PRELIMINARY ACTIVITY FOR
Baking Soda and Vinegar Investigations
Open Inquiry Version

Sodium bicarbonate is a widely used compound with the formula NaHCO₃. It is also known as baking soda, bicarbonate of soda, cooking soda, and sodium hydrogen carbonate. Vinegar is a dilute solution of acetic acid, HC₂H₃O₂, 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:

\[ \text{NaHCO}_3(s) + \text{HC}_2\text{H}_3\text{O}_2(aq) \rightarrow \text{CO}_2(g) + \text{H}_2\text{O}(l) + \text{NaC}_2\text{H}_3\text{O}_2(aq) \]

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 first use reference sources to find out more about baking soda and vinegar before you choose and investigate a researchable question dealing with the properties of baking soda and/or vinegar or the reaction between them. Some topics to consider in your reference search are:

- baking soda
- vinegar
- chemical properties
- physical properties
- chemical change
- physical change

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.
Experiment 2

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.

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, \( \Delta t \), 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.

6. List at least one researchable question concerning the chemistry of baking soda and vinegar.

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.
Vernier Lab Safety Instructions Disclaimer

THIS IS AN EVALUATION COPY OF THE VERNIER STUDENT LAB.

This copy does not include:
- Safety information
- Essential instructor background information
- Directions for preparing solutions
- Important tips for successfully doing these labs