

# The Next Generation Science Standards (NGSS)

## CHAPTER 6, LESSON 4: TEMPERATURE AND THE RATE OF A CHEMICAL REACTION

**MS-PS1-2.** Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

**MS-PS1-5.** Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.

### DISCIPLINARY CORE IDEAS

#### *PS1.A: Structure and Properties of Matter*

- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2), (MS-PS1-5)
- The total number of each type of atom is conserved and thus the mass does not change. (MS-PS1-5)

*Students use solutions of baking soda and calcium chloride that they used in the last lesson. Students see that using warmer reactants makes the chemical reaction happen faster than using colder reactants. Students are introduced to the idea that molecules need to collide with enough energy for atoms to rearrange to form the products.*

### SCIENCE AND ENGINEERING PRACTICES

#### *Developing and Using Models*

- Develop a model to describe unobservable mechanisms. (MS-PS3-2)

#### *Planning and carrying out investigations*

#### *Engaging in argument from evidence*

*Students investigate the question: Does the temperature of the reactants affect the rate of the chemical reaction? Students plan and conduct an investigation to see if a chemical reaction happens faster if the reactants are heated. Students see an animated model of a reaction showing that molecules need to collide with enough speed for atoms to rearrange and make products. Students use and further develop this molecular model and apply it to evidence they have observed to explain their observations on the molecular level and to answer the question to investigate.*

## CROSCUTTING CONCEPTS

### *Cause and Effect*

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)

### *Scale, Proportion, and Quantity*

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1)

### *Energy and Matter*

- Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)

*Students use a molecular model animation of molecules colliding to explain how heating affects the speed of molecules, and how the speed of the molecules affects the macroscopic observation of differences in the rate of a chemical reaction.*