

Name of Demonstration: Cryogenics

Description of Demonstration: Learn about conditions, substances, and processes at extremely low temperatures. Using liquid nitrogen, the presenter shows how substances change from solid to liquid to gas, describes the nature and importance of thermal energy in matter, illustrates the behavior of heat, and shows how substances change when their temperature is varied by hundreds of degrees. Ages 8 and up.

MN SCIENCE Grad Stand/Strand/Sub-strand: Number####:

2P 3.1.1.1

5P 2.1.1.1

8E 1.1.1.1, 8P 1.2.1.1, 8P 1.2.1.4, 8P 3.2.1.1, 8P 3.2.1.1

Grade Level(s): 2nd through 8th Grades

Content Area(s): Physical Science, Energy, Matter and Its Interaction

Learning Target(s):

1. I can explain that all matter is made of particles, either single atoms or molecules. I can identify, assess, and describe the physical properties of objects.
2. I can explain that particles are always in motion colliding with one another which can cause the matter to heat up when the particles give up some of their kinetic energy.
3. I can explain the state of a substance – solid, liquid, or gas – is determined by the velocity of its particles.
4. I can explain why heat energy never goes from something cool to something warmer. It always moves from warm to cool. I know and can explain in terms of molecular motion why objects tend to expand when they are heated and contract when they are cooled.
5. I can explain that, in scientific terms, freezing means changing from a liquid to a solid, melting means changing from a solid to a liquid, evaporating means changing from a liquid to a gas, boiling means rapidly changing from a liquid to a gas, and condensing means changing from a gas to a liquid. Also, each substance has its own freezing point, melting point, and boiling point.
6. I can create a list of causes of frostbite and explain the possibility of serious and painful injury.

Essential Question(s):

1. How does heating and cooling affect materials such as metal, glass, plastic, etc.?
2. What changes caused by heating and/or cooling can be reversed?
3. What changes caused by heating and/or cooling cannot be reversed?
4. What are the differences between liquids, solids and gasses?
5. What are the effects of thermal energy on the kinetic energy of the particles and the state of matter?
6. What effect does the transfer of energy have on the temperature of a substance? What effect does the mass of an object have on the temperature of a substance? What effect does the type of matter have on the temperature of a substance?
7. How do chemical reactions affect the properties of substances?
8. What happens when molecules are in motion, or not in motion?
9. What causes frostbite? How does the freezing of cell tissue relate to the movement of particles?

Key Vocabulary: Molecules, Cryogenics, Liquid Nitrogen, Nitrogen, 321°(Degrees) Below Zero, Gas, Liquid, Solid, Fahrenheit, Celsius, Chemical Reaction, Cells, Cellular Composition, Cellular Structure, Properties (changes), State of Matter, Freezing, Melting, Evaporating, Boiling, Condensing, Molecular Motion

Prerequisite Terms: Atom, Differences, Effects, Energy, Energy Transfer, Heat Energy, Investigation, Kinetic Energy, Mass, Model, Particles, Phenomena, Similarities, Temperature