The Heat is On!

Summary

This activity gives students experience with chemical change.

Group Size

Pairs

Materials

Baking soda
Calcium Chloride
Water
Phenol red or other indicator
Film canisters or small bottle
Ziploc bags
- The Heat is On! data sheet (pdf)

Safety goggles

Additional Resources

Books

- *Science Experiments You Can Eat*
  , by Vicki Cobb; ISBN 0064460029
- *The Science Chef: 100 Fun Food Experiments and Recipes for Kids*
  , by Joan D'Amico and Karen Eich Drummond; ISBN 047131045X

Background for Teachers

The evidence of chemical change that students will see is production of a gas, color change, and production of heat.

Note: pH is a measure of the acidity or basic nature of a solution. pH = 7 is neutral; pH < 7 is acid; pH > 7 is base. The scale is not linear--an acid of pH 4 is ten times more acidic than a pH of 5.

This activity makes use of pH indicator solution. Indicators show a change from a base to an acid or an acid to a base. The mixed calcium chloride, baking soda, and water make an acid solution. Phenol red is the indicator used in the instructions, but other indicators may be used. Bromythymol blue works well, changing from a blue to a yellow. Red cabbage juice (made by boiling the leaves of red cabbage) may be used. Cabbage juice starts off blue or violet and changes to bright pink. There are no special safety considerations for any of these indicators.

Calcium chloride is commonly used as a sidewalk ice-melter and comes in pellets. It is available in the automotive department under the brand name "Heat" and many others. It is also available through science supply companies, but is more expensive. When purchased through science supply companies, it generally comes in small flakes. The powder from the calcium chloride is harmful if inhaled. The pellet form is less likely to have powder that can be inhaled. *The pellet form is strongly recommended for safety.*

Any time things are mixed or heated in the classroom, safety goggles must be worn. The amounts of chemicals listed in these instructions are designed to keep the bags from popping open. Larger amounts of chemicals produce more gas that may cause bags to pop open and create an additional splash danger.

Intended Learning Outcomes

1. Use Science Process and Thinking Skills

4. Communicate Effectively Using Science Language and Reasoning

Instructional Procedures

Invitation to Learn

Review the mixing of colors. What does red plus yellow make? How about blue and yellow? What if you mix red and white? Students may be surprised when we conduct today's experiment!

Instructional Procedures

Advance Preparation

Prepare a Ziploc bag containing two teaspoons baking soda and one teaspoon calcium chloride for each pair of students. *These amounts should not be increased, or the bag may burst open*.

Prepare small bottles or film canisters (without lids) with approximately three tablespoons of water. Add two or three drops of phenol red. Use only enough phenol red to make the color show.

Activity

Distribute *The Heat is On!* data sheets and safety goggles. Read instructions and remind students that goggles must be worn until the chemicals are disposed of and desks are clean.

Discuss what makes a good scientific observation. Measurements are great! Objective observations are great! Statements like "it stinks" or "it turned an ugly color" are opinions and could be rephrased to be more objective. Saying, "It has a strong odor," or saying, "It changed to a bright yellow-orange color," is more objective.

Goggles should be worn at this point. Distribute bags and bottles.

Make initial observations about contents of the bag and bottle. Students record observations on the data sheet. Remember to measure temperature.

Zip the bottle inside the bag.

Tip bottle over and observe. Remember to measure temperature.

Record observations on data sheet.

Clean up by placing closed bags into garbage. Wash hands and put away goggles.

Discuss the evidence of chemical change. Students may write a one paragraph summary of the activity.

Extensions

Writing

Students write a paragraph telling what they know about chemical change, giving examples from this activity and daily life.

Adaptations

Allow students to illustrate what they observed in the activity without writing the sentences OR just label the things that are evidence of chemical change like “heat,” “color change,” “new gas.”

Students may record some observations in drawing form only.

Pair ELL students with a partner with the same primary language to do the writing work.

Review key vocabulary words before beginning writing.

Family Connections

Most students know what happens when they mix baking soda and vinegar together—it bubbles indicating that a gas has formed. With adult supervision, try other cooking liquids (e.g., milk, buttermilk, lemon juice, orange juice, etc.) to find which form a gas when combined with baking soda.

Students make a T-chart listing the physical and chemical changes involved in preparing a favorite food.

Assessment Plan

Assess student learning using the “filmstrip” at the bottom of the data sheet. Did s/he identify evidence of chemical change?
Students write a paragraph explaining how they know something has undergone a chemical change.

Authors

Utah LessonPlans