Observing Chemical and Physical Changes

Objective: In this laboratory activity you will observe chemical and physical changes that occur within a sealed plastic bag containing various substances. You will then construct and carry out experiments that will allow you to make deductions that associate the substances with the changes they cause.

Observations: When you make observations of chemical changes you should look for:

- any temperature changes (either an increase or a decrease in temperature)
- any color changes
- the formation of any precipitates*
- the formation of a gas as evidenced by the generation of bubbles

*NOTE: A **precipitate** is a solid that forms within a solution - the solution may become cloudy, appear to become thick, or you may see a solid substance form and collect at the bottom of the solution.

Materials

1 T Calcium Chloride ($CaCl_2$)
1 T Sodium Bicarbonate ($NaHCO_3$) a.k.a. baking soda
An Acid-Base Indicator: red cabbage juice*
Plastic Bag
Small plastic cup

*Instructions to prepare cabbage juice indicator may be found at the end of this document. You will also need red cabbage and white vinegar or lemon juice. It is important that your indicator be set to acid color (red). If it is blue – add some vinegar or lemon juice.

The Experiment

Step One: Initial Observations

Take a very careful look at each substance and describe each substance in as much detail as possible - note physical state: gas, liquid, solid, note any color or absence of color, note texture: size of crystals, shape of crystals, note any odors but be VERY careful smelling chemicals - never put anything directly under your nose! The correct way to smell during a laboratory is to wave your hand gently over the substance and let the odor come to you.

Step Two: Chemical Reactions

1. Add one level tablespoon of baking soda to the plastic bag.
2. Add two level tablespoons of calcium chloride to the plastic bag.
3. Pour about 0.5 fluid ounce (15 mL) cabbage juice or phenol red solution into the plastic cup.
4. Carefully place the cup inside the bag without allowing it to tip over and mix with the solids.
5. Close the bag. Push extra air out of the bag as you close it. **Seal it carefully - this is important.**
6. Record the time.
7. Turn the bag upside down spilling the liquid into the mixture of solids. You will need to touch the bag to find out if the temperature is changing.
8. Watch very carefully and take detailed notes. Record your observations carefully including the time for changes to occur.

Step Three: Designing Your Own Experiments

Rinse and dry the plastic bag. Repeat the experiment a few times, each time leaving out one of the three substances. To leave out the indicator just substitute plain water for it so that you still have a liquid to spill into the solid(s). Continue to write down all the changes you observe.

Organizing your data

Fill out the following chart:

Substances Mixed	**Changes Observed**
Baking soda + Calcium Chloride + Indicator	

Analysis and Conclusions

1. Which substances are responsible for evolution of gas? What is the chemical formula and name of the gas produced? Write the chemical equation for the production of the gas.

2. Which substance is responsible for the evolution of heat?

3. What is the color of the indicator in acid? in base? in a neutral solution? How do you know?

4. The cabbage indicator is made with vinegar or lemon juice. What is the formula for the acid in vinegar? What is the formula for citric acid?

5. Throughout this experiment physical and chemical changes take place. List three chemical changes and two physical changes that occurred.

Preparation of Cabbage Juice Indicator

You will need a small red cabbage, some vinegar or lemon juice, a small pan, a strainer and a bowl.

Cut up about half of a small head of cabbage into small pieces.

Add about one-half cup of white vinegar or 2-3 tablespoons of lemon juice to the pan, then add water to just cover the cabbage.

Boil for 20 minutes or until the cabbage is soft then strain into a bowl and allow to cool completely. Discard the cabbage. Store the juice in the refrigerator until ready to use. Discard after a couple of weeks.

This lab was written and photographed by Joy Walker but is based on many similar labs available on the Internet.