



E-labs Chemical Reactions

Pre-lab Lesson: Chemical vs. Physical Changes

I. Introduction

The material contained within this lesson plan is meant to be used as preparation for the Chemical Reactions e-Lab. Prior to this lesson, students should have some familiarity with what matter is and how chemistry is the study of matter and its changes. As part of this pre-lab lesson, students will:

- Be able to define and differentiate between chemical and physical changes of matter
- Classify changes as being chemical or physical
- Observe and list signs of chemical changes
- Learn key vocabulary related to physical changes and chemical changes (i.e. sublimation, precipitate, etc.)

II. Materials

- Quart-size zipper baggie
- Snack size baggie (un-zippered)
- 1 tsp. baking soda
- 2 tsp. calcium chloride (sold commercially as Driveway Heat)
- 2 tsp. water
- Physical or Chemical Change Powerpoint

III. Key Vocabulary

Physical change - a change in state, form, or appearance of matter that does not chemically change the substance or produce a new kind of matter

Chemical Change (chemical reaction) - a change that produces a new kind of matter with different chemical properties than the starting material(s)

Evaporation - a physical change in which matter changes from the liquid to the vapor state

Condensation - a physical change in which matter changes from the vapor state to the liquid state

Sublimation – a physical change in which matter changes directly from the solid to the gaseous state

Precipitate - an insoluble substance (solid) formed during a chemical reaction in a solution

IV. Lesson Sequence

A. ENGAGE

1. Show students a piece of paper. Ask them to describe the paper, giving some characteristics. Write the characteristics on the board. Some of the characteristics will be physical properties and some will be chemical properties. Make 2 columns and sort the characteristics so the students can see the differences.

Sample Physical Properties

Color

Lightweight

Flat

Dimensions

Sample Chemical Properties

Made of wood products

Flammable

Reacts with an acid

Potential to Rust

2. Ask the students for some ideas of how we can change the paper.

We can tear it, crumple it into a ball, shred it, burn it, dye it, etc.

3. Ask the students if tearing the paper will change what the paper looks like? **YES!**
Ask the students if tearing the paper will make a new substance? **NO!**
Ask the students if burning the paper will change what the paper looks like? **YES!**
Ask the students if burning the paper will make a new substance? **YES!**
4. Define and differentiate chemical changes vs. physical changes, highlighting the important fact that chemical changes produce a new kind of matter that wasn't there to start with. Physical changes, while they alter the appearance, the phase, the size of the substance, they DO NOT change the chemical make-up of the matter.

B. EXPLORE AND EXPLAIN

1. Make 2 columns on the board – physical changes and chemical changes – and ask students to give some examples of each. Provide some examples of your own and ask students to classify. Make sure to highlight that changes of state (evaporation, condensation, melting, freezing) are physical changes b/c they do not alter the chemical make-up of the substance.

Examples:

Physical Changes

Cutting your hair
Crushing a can
Melting Butter
Freezing water to make ice cubes
Salt dissolving in water

Chemical Changes

Bleaching your hair
Burning gasoline
Fireworks exploding

2. Now you will perform a simple chemical reaction (aka chemical change) using the materials listed on page 1. In front of the students, place 1 tsp baking soda and 2 tsp. calcium chloride into the zipper bag. In the smaller un-zippered bag, place 2 tsp. water. Carefully place the bag of water inside the zippered bag, **TAKING CARE NOT TO SPILL THE WATER**. Squeeze the zipper baggie to remove excess air and then seal the bag with the zipper. Tip the bag over and allow the water to mix with the white solids. Ask students to observe.

The bag will begin to feel warm and will inflate as carbon dioxide gas is produced during the chemical change. Students should also observe bubbling and be able to hear a “sizzling” as the reaction occurs.

3. Ask the students whether they think a chemical change or physical change has occurred inside the bag. Solicit reasons for why they hold their beliefs.

Ultimately, students should come to the realization that the bubbling and inflating of the baggie upon mixing the materials is a sign that a new gas was produced during the reaction. You will likely have to tell them that it is carbon dioxide gas being made. As long as you remove the excess air before allowing the reactants to mix and ensure that the bag is sealed, the inflation of the bag should be noticeable and a sure sign that something new was made during the change. Anytime anything new is made, we have a chemical change.

4. Return to the list of chemical changes (reactions) originally listed on the board. Discuss with students that it is sometimes difficult to tell whether some new product was made during a change. However, there are often signs that we look for to help tell us when a chemical change (reaction) has occurred. See how many "signs" students can come up with based upon the list they have made and the experiment done in class.

Signs: Color change, production of a gas (as evidenced by bubbling), production of light, change in temperature, formation of precipitate, odor changes, evolution of sound

5. Revisit the definitions and differences between chemical and physical changes.

C. ELABORATE

1. Display power-point presentation "Chemical OR Physical Change?" (answers are found within ppt). Have students decide which changes are physical and which are chemical changes. Ask students to justify their decisions by writing a sentence or two to explain why they classified each change as they did.

D. EVALUATE

1. As you review the answers with the students, introduce key terms as they come up. For example, for Change #14, identify and define the term "precipitate" as any solid that is produced during a chemical reaction in a liquid.