Workshop 6B on Stoichiometry   Name: _____

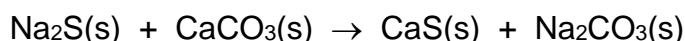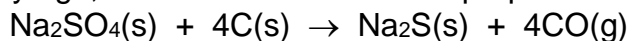_____1. If 21.4 g of solid zinc are treated with 3.13 L 0.200 M HCl, how many grams of hydrogen gas will theoretically be formed? How much of which reactant will be left unreacted? The products of this reaction are hydrogen gas and zinc chloride.

_____2.   A century ago, sodium bicarbonate was prepared from sodium sulfate by a three-step process: $Na_2SO_4(s) + 4C(s) \rightarrow Na_2S(s) + 4CO(g)$

$$Na_2S(s) + CaCO_3(s) \rightarrow CaS(s) + Na_2CO_3(s)$$

$$Na_2CO_3(s) + H_2O(l) + CO_2(g) \rightarrow 2NaHCO_3(s)$$

How many kilograms of sodium bicarbonate could be formed from one kilogram of sodium sulfate, assuming an 82% yield in each step?

_____3.   A 2.5600 g sample of a sulfur-containing compound is analyzed by precipitating the sulfur as barium sulfate. If 1.1756 g of $BaSO_4$ is formed, what is the percentage of sulfur in the sample?

_____4.   Iron ore is a rock which contains a mixture of hematite (Fe_2O_3) and other minerals.   What is the weight of iron contained in 15.000 g of an iron ore which is 60.0% Fe_2O_3?

_____5.   Iron reacts slowly with oxygen and water to form a compound called rust ($Fe_2O_3 \cdot 4H_2O$). For 65.2 kg of rust, calculate the grams of iron present.

Liquid mercury and bromine gas will react under appropriate conditions to produce solid mercury(II) bromide. 6a.   Write the balanced chemical equation for this process below.

_____6b.   What is the maximum mass of $HgBr_2$ that can be produced from the reaction of 10.0 g Hg and 9.00 g Br_2?

_____6c.   Determine the remaining mass of each reactant (if any) available upon conclusion of the reaction.

_____6d.   If 15.3 g of mercury(II) bromide is produced in this reaction, determine the percentage yield of product.

7a. Silicon nitride (Si3N4), a valuable ceramic, is made by the direct combination of silicon and nitrogen at high temperature. Write the balanced chemical equation for this process below.

_____7b.   How many grams of silicon must react with excess nitrogen to prepare 125 g silicon nitride if the yield of the reaction is 85.0%?

8. Consider the following unbalanced reaction: $XNO_3(aq) + CaCl_2(aq) \rightarrow XCl(s) + Ca(NO_3)_2(aq)$

_____8.   If 30.8 g of $CaCl_2$ produced 79.6 g of XCl, determine the identity of X. Quantify your response. Random guessing will not earn any credit for this problem!