion in the resulting solution?

   2.15g AgCl, 0.523M Na^+, 0.250M NO_3^-, 0.272M Cl^-