

BAKING SODA AND VINEGAR INVESTIGATIONS GUIDED INQUIRY VERSION

From *Vernier Investigating Chemistry through Inquiry*



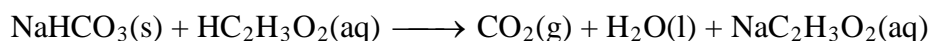
Westminster
College

LAB 2

INTRODUCTION

Sodium bicarbonate is a widely used compound with the formula NaHCO_3 . It is also known as baking soda, bicarbonate of soda, cooking soda, and sodium hydrogen carbonate. Vinegar is a dilute solution of acetic acid, $\text{HC}_2\text{H}_3\text{O}_2$, made by the fermentation of wine or some other solution containing ethanol.

Baking soda reacts with acetic acid in vinegar to produce carbon dioxide gas, water, and an aqueous solution of sodium acetate according to the equation:



In the Preliminary Activity, you will gain experience using a Temperature Probe as you determine the temperature change when 2.00 g of baking soda is added to and reacts with 50.0 mL of vinegar.

After completing the Preliminary Activity, you will investigate your assigned researchable question. Use reference sources to find out more about baking soda and vinegar before planning and conducting your investigation.

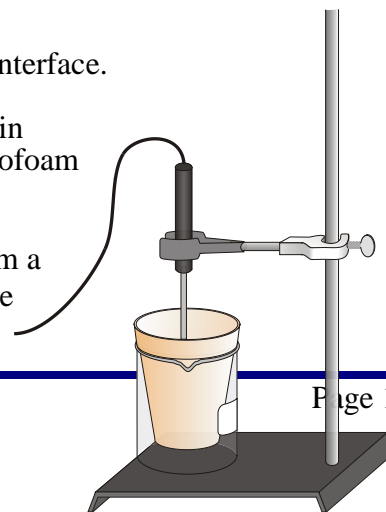
MATERIALS

LabPro or LabQuest
Baking soda
Temperature Probe
Styrofoam cup
400 mL beaker
Ring stand

Utility Clamp
Vinegar
Balance
Stirring Rod
50 mL graduated cylinder
other requested by students

PROCEDURE

1. Obtain and wear goggles.
2. Connect the Temperature Probe to the data-collection interface.
3. Place a Styrofoam cup into a 400 mL beaker as shown in Figure 1. Measure out 50.0 mL of vinegar into the Styrofoam cup.
4. Use a utility clamp to suspend a Temperature Probe from a ring stand as shown in Figure 1. Lower the Temperature



Probe into the vinegar. **Note:** It may take up to 45 seconds for the Temperature Probe to equilibrate at the temperature of the vinegar

5. Measure out 2.00 g of baking soda.
6. Start data collection. After 3–4 readings at the same temperature have been plotted, *carefully* add the baking soda to the cup. Stir the reaction mixture gently.
7. When the temperature readings stabilize, stop data collection. Otherwise data collection will stop after 180 seconds.

Figure 1

8. Use the Statistics function to display the minimum and maximum temperature readings during the reaction. Record these values (to the nearest 0.1°C).
9. Rinse and dry the Temperature Probe, Styrofoam cup, and stirring rod. Dispose of the solution as directed.

QUESTIONS

1. Subtract the initial temperature from the final temperature to determine the temperature change, Δt , for the reaction.
2. Which substance is in the bubbles that are produced as baking soda reacts with vinegar?
3. List two physical properties of baking soda.
4. List two physical properties of vinegar.

5. List two observations evidencing that a chemical change took place when you added baking soda to vinegar in the Preliminary Activity.

Note: The plan that you submit for instructor approval should list laboratory safety concerns, including chemical safety concerns, and specify how you will address these safety concerns during your investigation