

# Pre-Lab: Experiment 6-Thermal Decomposition of Sodium Bicarbonate

See lab report checklist. You are graded on how you format the lab and record your data, not just data collection.

**Before class starts:** Read the lab for the week carefully before you start writing your pre-lab. The purpose, introduction, and procedure should be neatly written in your lab book before class starts. Keep the introduction and the purpose separate. Pre-lab questions need to be correctly answered.

**Spacing for the lab:** You will need 0.5 page(s) for the purpose and introduction, 1 page for the procedure, about 0.5 page for the data tables, 1 page or less for calculations, 0.5 page for the results table, 1 page for the results statements. Questions occupy about three pages.

**Purpose:** Address the following in your purpose: The title of this lab is a good place to start for the purpose for this lab.

**Introduction:** Read the introduction to the lab but **DO NOT** write an introduction. Use this space for the two balanced equations.

**Pre-lab question:** How will you prove that the product solid is either sodium oxide or sodium carbonate?

## **Procedure:**

- Check your crucible for cracks. Hold it one inch from the counter and drop it. Listen for a clear, bell like ring. If it thuds, you might need a new crucible.
- Do not weigh the crucible when it is too warm because this will make the mass lower than it should be.
- Heat the solid GENTLY. Make sure you use medium heat. Do not heat to red-hot.
- Leave space to record several weighing. It takes a few heating and cooling cycles to get the product to constant mass.
- Test for carbonates AFTER you have taken the final mass of the crucible by putting a small amount of product on a watch glass and carefully adding acid drop by drop.
- Draw a picture of your apparatus in your lab book.

**Qualitative Observations/Data Collection:** it is hard to see changes in the reactant and the product for this lab. Never the less, make some general observations. You should describe the appearance of the powder before heating, and after heating. You should also note colors, possible energy changes, and smells of the materials at given steps. Did the crucible lose mass? Gain mass? You should record any errors that occurred when carrying out the procedure, such as breaking the crucible or spilling the product. It is probably preferable to use an analytical balance, because you will have more significant figures. In any case, it is important to note the balance that you used for the lab. Even though you start with a white solid and end with a white solid, they don't look the same. How are they different?

**Data Tables:** For this experiment, you should transfer your data with the correct significant figures and units from the observation section into a data table that is easy to understand.

**Calculations:** For this experiment, you should a) balance **Format & Clarity of the Report:** the equations (A) & (B). Calculate b) the mass of sodium bicarbonate that reacted b) mass of product formed c) the theoretical mass of sodium oxide d) the theoretical mass of sodium carbonate. E) Calculate the percent yield of the reaction based on your choice for the actual product. The calculation section should be easy to follow and read. All of your calculations should have proper significant figures and units.

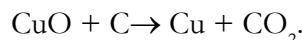
Graph: No graph

**Results Tables:** The results table should show your results. What was the actual mass of the product? What product formed based on your results?

**Results Statement:** no results statement, instead you will answer questions thoroughly.

**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]

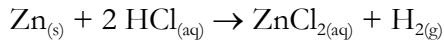


4. Hexamethylenediamine ( $\text{C}_6\text{H}_{16}\text{N}_2$ ) is one of the starting materials for the production of nylon. It can be prepared from adipic acid ( $\text{C}_6\text{H}_{10}\text{O}_4$ ) by the following overall reaction:



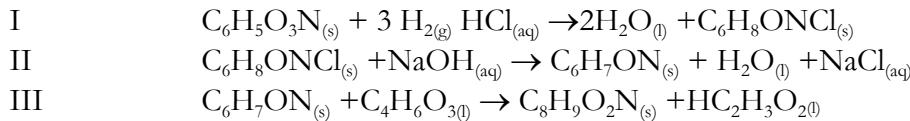
- a. What mass of hexamethylenediamine can be produced from  $1.00 \times 10^3$  grams of adipic acid? Show your work for full credit.
- b. What is the percent yield if 765 g of hexamethyldiamine is made from  $1.00 \times 10^3$  adipic acid?
5. Potassium superoxide,  $\text{KO}_2$ , is used in re-breathing gas masks to generate oxygen (a side product is KOH). If a reaction vessel contains 0.15 mol of  $\text{KO}_2$  and 0.10 mol of water, what is the limiting reactant and how many moles of excess reagent will remain?

6. 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.
7. Commercial brass, an alloy of Zn and Cu, reacts with hydrochloric acid as follows:

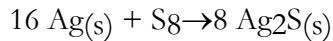


Cu does not react with the HCl. When 0.5065 g of a certain brass alloy is reacted with excess HCl, 0.0985 g of ZnCl<sub>2</sub> is eventually isolated. What is the composition of brass by mass?

8. 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?
9. 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?
10. 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 (CH<sub>3</sub>Cl) forms? (The second product is HCl<sub>(g)</sub>)
11. The aspirin substitute, acetaminophen (C<sub>8</sub>H<sub>9</sub>O<sub>2</sub>N), 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 C<sub>6</sub>H<sub>5</sub>O<sub>3</sub>N reacted. What is the percent yield by moles for the overall process? What is the percent yield by mole of step III?



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



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