

## Lesson 2: Composites versus chemical compounds

### Objectives:

1. Create a variety of composites and chemical compounds.
2. Distinguish between composites and chemical compounds

### Introduction:

A composite is a heterogeneous mixture of different chemical substances. Their properties remain distinct from one another. A chemical compound is a combination of elements with chemical bonds produced by a chemical reaction. It takes on very different properties from before the reaction occurred. Carry out the following simple experiments, then determine whether each one creates *a new chemical compound*, or *a composite*.

### Experiment #1: Chalk and vinegar

#### Materials:

Glass beaker  
Vinegar  
Chalk

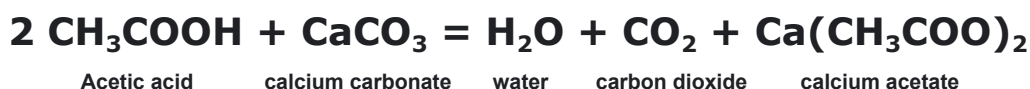
#### Procedure:

1. Pour vinegar into a beaker
2. Add in a piece of chalk and observe.
3. Then try adding more chalk to see what happens, or try crushing up the chalk to see what happens.
4. Record your results at the bottom of the sheet.



### What happened?

The chalk is made of a compound called calcium carbonate, while the vinegar is acetic acid. When calcium carbonate is placed in vinegar, it will form water, carbon dioxide and calcium acetate, as seen below.



### Experiment #2: Cornstarch and water

#### Materials:

2 cups cornstarch  
1 cup of water  
Bowl  
Stir stick or spoon

#### Procedure:

1. Pour 2 cups of cornstarch into the bowl.
2. Mix 1 cup of water in.
3. Once it is mixed, you can pick it up and test it out.



4. This mysterious product contains the properties of both liquids and solids. Try punching it; it will feel solid. Then try slowly dipping your hand into it; it will feel like a liquid.

### What happened?

When cornstarch and water mix together, it becomes a non-Newtonian fluid called an 'oobleck', which means the viscosity of it can change under various pressures. It is a mixture of water and cornstarch together, and it takes on properties of both. If you left the oobleck material sitting out (much like playdough), it would dry out as the water evaporated from the mixture.

### Experiment #3: Red cabbage, baking soda, and vinegar.

#### Note: Prepare cabbage juice indicator before lesson

- a. Cut red cabbage into small pieces and boil for 30-60 minutes.
- b. Use a strainer to collect cabbage juice.
- c. It will be usable for 1-2 days.

### Materials:

Red cabbage juice

Water

Baking soda

Vinegar

Gloves

Spoon

Pipette



### Procedure:

1. Mix water and a heaping spoonful of baking soda into a beaker.
2. In another beaker, pour vinegar.
3. Use a pipette to draw cabbage juice into each of your beakers.
4. Observe the changes that occur.

### What happened?

Red cabbage has a purple dye in it called anthocyanin. When anthocyanin reacts with other substances, the molecule changes shape, and it takes on a different color depending on the substance. Cabbage juice can turn different shades of blue, red and even yellow depending on how 'acidic' or 'basic' a substance is. Acidic substances like vinegar tend to have an excess of  $H^+$ , or hydrogen, ions. Basic substances like baking soda, tend to have an excess of  $OH^-$ , or hydroxide, ions. Since these ions are charged particles, they will have a tendency to react with the anthocyanin molecules.

## **Experiment #4:** Styrofoam and acetone

### **Materials:**

Styrofoam cup or several styrofoam peanuts

100% acetone

Goggles

Rubber gloves

### **Procedure:**

5. Put on goggles and rubber gloves.
6. Pour acetone into a shallow bowl, about 1/4 inch deep.
7. Slowly lower the styrofoam into the bowl.
8. Record what you observed.
9. With gloves on, feel the slime that is created.



### **What happened?**

The foam cup is made out of polystyrene foam, which is a type of synthetic polymer. When styrofoam is produced, tiny pockets of air are blown into it, creating a light foam that works as great insulation for hot and cold drinks. This may seem like a chemical reaction, but actually it is only a physical reaction. The polystyrene gets dissolved into the acetone. As it absorbs the acetone, the trapped air gets released from the styrofoam. There are no new compounds that form, it is only a slimy mixture of acetone and polystyrene.

### **Results**

	What did you observe?	Was a new chemical compound or composite created? How do you know?
Experiment #1: chalk and vinegar		
Experiment #2: cornstarch and water		
Experiment #3: red cabbage, baking soda, and vinegar.		
Experiment #4: Acetone and styrofoam		