

Name \_\_\_\_\_

## Mixed Stoichiometry

- 1) A sample of solid  $\text{KClO}_3$  was heated in a test tube and decomposed according to the following reaction:  
$$2\text{KClO}_3(\text{s}) \rightarrow 2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g})$$

The oxygen produced was collected by water displacement at  $22.0^\circ\text{C}$  at a total pressure of  $754\text{mmHg}$ . The volume of the gas collected was  $0.650\text{L}$ . The water vapor pressure at  $22.0^\circ\text{C}$  is  $21.0\text{mmHg}$ .

    - a. Calculate the partial pressure of  $\text{O}_2$  in the gas collected.
    - b. Calculate the moles of oxygen produced.
    - c. Calculate the mass of  $\text{KClO}_3$  that was decomposed.
  - 2) A sample of methane gas ( $\text{CH}_4$ ) having a volume of  $2.80\text{L}$  at  $25.0^\circ\text{C}$  and  $1.65\text{atm}$  was mixed with excess oxygen. The mixture was then ignited to form  $\text{CO}_2$  and water. Calculate the volume of  $\text{CO}_2$  formed at a pressure of  $2.50\text{atm}$  and a temperature of  $125^\circ\text{C}$ .
  - 3) Every year thousands of tons of limestone ( $\text{CaCO}_3$ ) are decomposed by heating into  $\text{CO}_2$  and  $\text{CaO}$  (quicklime) according to the following reaction:  
$$\text{CaCO}_3(\text{s}) \rightarrow \text{CO}_2(\text{g}) + \text{CaO}(\text{s})$$

How many liters of  $\text{CO}_2$  at  $1.03\text{atm}$  and a temperature of  $950^\circ\text{C}$  will be produced if  $1.00\text{kg}$  of  $\text{CaCO}_3$  is decomposed?
  - 4) If  $6.32\text{g}$  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  $50.0\text{mL}$  was used?
  - 5) If  $98.2\text{mL}$  of a  $1.50\text{M}$  hydrochloric acid solution is reacted with excess aluminum hydroxide, then how many grams of aluminum chloride would be your theoretical yield?  
$$\text{Al}(\text{OH})_3 + 3\text{HCl} \rightarrow \text{AlCl}_3 + 3\text{H}_2\text{O}$$
  - 6) If  $25.2\text{mL}$  of a  $2.50\text{M}$  sodium bromide solution reacts with excess chlorine gas, then how many liters of bromine gas would you expect to collect at  $1.03\text{atm}$  and  $295\text{K}$ ?
  - 7) When a  $45.3\text{g}$  sample of  $\text{KI}$  dissolves in  $85\text{g}$  of water, the temperature drops from  $23.5^\circ\text{C}$  to  $7.9^\circ\text{C}$ . calculate the heat of reaction for the process in  $\text{kJ}$ . (hint: calculate  $\text{kJ/mol}$ )  
$$\text{KI}(\text{s}) \rightarrow \text{K}^+(\text{aq}) + \text{I}^-(\text{aq}) \quad \Delta\text{H}=?$$
  - 8) When a  $52.99\text{g}$  sample of sodium iodide dissolves in  $50.0\text{g}$  of water, the temperature rises from  $22.8^\circ\text{C}$  to  $32.8^\circ\text{C}$ . Calculate the heat of reaction for the process in  $\text{kJ}$ . (hint: calculate  $\text{kJ/mol}$ )  
$$\text{NaI}(\text{s}) \rightarrow \text{Na}^+(\text{aq}) + \text{I}^-(\text{aq}) \quad \Delta\text{H}=?$$
- Hard!**
- 9)  $43.8\text{g}$  of liquid pentane was combusted in a  $15.38\text{L}$  container containing pure oxygen gas under  $8.93\text{atm}$  of pressure at  $299\text{K}$ . What is the final pressure of the container after the reaction occurs if the final temperature was  $426\text{K}$ ?
  - 10)  $1.83\text{g}$  of sodium chloride is dissolved in  $36.5\text{mL}$  of water and is mixed with  $23.4\text{mL}$  of a  $0.64\text{M}$  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?