



**/ as you read; X as you do! This is a lab best done by 2 people. Read out loud. Both work and mark X for done.**



1. Your **Problem**: **Determine if energy is gained or lost during a chemical reaction of  $\text{NaHCO}_3 + \text{C}_2\text{H}_4\text{O}_2$ .**  
You will measure the temperature change during the reaction to find out if energy is gained or lost.

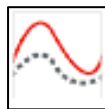
2. **Background Information**:  
 A chemical change takes place during a chemical reaction.  
 A chemical change creates a new substance and either uses or releases energy.  
 When sodium bicarbonate ( $\text{NaCOH}_3$ ) or baking \_\_\_\_\_ is added to 5% Acetic acid ( $\text{C}_2\text{H}_4\text{O}_2$  or v \_\_\_\_\_) the result is carbon dioxide ( $\text{CO}_2$ ) gas AND, the solution changes temperature.  
 The chemical equation is  $\text{NaHCO}_3 + \text{C}_2\text{H}_4\text{O}_2 \rightarrow \text{NaCO}_3 + \text{H}_2\text{O} + \text{CO}_2$   
 **Exothermic reactions give off heat or become w \_\_\_\_\_.**  
 **Endothermic reactions take in and use heat so become c \_\_\_\_\_.**


3. Finish this **Hypothesis** (as your prediction). Always use a complete sentence with no "it".  
*When vinegar and baking soda react to form carbon dioxide, the temperature will go \_\_\_\_\_ showing that energy is \_\_\_\_\_.* The reaction will be \_\_\_\_\_ thermic.  
 (up or down) gained (in) or lost (out)




4. Be Ready:  
 a) Wear goggles! **Follow the directions!**  
 b) **Protect** your Computer.  A laptop should be up on something.  
  Cords should be out of sink and any liquid.  
 c) **Place NO PRESSURE on sensor. Handle sensor with care.**  
 d) Prepare and **Test** the Application.



Open "Vernier Graphical Analysis".  
 Choose Sensor Data Collection. Plug in your temperature sensor.  
 Use "Mode" to set the **Start and Stop on "Manual"**  
 Choose "Graph and Table" in the upper right corner box.   
 Each of you use the "Graph Tools" (lower left) to draw your prediction for your elbow temperature.  
 "Collect" Take turns placing the sensor inside your elbow.....Watch... "Stop".  Checked \_\_\_\_\_ 



5. **Procedures and Observations**: **Check / as you read. X as you do.**  
 a) Open "Graphical Analysis".  Start **NEW**.  Check **ALL** of the **above settings**.   
 b) Sensor should be plugged in.  
 c) **Be Safe!**  Goggles should be on.  No big sleeves.  Long hair tied back.  
 Checked \_\_\_\_\_  d) Obtain a flask of vinegar.

Place the temperature sensor (thermometer) in your flask of vinegar.   
 **ALWAYS HOLD FLASK with one hand, when the sensor is in the flask.**  
 e) **Each of you** draw your prediction graph on screen. **Change "Prediction 1(2)" to your Name(s). Save.**  
 f) Obtain Sodium Bicarbonate on a paper towel. **Fold towel to make it easy to pour. DO NOT ADD.**  
 g) **"Collect"** to record temperature.  
 h) Record the **beginning** (before) temperature **here**. \_\_\_\_\_ °C (degrees Celsius)  
 i) **NOW, with one hand holding the flask, SLOWLY add your Sodium bicarbonate (baking soda) to the acetic acid (vinegar).**  
 j) **Collect** until the bubbles are very slow or stop. Click on **"Stop"**.  
 k) Record your **ending** temperature **here** \_\_\_\_\_ °C (degrees Celsius)  
 l) Have your screen graph Checked  OR if time is too short, Save as...:   
 **Save as.....** Add your names + period →  
 m) Rinse and dry your sensor. **Ask! Please DO NOT wrap cord as that breaks wires.** 

6. Use Graph Tools ("Edit Graph Options" and "Add Annotations") to label:  its name,  your names,  both prediction names,  x-axis &  y-axis.

7. **Save.**

8. **Conclusion**: Add your Conclusion as an Annotation next to the title, using a complete sentence with no "it".  
*When vinegar and baking soda react to form carbon dioxide, the temperature goes \_\_\_\_\_ showing that energy (in the form of heat) is \_\_\_\_\_ showing that it is an \_\_\_\_\_ reaction.* Save