Sciencenter

Revised December 2024

STATES OF MATTER

TEACHER MATERIALS

States of Matter is an add-on educational program for your field trip to the Sciencenter. In addition to plenty of time to explore museum exhibits, a States of Matter field trip includes a hands-on program investigating properties of matter.

Program Overview

States of Matter is an NYS science standards-aligned, hands-on program for students in grades K-2. During the programmatic portion of the program, students will explore one of two unusual properties of matter: sublimation or non-Newtonian fluids.

When available, students will investigate sublimation with dry ice. Unlike water ice, which melts from solid to liquid, dry ice (frozen carbon dioxide) sublimates from a solid to a gas at room temperature. After an interactive presentation introducing dry ice and demonstrating some of the interesting things that we can do with it, students will investigate dry ice with a hands-on sublimation bubbles activity.

If dry ice is unavailable, students will instead engage in an interactive presentation about states of matter followed by a program session investigating oobleck, a mixture of cornstarch and water that acts as a non-Newtonian fluid.

NYS Science Standards Alignment

This program supports the following performance expectations:

- **K-PS1-1** Plan and conduct an investigation to test the claim that different kinds of matter exist as either solid or liquid, depending on temperature.
- **2-PS1-1** Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

This program addresses the following elements of three-dimensional science learning:

Science & Engineering Practices	Engaging in argument from evidence Asking questions and defining problems Planning and carrying out investigations
Crosscutting Concepts	PS1.A Structure and properties of matter Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.
Disciplinary Core Ideas	Patterns Energy and matter

Planning Resources

Chaperone Guide

We encourage you to review and share the Sciencenter Field Trip Chaperone Guide, available to download here. This document contains important information about how the day of your field trip will run, and is a helpful overview of what you can expect during your visit to the museum!

Sample Field Trip Schedule

The **Sciencenter team will create and share a schedule** of lunch and visit times for your group based on the number of classes and participants attending the field trip. This schedule, as well as additional information about getting to the museum, will be shared with you one week in advance of your trip. Here's a sample schedule to give you an idea of what to expect. If you have any questions or concerns about your group's schedule, please reach out to fieldtrips@sciencenter.org! The hands-on portion of the States of Matter program will last approximately 15 minutes for each group, with the demonstration in the beginning taking another 15 minutes (approximately 30 minutes of program time total).

GROUP 1	GROUP 2	GROUP 3
10:00 Welcome & Orientation in Connection Zone		
10:30 Program in Classroom	**10:50** Program in Classroom	**11:10** Program in Classroom
11:00 Lunch in Community Room	**11:20** Lunch in Community Room	**11:40** Lunch in Community Room
12:55 Reconvene for departure at Franklin Street Entrance		

Complementary Activities for Your Classroom

We've compiled a couple of optional extension activities that we recommend trying in class or sending home for students to try with their families. We would love some feedback as to which of them you used with your class, how you used it, and how it went! Send feedback and photos to fieldtrips@sciencenter.org. Printable activity guides can be found at the end of this document.

- *Investigate Flubber:* Explore a non-Newtownian fluid made from glue, water, and borax.
- *3 States in One:* Investigate shaving cream, which doesn't fit neatly into the category of solid, liquid, or gas.
- *Tasty State Change:* Make ice cream in a bag!

Investigate Flubber

Invite students to use a variety of tools to explore the properties of flubber, a non-Newtonian fluid that sometimes acts like a solid and sometimes acts like a liquid.

Materials:

- ☐ Flubber, pre-made (glue, water, borax)
- ☐ Variety of tools for flubber exploration
- ☐ Optional:

Flubber Recipe

- ☐ 3 cups of very warm water, divided
- ☐ 2 cups of Elmer's white glue
- ☐ Liquid watercolor
- ☐ 2 tsp 20 Mule Team Borax

1. In a large container combine 1 ½ cups very warm water, 2 cups glue, and a few drops of liquid watercolor. Mix well.
2. In a small container, combine and mix 1 1/3 cups very warm water and 2 tsp 20 Mule Team Borax. Mix until the Borax is completely dissolved.
3. Combine the glue and borax mixtures. Mix well using your hands until all the liquid is absorbed. You may need to squish, mix, and break up the flubber to get it fully combined. Store the flubber in a plastic, airtight container at room temperature. For best results, measure precisely and mix well as noted above.

Setup

Pre-mix a batch of flubber, and divide it up so that each student/pair has their own sample. Provide a tray and a variety of tools for students to explore the flubber. We use: plastic scissors, cookie cutters, potato mashers, rulers, rolling pins and extruder tools to demonstrate a variety of properties with the flubber.

Try this!

- Invite students to explore the flubber using a variety of tools!
- Try measuring how far they can stretch the flubber. Does it stretch further if it's stretched quickly, or slowly?
- Students can record their observations. When does the flubber act like a solid? Like a liquid? Does it ever hold its shape?

3 States in One

Challenge yourself to explain an interesting state of matter. Reinforce knowledge of the three states of matter, practice making observations, and engage in argument from evidence.

Materials

- ☐ Can of shaving cream
- ☐ Paper towels
- ☐ Penny
- ☐ Magnifying lenses

Try this!

1. Squirt some shaving cream onto a piece of paper towel and observe it. If possible, examine it with a magnifying lens.
2. Try blowing gently on the shaving cream.
3. Try rubbing some between your fingers.
4. Carefully place a penny on top of the shaving cream and observe what happens.
5. Leave the shaving cream overnight and observe again in the morning. Leave it for several more days. How has it changed?
6. For clean science fun, put some shaving cream directly on the students' desks. After they have observed it, they can use the soapy foam and wet paper towels to clean their desktops.

Explanation: Students have learned the properties of different states of matter, but some matter doesn't seem to fit well into any category. For example, what is shaving cream? Shaving cream is a mixture of solid, liquid and gas! The solid soap mixed with liquid water traps tiny air bubbles forming foam.

Tasty State Change

Show a state change from liquid to solid by making ice cream.

Materials

- ☐ Half and half
- ☐ Sugar
- ☐ Vanilla
- ☐ Chocolate syrup
- ☐ Ice
- ☐ Salt
- ☐ Pint-sized Ziploc bags
- ☐ Quart-sized Ziploc bags
- ☐ Thermometer

Try this!

1. Place ice in two cups. Add salt to one of the cups. Measure the temperatures in each of the cups and record them.
2. To make the ice cream, put the liquid ingredients for each student in a pint sized bag and seal carefully.
    a. Recipe per student:
        i. ½ cup half and half
        ii. 1 tbsp sugar
        iii. 1 squirt of chocolate syrup or a few drops of vanilla
3. Place the pint bag inside a quart bag and fill on both sides with ice and salt. Seal the outer bag carefully.
4. Shake until the liquid ingredients turn into ice cream.
5. Discard salt and ice. Rinse the pint bag before opening. Students can eat ice cream directly from pint bags.