



Classroom Teacher Preparation

Chemistry 11: States of Matter

Please use the following to prepare for the next SfS lesson.

Description:

This module provides students with an introduction to the states of matter, especially phase transitions. Through observations with dry ice, students will get to see both water and carbon dioxide change phases in multiple ways and understand how heat energy causes these changes.

Lesson Objectives – SWBAT (“Students Will Be Able To...”):

3rd-8th

- Identify the transitions between two states of matter:
 - Melting (solid → liquid) & Freezing (liquid → solid)
 - Evaporation/vaporization (liquid → gas) & Condensation (gas → liquid)
 - Sublimation (solid → gas) & Deposition (gas → solid)
- Explain the role of heat energy in phase transitions

Disciplinary Core Idea (DCI)

PS1 Matter and its Interactions - PS1.A: Structure of Matter

- (3rd-5th): Because matter exists as particles that are too small to see, matter is always conserved even if it seems to disappear. Measurements of a variety of observable properties can be used to identify particular materials.
- (6th-8th): The fact that matter is composed of atoms and molecules can be used to explain the properties of substances, diversity of materials, states of matter, phase changes, and conservation of matter.

Science & Engineering Practice (SEP)

Constructing Explanations

- (3rd-5th) Construct an explanation of observed relationships (e.g., the distribution of plants in the back yard).
- (6th-8th) Construct an explanation that includes qualitative or quantitative relationships between variables that predict(s) and/or describe(s) phenomena.

Crosscutting Concept (CCC)

Energy and Matter: Flows, Cycles, and Conservation

- (3rd-5th) Matter is made of particles.
- (6th-8th) Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

Preparation:

It is helpful for the students to be familiar with the three states of matter most commonly observed in our daily life: solid, liquid, and gas.



Room Set Up for Activities:

This lesson will begin with an activity involving three groups of students modeling states of matter, with themselves at the atoms. Some open space for this demonstration would be helpful. The students will then work individually for the rest of the activity, and will be able to remain at their desks. Access to a sink will be required for cleanup. Outlets may be needed for one demonstration.

Safety:

This lesson uses dry ice in an empty cup and submerged in a cup of water. Dry ice is extremely cold and can cause frostbite if handled incorrectly. In addition, there is a risk of asphyxiation if the dry ice is swallowed. The instructor will review the safety procedures, but students should be carefully monitored to ensure they do not touch the dry ice or try to ingest either it or the water in which the dry ice is submerged.

Related Modules:

This lesson may be taught as part of a sequence or group of related modules on **Weather** or **Chemistry**. Other modules in these sequences include:

Chemistry 1: Properties of Water - This module explores the unique properties of water through a series of activities, including cohesion, adhesion, density, and heat capacity.

Earth Science 12: Water Cycle - This module presents a game (where students act as water molecules) that explains how water cycles through different forms and storage types on Earth and in Earth's atmosphere.

Chemistry 14: Viscosity - Students investigate viscosity by using falling sphere viscometers to examine the speed at which a marble drops through tubes of common household liquids with varying viscosities.

For other module sequences and groups, look here: <http://www.sciencefromscientists.org/sequences>

Standards Covered:

Please click the following link to our website to review the standards covered by this lesson, listed by state: www.sciencefromscientists.org/standards/

Lessons are matched to both national NGSS and local state standards.

After Our Visit:

Extend this lesson by creating homemade ice cream from scratch, utilizing the chemical properties of salt and its effect on the freezing point of water.

Access this Extension activity by visiting the Classroom Post found on our website at sciencefromscientists.org/cohorts. Use the name of your school/cohort and password to log in.

To help Evaluate, check out our Open Response questions online at sciencefromscientists.org/open-response-questions. They are freely available for all of our lessons for current teachers. Use the password supplied by your instructor to log in.

Additional Resources:

- "Why Is Dry Ice Dangerous?" (2:20): <https://www.youtube.com/watch?v=haXZZvmDJsE>
- Series of Crash Course Kids videos on matter: <https://www.youtube.com/watch?v=wyRy8kowsM8>

