## Grade 2 - Lesson 5.2
## Changes Caused by Heating That Cannot Go Back Again
## Teacher Background

In Lesson 5.2, students see that heating cookie dough changes the dough in a way that cannot be changed back again by cooling. This lesson can serve as an introduction to the concept that when substances have a chemical reaction, a new substance is produced. There are several different chemical changes that occur in baking cookies, but the one that the lesson focuses on is the production of a gas by baking powder.

### Baking Powder Basics

One ingredient that is usually in cookie dough, and is responsible for producing a gas while baking, is baking powder. Homemade baking powder has two main ingredients: a dry powdered base (baking soda) and a dry powdered acid (cream of tartar). The moisture in the cookie dough and the heat in the oven causes these two ingredients to react and produce carbon dioxide gas. Some modern baking powders are more complex than the homemade variety and have three ingredients: baking soda and two powdered acids. The first acid reacts with the baking soda early in the baking process but the other acid doesn't react until it gets to a high enough temperature. This is double-acting baking powder and is the standard in many cookie dough recipes.

The lesson uses homemade baking powder (baking soda and cream of tartar) because it shows a bigger difference in gas production in cold and hot water than does double acting baking powder. This may be because the temperature of the hot water is not high enough to activate the second acid in the double-acting baking powder.

### Heat Increases the Rate of the Reaction

The main reason why hot water causes gas to be produced faster is because heat causes the molecules of the reactants to move faster and contact each other more often. Since the reactants are moving faster and making contact more frequently, they are more likely to react and produce more carbon dioxide gas.