

Where's the heat?

Investigation Question: What evidence can we observe and measure that indicates a chemical reaction has occurred?

Procedure: PART I

1. Put on your **gloves** and **goggles**. **DO NOT REMOVE EITHER UNTIL YOUR TEACHER INSTRUCTS YOU TO DO SO.**
2. Retrieve your materials: **Ask your teacher** for:
 - a. **25 mL of citric acid solution** in a foam cup
 - b. **1 tbsp. of sodium bicarbonate** in a medicine cup
3. Record the starting temperature of the **citric acid solution** in your data table. Use a **thermometer**. **MAKE SURE TO HOLD THE TOP OF THE THERMOMETER SO THAT THE CUP DOES NOT TIP OVER!**
4. **Add** the **sodium bicarbonate** to the **citric acid solution** in the foam cup
5. Use a **stopwatch** to record the temperature every 15 seconds until it stops changing.
6. **Record** your **observations** during the reaction. (What other signs of a chemical reaction did you observe?)

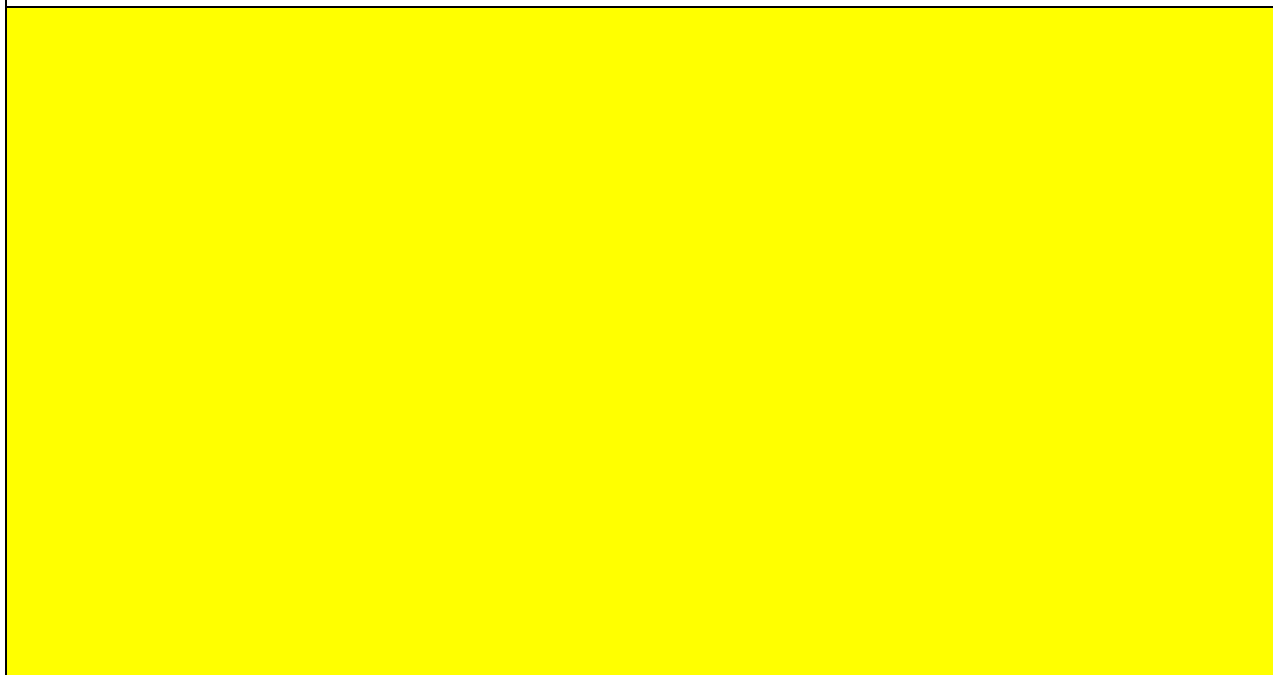
What **observations** did you make during the 1st chemical reaction (citric acid & sodium bicarbonate)?



Procedure: PART 2

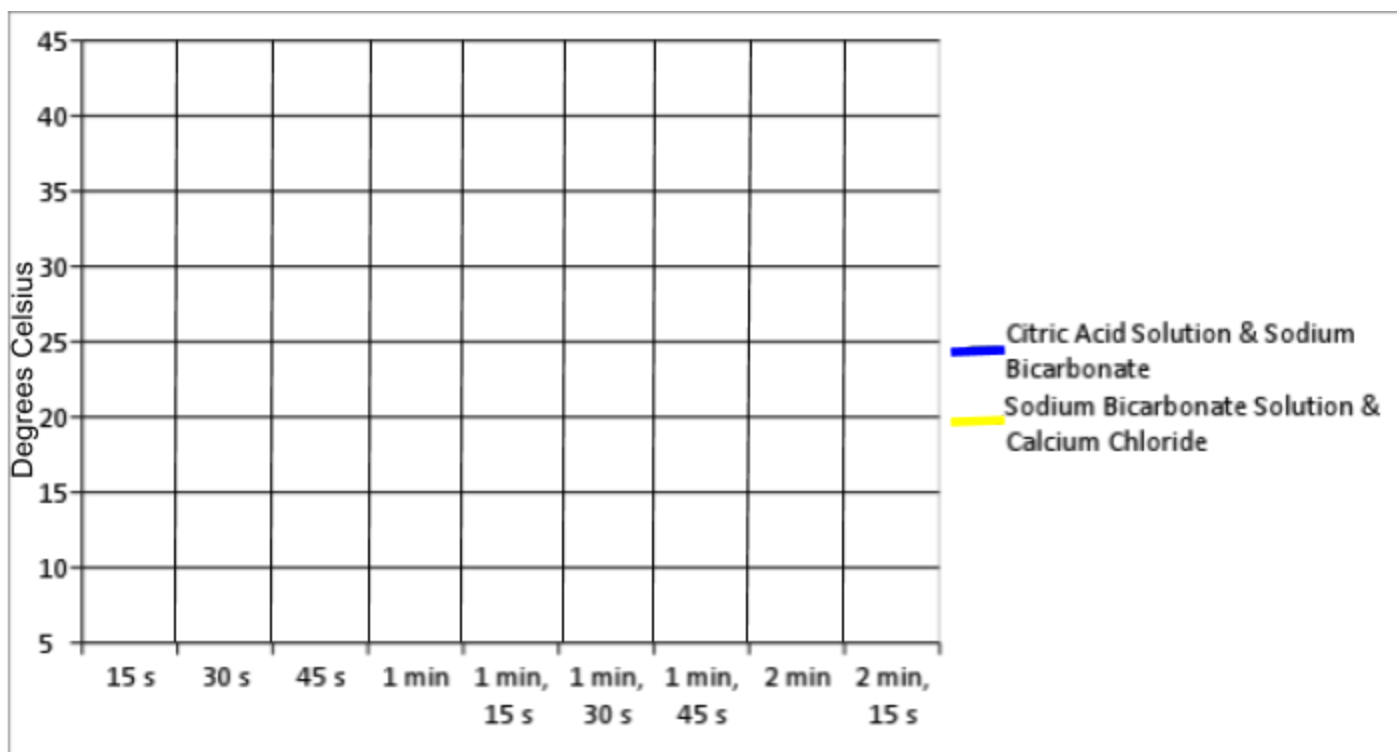
1. Rinse your thermometer with water.
2. Return your blue medicine cup (unwashed) to the back counter..
3. Rinse your blue foam cup and return to the front.
4. Retrieve your materials: Ask your teacher for:
 - a. 25 mL of sodium bicarbonate solution in a foam cup
 - b. 1 tbsp. of calcium chloride in a medicine cup
5. Record the starting temperature of the sodium bicarbonate solution in your data table. Use a thermometer.
6. Add the calcium chloride to the sodium bicarbonate solution in the foam cup
7. Use a stopwatch to record the temperature every 15 seconds until it stops changing.
8. Record your observations during the reaction.
9. Return your yellow medicine cup (unwashed) to the front.
10. Rinse your yellow foam cup and return to the front.
11. Rinse your thermometer and leave in the center of your desk.

What observations did you make during the 2nd chemical reaction (citric acid & sodium bicarbonate)?



Time	Temperature	
	Citric Acid Solution & Sodium Bicarbonate	Sodium Bicarbonate Solution & Calcium Chloride
Starting temp.		
15 s		
30 s		
45 s		
1 min		
1 min, 15 s		
1 min, 30 s		
1 min, 45 s		
2 min		
2 min, 15 s		

Temperature Change



Conclusion Questions:

1. What evidence do you have that the changes in the two cups were chemical reactions?
2. What happened to the temperature in the two cups? How would you explain the changes?
3. Based on your observations and past experience, would a change in temperature be enough to convince you that a chemical change has taken place? Why or why not? What else could cause a temperature change?