

# The Next Generation Science Standards (NGSS)

## CHAPTER 5, LESSON 9: TEMPERATURE CHANGES IN DISSOLVING

**MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.**

### DISCIPLINARY CORE IDEAS

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

- In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4)
- Each pure substance has characteristic physical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3)

*Students dissolve calcium chloride and potassium chloride in water. Students see a different temperature change for each substance. Students see that the temperature change associated with dissolving a particular substance is a characteristic property of that substance.*

### SCIENCE AND ENGINEERING PRACTICES

#### *Developing and Using Models*

- Develop a model to predict and/or describe phenomena. (MS-PS1-1), (MS-PS1-4)

#### *Planning and carrying out investigations*

#### *Analyzing and interpreting data*

#### *Engaging in argument from evidence*

*Students investigate the question: Which solute dissolves the most endothermically and the most exothermically? Students plan and conduct an investigation and see that dissolving different substances in water results in different temperature changes. Students use molecular model animations to explain why the dissolving process can result in a change in temperature. Students use the model to explain dissolving which is exothermic (net energy releasing) and dissolving which is endothermic (net energy absorbing). 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.*

## CROSSCUTTING 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)

*Students use molecular-level models to explain how these sub-microscopic processes affect the macroscopic observable characteristic of the temperature increasing or decreasing during the process of dissolving.*