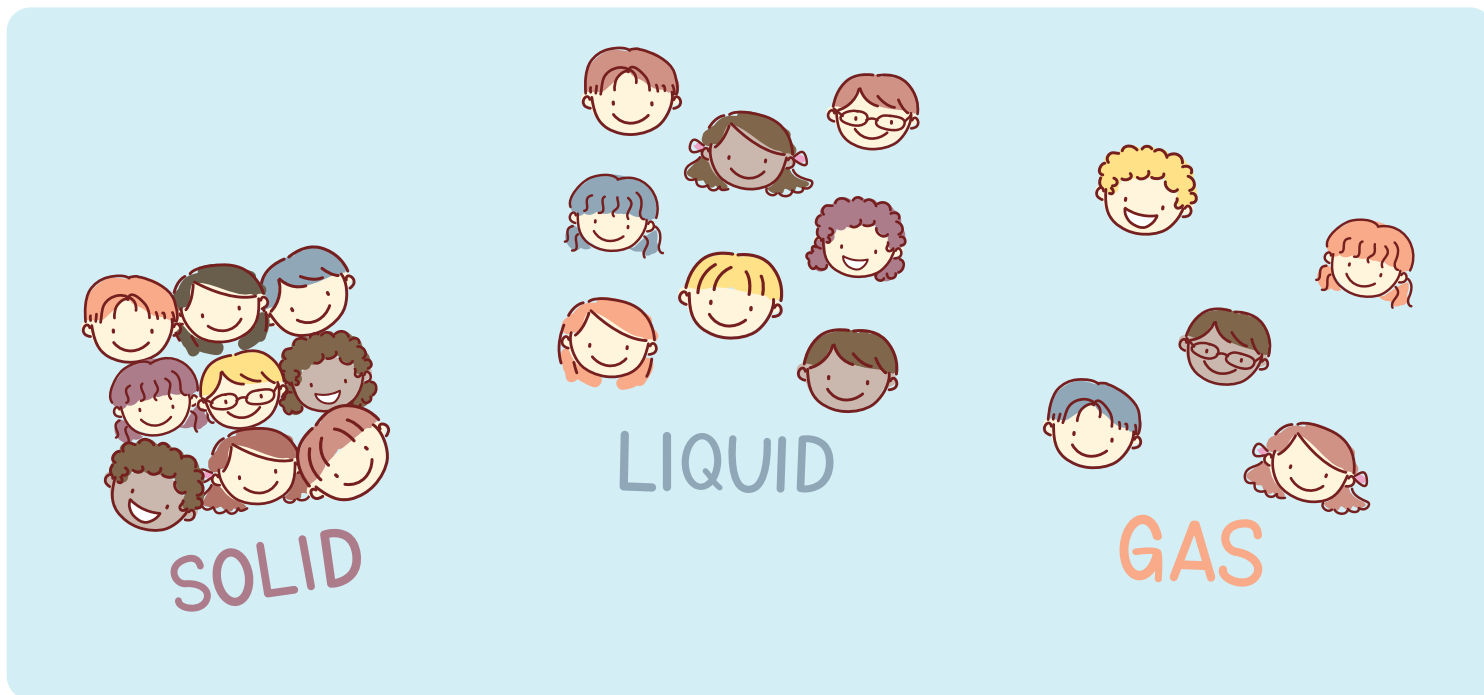


LESSON

Molecule Madness

Grade Level: 2
Duration: 30 min

Students will use their own bodies to demonstrate how molecules are arranged and move within the three states of matter: solid, liquid, and gas.



Outline

Frame the Activity	10 min total
Activate Prior Knowledge	10 min
Playing the Game	20 min total
Game Play	15 min
Debrief	5 min

Grade Level: 2

Duration: 30 min

Concepts/Skills

States of matter, teamwork

Objectives

Students will:

- Identify the three most common states of matter – solids, liquids, and gasses.
- Demonstrate the molecular patterns of arrangement and movement for the three states of matter: solid, liquid, and gas.
- Identify the states of matter of different objects.



Lab Connection:

Make it Matter

Materials and Preparation

Materials

For the lesson:

- Large space where students can move around freely
- Optional:* Print or project [Molecule Madness Graphic](#) for the class

Preparation

1. Plan for a space to do the activity. Use a large, open space where students can run around, like a gym, field, or blacktop.
2. *Optional:* Prepare the [Molecule Madness Graphic](#).



Lab Connection

If you took the [Make It Matter lab](#) at The Tech Interactive, plan to have students recall their experience at the beginning of the lesson.



Frame the Activity

Activate Prior Knowledge (10 min)

1. Start by reviewing what students have already learned about the three states of **matter**.
 - Have students name the three states of matter and give examples of each.
 - Ask students to describe the basic **properties** of each state. Student responses may vary, but they should generally include:
 - **Solid:** a hard object; does not change shape on its own.
 - **Liquid:** an item that flows; takes the shape of a container it is in.
 - **Gas:** something we may not be able to see; does not take the shape of the container it is in.
2. Let them know that today they are going to be learning about **molecules**, or two or more **atoms** bonded together.
 - Emphasize that while all matter is made up of molecules, they are arranged and move in different ways depending on the object's state of matter.
3. *Optional:* Show students the [Molecule Madness Graphic](#) and ask them to identify how the molecules are arranged and move for each state of matter. Students responses may include:
 - Solids: molecules are tightly bonded so that they can't move easily.
 - Liquids: molecules are more loosely arranged and can flow and move past each other.
 - Gases: molecules are very loose and move very easily past each other.
4. Tell students that they are going to explore how the molecules move in these three states by pretending to be molecules.



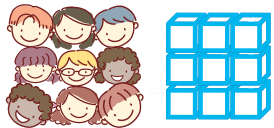


Check out the [Explore Design Challenge Learning](#) page for tips on how to help learners become creative problem solvers. Here you can find a variety of Tech Tips, videos, and downloadable resources.



Play the Game

Molecule Madness (15 min)

- Gather your students outside on a large flat surface like a basketball court.
- Let your students know that they are going to play the role of “molecules.”
 - You are going to call out different types of objects. The goal is to work together to show what state of matter the object has.
 - First, they are going to practice what each state of matter looks like.
- Arrange the students in the following configurations:

<p>Solid</p>	<p>Put students into straight rows and columns to form a solid square. They should be very close together and not be able to move around easily.</p> <p>Tip: If you have a four square court, this is ideal for setting up students into solid state.</p>	
<p>Liquid</p>	<p>Put students into groups of three or four and have them link arms. Now have them move around the space, flowing past each other.</p> <p>Tip: If they start to drift out of the designated space, remind them that liquids don't move out of their container on their own.</p>	
<p>Gas</p>	<p>Each student is their own molecule, free to move around however they decide.</p> <p>Tip: Unlike liquids, gases can even move outside the space.</p>	

- After students practice all three states of matter, start the game. Call out random objects and have students get into the matching configuration. Use the examples below or come up with your own.
 - Solids – ball, pencil, stuffed animal, marble, chair
 - Liquids – water, orange juice, olive oil, shampoo
 - Gasses – water vapor, oxygen, helium



Lab Connection

If the class has already attended the [Make It Matter](#) lab at The Tech Interactive, try using the attention getters for solid, liquid and gas.



Debrief (10 min)

1. Bring the class back together. Ask guiding questions to debrief from the game.
 - *What did it feel like to be a molecule at the different states of matter?*
 - *What are some differences between how the molecules at different states of matter move?*
 - *Say you froze water into an ice cube. How would this change how the molecules in the water move?*



Career Connection: Chemical Technician

In the real world, conducting tests on matter is essential for quality control, or making sure products are safe for people. Chemical technicians assist scientists with making qualitative or quantitative analyses of solids, liquids, or gaseous materials. They conduct laboratory tests on materials to develop or improve on consumer products, but also to ensure that these products adhere to safety regulations and have minimum environmental impact. Chemical Technician jobs usually require an associate's degree in chemical technology or applied science.

To learn more about a career as a Chemical Technician, check out the resources below.

- **Become an Expert:** Explore the ["American Chemical Society's Educational Resources,"](#) ACS website for videos, activities, games and other interactive content on the world of chemistry.
- **Try it:** Check out our [Tech at Home](#) chemistry activities! Mix your own colorful paints with [Cabbage Inks](#) or experiment with oxidizing compounds with [Green Pennies.](#)
- **Play it:** Enjoy learning more about molecules by playing a game? Try free online games that engage students in the scientific method, like ["The Meaning of Beep: Scientific Method,"](#) BrainPOP website, or ["Science Games,"](#) PBS Kids website.

Standards Connections

Next Generation Science Standards

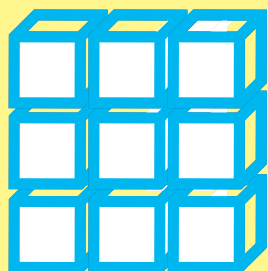
Grade	Performance Expectation	Description
2	2-PS1-2	Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
2	2-PS1-2	Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
Science and Engineering Practices		Asking Questions and Defining Problems Planning and Carrying Out Investigations
Cross Cutting Concepts		Patterns Cause and Effect Structure and Function

Vocabulary

- **Atom:** A particle that consists of a nucleus of protons and neutrons surrounded by a cloud of electrons
- **Gas:** A state of matter that does not have its own defined shape, mass, or volume and will completely fill any container they are placed in (i.e., air, helium, and oxygen)
- **Matter:** Any substance with mass and takes up space by having volume
- **Molecule:** Two or more atoms bonded together to make up a chemical substance
- **Liquid:** A state of matter that does not have its own shape but takes the shape of the container it is in. It has its own defined weight and volume (i.e., water, milk, and juice)
- **Properties:** Physical characteristics of an item (shape, size, strength, color, etc.)
- **Solid:** A state of matter that has its own defined shape, weight and volume (i.e., wood, metal, and plastic)

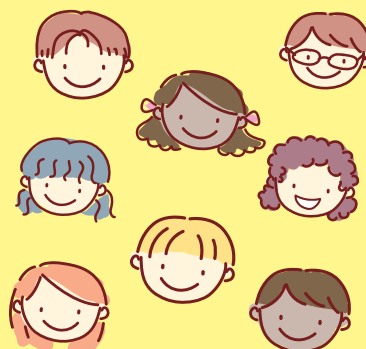
Molecule Madness Graphic

Solid



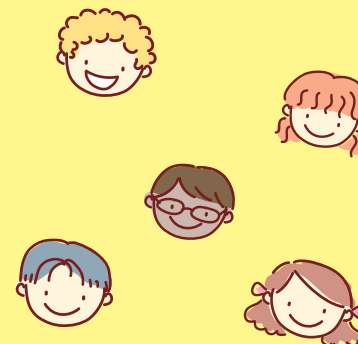
Definite shape
and volume

Liquid



Shifting shape,
definite volume

Gas



Shifting shape
and volume