

# The Next Generation Science Standards (NGSS)

## CHAPTER 2, LESSON 5: CHANGING STATE - MELTING

**MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.**

### 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)
- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4)
- Solids may be formed from molecules, or they may be extended structures with repeating sub-units (e.g. crystals). (MS-PS1-1)
- The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)

*Students see a demonstration showing ice melting quickly on a piece of steel and slowly on a piece of Styrofoam. Students have a class discussion about the source of the heat that is melting the ice and why the melting is faster on the steel. Students warm ice by putting it in water and use their observations, the discussion, and what they have learned so far about the motion, attractions, and arrangement of molecules in a liquid and in a solid to begin to understand the process of melting.*

### 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*

#### *Asking Questions and Defining Problems*

#### *Engaging in Argument from Evidence*

*Students investigate the question: Will placing ice in water make it melt faster? Students help design an experiment to see if warming ice by putting it in water increases the rate of melting. Students see a molecular model animation and use a 3-D model of their own to better understand how and why ice changes from a solid to a liquid. 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)

*Students see and apply the cause and effect relationship between warming, increasing molecular motion, and the molecules becoming unfixed, and moving closer together to form a liquid. Students use a molecular-level explanation to explain the macroscopic effect of the ice changing to liquid water.*