

# Chemistry in a Bag

## The Big Idea

- 1) Chemical reactions involve elements and compounds combining to form new substances.
- 2) Evidence of chemical reactions includes color change, gas formation, solid formation and energy change.

## Background

Often chemical reactions are used in demonstrations to give the sense that something “magical” has occurred. To break down that notion, we will simply define a chemical reaction as a combination of elements and/or compounds in which a new substance is formed. In other words, elements and/or compounds are switched around and a new substance(s) with new properties is produced. Furthermore, there are clues that a chemical reaction has taken place – color change, gas formation, solid formation (precipitate forms) and energy is released or absorbed (exothermic or endothermic).

## Materials

### Powders (1 cup of each per table)

A= Epsom salts  
B= Flour or baking soda  
C= Corn starch  
D= Powdered lemonade  
E=Washing soda (sodium carbonate) or TSP (carbonate substitute)  
F= Pool chemicals (calcium chloride anhydride)

### Liquids (1 soufflé cup of each per table)

1=baking soda solution with purple cabbage juice  
2=Water with purple cabbage juice  
3=Vinegar with purple cabbage juice  
4=Sodium carbonate solution with purple cabbage juice  
5=Diluted lemon juice with purple cabbage juice  
6=Diluted tincture of iodine solution

### Other supplies (per table)

Spoons (6)  
Cups (6)  
Soufflé cups with lids (6)  
Zip lock bags (6)  
Cafeteria trays (1)



## Procedure

**Prepared before the session: (Note- this part is prepared ahead of time by the FUSE Coordinator)**

1. Purple cabbage juice is an acid-base indicator made by cutting up cabbage into 1 cm square pieces, covering with water, then boiling (or microwaving) until the liquid has most of the color. Purple cabbage juice is red in acid, purple when neutral, and as it gets more basic it is blue then green then yellow.
2. Liquids are mixed and poured into soufflé cups so that each is a different color and are labeled by number (you can also write the ingredients or include a legend). Keep these at the front of the room as they will be handed out to families later in the activity.
3. Powders are in cups and are labeled by letter (you can also write the ingredients or include a legend). Place one of each, with a spoon, on a tray at each table. Also place ziplock bags at each table.

### During session

1. Give an example of a physical reaction from everyday life (e.g. ice melting). Ask families what other physical reactions they can think of (if a chemical reaction is brought up, use it as an example in step 2).
2. Give an example of a chemical reaction from everyday life (e.g. toasting bread). Ask families what other chemical reactions they can think of. Discuss the differences between physical and chemical reactions and try to elicit as many of the families' ideas as possible (ask lots of questions).
3. Explain that families will now be doing their own reactions. Ask for ideas of evidence from the activity that will give them more information about the reaction taking place (what they might observe).
4. Have each group open a zip lock bag and add one teaspoon of any powder and another teaspoon of a different powder to their bag. (The powders will be in cups on a tray at each table)
5. Wait until each group has completed the above and instruct them to select a cup containing liquid (about ½ oz) from a tray that you bring around. Have them place the cup into the bag **with the lid off but still upright** and **zip the bag tight**, squeezing out as much air as possible. Ask them to record which powders and liquids they selected. Wait until each person has placed a soufflé cup of liquid into their bag, **without letting the liquid and powder mix**, before continuing.

6. When everyone is ready, have them gently shake the bag and mix the liquid with the powders. Ask the families to observe what changes occur and discuss these with others at their table.

7. Ask the families whether a chemical reaction had taken place and if so how they knew it had taken place, what evidence they were able to observe. Write the evidence they describe on the board and ask questions until a list is generated that includes: gas formation, color change, solid formation and energy is released (exothermic) or absorbed (endothermic) in the form of heat. (If not all of these are observed, try to have them think of the possibilities or explain them and add them to the list).

8. Ask families to use their evidence to find patterns about the reactions. Ask them which combinations of powders and liquids seem to create which type of reactions. (e.g. baking soda, calcium chloride, and cabbage juice release energy in the form of heat). Have a fun discussion about the different types of chemical reactions.

## **Reactions**

Acid + base → neutral last (as long as equal amounts of acid and base are used)

Acid + carbonate →  $\text{H}_2\text{CO}_3$  (carbonic acid) →  $\text{H}_2\text{O} + \text{CO}_2$  (gas) BUBBLES AND FIZZES!

$\text{I}_2 + \text{I}^- + \text{starch} \rightarrow$  iodine-starch complex (dark blue)

Exothermic reactions (these get hot)

Endothermic reactions (these get cold)

## **Resources**

<http://www.csupomona.edu/~ceemast/science/scienceLessonPlans.htm>

<http://www.buzzle.com/articles/chemical-reactions-in-everyday-life.html>

<http://www.oms.edu/chemunit2>