**Decomposition of Baking Soda: Mole Relationships and the Balanced Equation**

# Background

Due to the widespread use of sodium bicarbonate (commonly called baking soda) in many food products, the thermal decomposition reaction has been studied extensively by food chemists. Baking soda is used to prepare cakes in order to ensure that cakes “rise” as they bake. As the temperature of the cake batter reaches approximately 50 °C, the baking soda decomposes and carbon dioxide is released. The use of baking soda is especially popular in pancakes and waffles since the high cooking temperatures of 350–450 °F (175–230 °C) cause the carbon dioxide to be liberated before the dough has set. Thus, the batter rises before it sets, and we get a light and tasty finished product. There are three possible chemical reactions that could be occurring during the baking process. All three of these reactions shown below are theoretically possible, yet only ***one*** reaction actually occurs.

|  |  |
| --- | --- |
| sodium bicarbonate (s) → | sodium hydroxide (s) + carbon dioxide (g) |
| sodium bicarbonate (s) → | sodium oxide (s) + carbon dioxide (g) + water (g) |
| sodium bicarbonate (s) → | sodium carbonate (s) + carbon dioxide (g) + water (g) |

## Possible Decomposition Reactions

**Materials:** baking soda(2 g), balance (0.01-g), ring stand/ring, Bunsen burner, clay triangle, crucible, crucible tongs, scoopula, weigh boat

## *Safety Precautions: Exercise caution when using the Bunsen burner and when handling objects that have been heated. Do not touch the crucible or any metal that may remain hot. Use heat-resistant gloves if necessary. Wear safety goggles while performing this demonstration.*

## *Please review all Material Safety Data Sheets for additional safety, handling and disposal information.*

# Experiment Overview: The goal of this lab is for you to experimentally determine which of these three reactions is correct. Students will need to use stoichiometry to determine which reaction is actually occurring inside the crucible.

# Procedure

1. Measure the mass of the empty crucible.
2. Place the empty crucible on the balance pan and then press the tare/reset button.
3. Measure about 2.00 g of baking soda into the crucible. Record the exact measurement.

4. Assemble the ring stand with a circular ring support. Place the clay triangle on top of the ring support and

place the crucible containing the baking soda on top of the clay triangle (see Figure 1).

5. Heat the crucible and its contents with the Bunsen burner for ten minutes. Use a scoopula to carefully

break up any “clumps” that form during heating. Clumps need to be broken only once during heating.

6. Mass the crucible and its contents.

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Decomposition of Baking Soda Lab

**Data:**

**Calculations:**

1.Calculate the amount of solid product that will be produced from the 2.00g of the sodium bicarbonate for ***each*** possible decomposition reaction.

2. Which reaction listed in the prelab is the “real” reaction? How do you know?

3. Calculate your percent yield using the the amount of solid product produced from the “real” reaction.