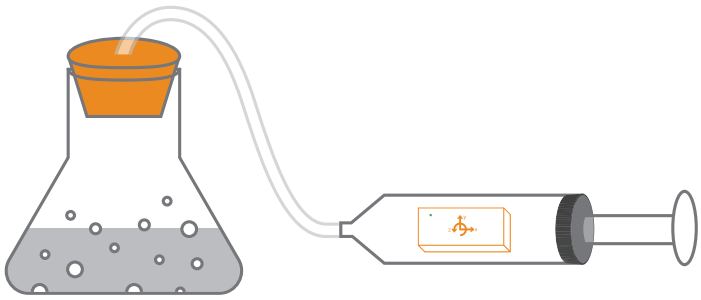
Measuring Pressure Change from Chemical Reaction

Exploration

After a change occurs, if the molecules of the chemicals involved do not change, it is only a physical change. Ice melting to water is an example of this. A change has occured, but the H_20 as ice, remains H_20 as water. If however the molecules of the chemicals involved do change to form new chemicals, then a chemical change has occured. When the coal in a grill burns during a cookout, the carbon (C) from the coal combines with the surrounding oxygen (O_2) to form a new gas, carbon dioxide (CO_2). In this investigation you will use PocketLab to explore chemical reactions while measuring their intensity.

Materials

- Syringe and Erlenmeyer flask
- Tubing connected to flask stopper
- Baking soda and vinegar
- Napkins
- PocketLab



Objective

In this experiment, students will:

1. Examine data before and after a change has taken place to analyze and prove whether it was a chemical change.
2. Interpret the collected data to determine how the substances may have changed.
3. Determine whether there is a greater change if more of the substances are involved in the reaction.

Part 1: Observing a change

- There are multiple ways to tell if a chemical change has occured between substances. Two common signs are a change of color (the chemical change in leaves during the fall), and a production of gas (carbon and oxygen producing carbon dioxide as coal burns). Use these two signs to help determine whether a chemical change has occured during your investigation. You can observe a change in color and use PocketLab's pressure sensor to measure whether a new gas was produced.

Prediction

- If baking soda and vinegar are combined will there be a change? If so will it be a physical or chemical change? How will you know? Write a hypothesis that predicts the answers to these questions.

Procedure

1. Connect one end of the tubing to the syringe and the other end to the rubber stopper as shown in the diagram.
2. Connect the PocketLab to the PocketLab app and place the PocketLab inside the flask. Pull the plunger on the syringe all the way back but wait to seal the flask with the rubber stopper.
3. Turn the graph to Pressure
4. Pour 7 mL of vinegar into the flask.
5. Unfold the napkin and place 1 tablespoon of baking soda in the center of the napkin. Fold/roll the napkin so the baking soda is sealed inside.
6. Place the napkin with baking soda into the flask and quickly seal the flask with the rubber stopper and begin recording data. Do this quickly before the napking soaks through with vinegar and the reaction starts.
7. Make visual observations between the two substances and pay attention to how the graph changes.
8. When the reaction is over stop recording the data. Write down your observations and fill out the table below.

Baking Soda	Vinegar	Pressure before reaction	Pressure after reaction	Total change in pressure
1 tbl	7 mL			

Data Analysis and Observations

1. Describe what you saw between the two substances during the reaction. Is this evidence of a chemical change? Why?
2. Analyze the collected pressure data. Describe how it changed during the reaction. Is this evidence of a chemical change? Why?

Conclusions

- Was your hypothesis valid or invalid? In anwering this question, describe whether you think a chemical change occured and support your answer with evidence gathered during the investigation.

- If you observed a change in pressure, what do you think caused this change? Think about what may have happened at a molecular level with the atoms in the baking soda and the vinegar. How could this be evidence for a chemical change?

Part 2: Measuring the amount of change

- In Part 2 of the investigation you will determine whether changing the amount of vinegar or baking soda will affect the reaction in some way. Remember the two common indicators of chemical change discussed previously, change in color and production of a gas. Use the observations and conlcusions drawn in Part 1 to help you in Part 2.

Prediction

- How does increasing the amount of baking soda affect the reaction? How does increasing the amount of vinegar affect the reaction? How do you know? Write a hypothesis that predicts the answers to these questions.

Procedure

1. Set up the syringe, rubber stopper, tubing, syringe and PocketLab in the same way as Part 1.
2. Test and record the reaction between baking soda and vinegar in the same way as Part 1, except follow the amount of baking soda and vinegar described in each part of the table below.
3. Make visual observations between the two substances and pay attention to how the graph changes.
4. When the reaction is over stop recording the data. Write down your observations and fill out the data table below.

Baking Soda	Vinegar	Pressure before reaction	Pressure after reaction	Total change in pressure
1 tbl	5 mL			
1 tbl	10 mL			
1 tbl	15 mL			
2 tbl	5 mL			
2 tbl	5 mL			
3 tbl	5 mL			

Data Analysis and Observations

1. Describe what you saw between the two substances during the reaction as you changed both the amount of baking soda and the amount of vinegar. Is this evidence of a pattern?
2. Analyze the collected pressure data. Describe how it changed during the reaction as you changed both the amount of baking soda and the amount of vinegar? Is this evidence of a pattern?

Conclusions

- Was your hypothesis valid or invalid? In anwering this question, describe any patterns you observed when changing the amount of baking soda or the amount of vinegar.
- If you observed a pattern as the amount of either substance changed, describe why you think that pattern could be observed. Was there a different type of change that occured as the amount of baking soda or vinegar changed? Explain.