**Experiment 6-Thermal Decomposition of Sodium Bicarbonate**

**Questions:** The questions for this should be answered clearly and completely. Type any answers that are explanations. Show your work!

1. If the reaction did not go to completion, would the mass of the residue in the crucible be greater than expected or less than expected? Explain.
2. If you started with 2.486 g of sodium bicarbonate and heated it to constant mass, what would the mass of the residue be after the reaction? Show your work.
3. Coke is an impure form of carbon that is often used in the industrial production of metals from their oxides. If a sample of coke is 95.00% carbon by mass, determine the mass of coke needed to react completely with 1.00 short ton of copper(II) oxide. [2000 lb = 1 short ton]

CuO + C→ Cu + CO2.

1. Hexamethylenediamine (C6H16N2) is one of the starting materials for the production of nylon. It can be prepared from adipic acid (C6H10O4) by the following overall reaction:

C6H10O4 +2 NH3+ 4 H2 → C6H16N2 + 4 H2O.

* 1. What mass of hexamethylenediamine can be produced from 1.00 X103 grams of adipic acid? Show your work for full credit.
  2. What is the percent yield if 765 g of hexamethyldiamine is made from 1.00X103 adipic acid?

1. Potassium superoxide, KO2, is used in re-breathing gas masks to generate oxygen (a side product is KOH). If a reaction vessel contains 0.15 mol of KO2 and 0.10 mol of water, what is the limiting reactant and how many moles of excess reagent will remain?
2. A 0.4230 g sample of impure sodium nitrate was heated, converting all of the sodium nitrate to 0.2864 g of sodium nitrite and oxygen gas (these are the only products). Determine the percentage of sodium nitrate in the original sample.
3. Commercial brass, an alloy of Zn and Cu, reacts with hydrochloric acid as follows:

Zn(s) + 2 HCl(aq) → ZnCl2(aq) + H2(g)

Cu does not react with the HCl. When 0.5065 g of a certain brass alloy is reacted with excess HCl, 0.0985 g of ZnCl2 is eventually isolated. What is the composition of brass by mass?

1. When copper metal is heated with an excess of sulfur, copper(I) sulfide is formed. In a given experiment, 1.50 g of copper was heated with excess sulfur to yield 1.46 g of copper(I) sulfide. Calculate the theoretical yield. What is the percent yield?
2. Two successive reactions: A→ B and B → C, have yields of 73% and 68%, respectively. What is the overall percent yield for the conversion of A → C ?
3. When 29.5 g of methane and 45.0 g of chlorine gas undergo a reaction that has a 85.0% yield, what mass of chloromethane (CH3Cl) forms? (The second product is HCl(g))
4. The aspirin substitute, acetaminophen (C8H9O2N), is produced by the following three-step synthesis listed below. The first two reactions have percent yields of 87% and 98% by mole respectively. The overall reaction yields 3 moles of acetaminophen product for every four moles of C6H5O3N reacted. What is the percent yield by moles for the overall process? What is the percent yield by mole of step III?

I C6H5O3N(s) + 3 H2(g) HCl(aq) →2H2O(l) +C6H8ONCl(s)

II C6H8ONCl(s) +NaOH(aq) → C6H7ON(s) + H2O(l) +NaCl(aq)

III C6H7ON(s) +C4H6O3(l) → C8H9O2N(s) +HC2H3O2(l)

1. When a mixture of silver metal and sulfur is heated, silver sulfide is formed.

16 Ag(s) + S8→8 Ag2S(s)

What mass of silver sulfide is produce from a mixture of 2.0 g of silver and 2.0 g of sulfur? What mass of which reactant is left over?