

EARLY Elementary States of Matter

Preparation

Grade Level: K-2	Group Size: 25-30
Time: 45 minutes	Presenters: 3-5

Objectives:

The lesson will enable students to:

- Define three states of matter.
- Describe the characteristics of each state of matter.
- Provide examples of matter movement from one state to another.

Standards:

This lesson aligns with the following National Science Content Standards:



- Physical science, grades K-8

Note: While we strive to make our lessons as safe as possible, there are risks inherent in using certain equipment or materials. Safety guidelines have been published where necessary within each lesson. Please ensure that you have adequately reviewed the lesson and have the information and materials necessary to perform it safely. Micron is not liable for any injuries that result from use of these lessons. Some of the equipment and materials used in the States of Matter lesson can pose a safety hazard if used incorrectly. Follow all safety guidelines and instructions as noted within the text of the lesson and with the materials provided in the kit to avoid potential injury.

Materials:

- Examples of a solid, a liquid, a gas
 - Rock
 - Bottle of oil
 - Balloon or packing pillow
- 2 Posters
- Container with Styrofoam balls
- 20+ feet of rope
- Electric kettle
- Ice cubes (optional: food coloring added)
- Metal or glass pie plate or lid
- Small disposable cups
- Small disposable plates or bowls
- Disposable ~10" aluminum baking dish
- Cornstarch
- Pitcher of Water
- Paper towels

Preparation

Prior to arriving at the school, make colored ice cubes, or buy a bag of cubed ice.

Set up each of the stations with the equipment needed.

Introduction: Examples of Solid – Liquid – Gas, Posters. Have the rock, bottle of oil & balloon or packing pillow hidden at the front of the room.

*Station One: **Solid–Liquid–Gas Molecules.** Have the plastic container filled with the small foam balls and the long rope ready to use. This can be included as part of the introduction.*

*Station Two: **Ice Changes State.** Fill the kettle with water & turn it on to heat the water. Place one small disposable cup at each of the students' seats. Have*

*Station Three: **Ooblek – solid & liquid at the same time.** Place the cornstarch, food coloring & water with the aluminum plate at the table for this station. Have one disposable plate/bowl for each student. Have wet towels ready for cleanup.*

Introduction

Materials: *Rock & small clear plastic cup
Bottle of Oil
Packing Pillow or Balloon
2 Posters*

Begin the presentation with all of the students in a large group.

Matter is the word for everything around us, everything that exists on the earth. Matter exists in different states, each feels and looks different. There are three states that we are going to talk about today: SOLID, LIQUID, GAS. A solid stays the same shape and size. A liquid can change its shape easily, but the amount of liquid doesn't change. A gas can change its shape and size easily.

Ask the following questions and allow enough time for the students to answer.

Hold up the SOLID (rock)

Q: Who can tell me what state this is? Is it liquid? Is it solid? Is it gas?

A: A rock is solid. When we press on it or move it around, it does not change its shape.

Q: What are examples of solids?

A: Rocks, chairs, trees, books

Q: How does a solid feel on your skin? If something is a solid, can we see it?

A: *Let the students answer.* Hard, smooth, etc. Solids are easy to see.

Hold up the LIQUID (bottle of oil)

Q: Who can tell me what state this is?

A: This oil is liquid. Look how it changes its shape when I move the container around.

Q: What are examples of liquids?

A: Oil, water, orange juice, syrup

Q: How does a liquid feel on your skin? If something is a liquid, can we see it?

A: *Let the students answer.* Cool, wet, etc. Liquids are usually easy to see.

Blow up a balloon or hold up an air filled packing pillow

Q: What is this filled with?

A: Air!

Q: What state is air? Is it solid? Is it gas? Is it liquid?

A: Air is a gas. You cannot see it, but you can see that it is taking up space inside my balloon.

Look how I can change its shape by pushing on the balloon. If I pop the balloon, the air will escape and fill this room.

Q: What are examples of gases?

A: Helium in balloons, air (nitrogen and oxygen).

Q: How does a gas feel on your skin? If something is a gas, can we see it?

A: *Let the students answer.* Gases are not always something you feel or see.

We are going to do some activities to help us learn more about these three states of matter, and how matter moves from one state to another.

Use the Energy Levels poster to support the discussion on energy levels.

Matter can move from one state to another state when physical forces are applied. These physical forces either add or remove energy. Heat is one example of a physical force.

Q: How is heat measured?

A: Heat is measured by temperature.

Q: Is energy added or removed when temperature increases?

A: Energy is added when temperature increases.

Q: What is something you see every day that could go from a solid to a liquid?

A: Water can move from a solid, to a liquid, and then to a gas. It can also move from a gas to a liquid and then to a solid.

Solid, Liquid, Gas molecules

Materials: *Closed clear container with small Styrofoam balls*
 Small bucket – used to pour small balls out
 20 feet of rope

MODEL

We are all scientists today and scientists use models. This container is a model of molecules. Right now the molecules are very tightly packed together. This acts like a **SOLID**. The molecules do not change position when I move it around. The molecules have low energy.

Pour out about 1/3 of the balls

Now the molecules are loosely packed. This acts like a **LIQUID**. The molecules move around as I move the container. The molecules have more energy than the solid.

Pour out most of the remaining balls & shake the container

Now the molecules are not packed at all. This acts like a **GAS**. The molecules move all around the container. The molecules have very high energy.

GAME

Now we are going to play the “**solid, liquid, gas**” game. *Choose whether to have all students at once, or just ½ and repeat for the other ½. Ideal size is 8–10 students.*

Each of you is a molecule, and you are going to change from a solid to a liquid to a gas. Stand close together. *Put the rope on the floor around the students.*

All of you are a **solid**. The molecules have low energy and are packed close together. You must stay close together (and don’t fall down). *Pretend to ‘tip’ the container.* The molecules (student) move, and because they are inside the solid they stay together. Move your feet, don’t fall down!

I am adding “energy”. Now move apart just a bit. You are all a **liquid**. The molecules have a little more energy and are loosely packed together. I am ‘tipping’ the container toward the door. *Use your arms to make the motion of tipping a large bowl.* You all move toward the door, but stay in the container & don’t fall down. I’m tipping you the other way. Move like you are liquid molecules. *Students should move as a group from one side to the other, staying in a loose group.* The ‘bowl’ has stopped moving, what happens to the liquid? *Have them “settle” to the bottom of the circle, like a liquid would in a cup.*

I am adding more “energy”. Now spread out and move around, but the container is closed, so you have to stay in the circle. *Have them move around and wiggle without bumping into a neighbor.* You are a **gas**. The molecules have high energy and spread out to fill the entire space inside the container. I’m ‘opening’ the container, now you gas molecules float out and return to your seats. *Separate the ends of the rope and motion the students to leave the circle and return to their seats.*

If you split the students, have the other ½ of the students participate now.

H₂O Changes State

Materials: *Electric kettle*
 Ice cubes (optional: food coloring added)
 Clear glass bowl or lid
 Small cups (one for each student)

Fill the kettle ½ full with water and turn it on before starting the presentation. For safety reasons, turn it off just prior to starting this station. Pass out an ice cube in a cup to each student. Ask them what state it is in.

Q: What is in the cup? What state is it?

A: Ice Cube. Solid. It is solid water / H₂O.

Q: What must happen to change the ice into another state? What is the next state it will go into? How can we make that happen?

A: Add energy! It will turn into water, a liquid. Add heat. Add hot water.

Put some ice cubes into the water in the kettle.

Q: What is going to happen to them? What will happen to their shape?

A: They will get smaller. *Watch them melt.*

Q: What will happen after the ice cubes have turned to liquid and more energy is added? What is the next state water moves to? *Turn on the kettle.*

A: Steam will rise up out of the water.

Q: Where are the gas molecules are going?

A: Above the kettle.

Place 2–3 ice cubes inside the lid/bowl, tell the students that will make the glass cold. Hold the glass bowl/lid over the kettle, allowing the water vapor to hit the spot that has been cooled. When there is water condensing on the bowl/lid, show the students the liquid that has formed.

Q: What do you see happening on the glass?

A: Water vapor / steam hits the glass, temperature cools down, returns to liquid state.

Oobleck

Materials: *Large flat pan (disposable aluminum baking dish)*
 Cornstarch
 Pitcher of Water
 Food Coloring (optional)
 Small disposable bowls
 Plastic spoons
 Paper towels

Put 2 cups of cornstarch in the dish, add 1½ cups water & a small amount of food coloring. Use a spoon to mix everything together until it forms a thick paste.

Add a small amount into each student's bowl. Place a small bowl & spoon in front of each student.

I have mixed cornstarch & water to make this oobleck. The cornstarch starts as a powder, which is a solid. What state is the water? *Let students answer.*

Scoop up some oobleck and let it pour off your spoon. When pressure is applied to the oobleck it acts like a solid.

Q: Is this oobleck a solid or a liquid? *Instruct the students to scoop the oobleck with the spoon and watch it pour off the spoon as a liquid. Next encourage the students to poke the oobleck with the spoon (or finger) and see how it becomes solid.*

A: *Let students answer.*

Allow each student to explore the oobleck in their bowl. Trying to avoid too big of a mess.

Most of the time Matter is only solid, or only liquid, or only gas. This is an example of something that can exist as both a solid and a liquid.

Conclusion

Materials: *Examples of solids, liquids and gases.*

Ask students what they learned about the differences between solids, liquids and gases. Show each of the examples and have the students classify them as solid, liquid or gas.

States of Matter

Gas

- **Indefinite shape** – Gases fill a container of any size or shape
- **Indefinite volume** – The volume is defined only by the size of its container
- Molecules have a lot of free space between them, and move freely at high speeds



Liquid

- **Indefinite shape** – Liquids fill the shape of a container
- **Definite volume** – Liquids are hard to compress
- Molecules are somewhat close together, with room to move and slide past each other

Solid

- **Definite shape** – Solids hold their own shape
- **Definite volume** – Solids are hard to compress
- Molecules are tightly packed, with very little room for movement



Foundation
Micron

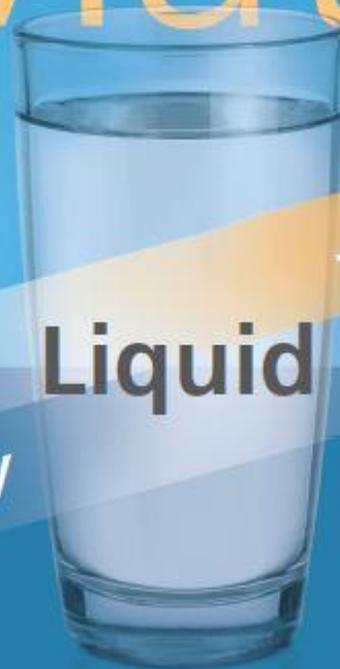
States *of* Matter



Solid

+ Energy

- Energy



Liquid

+ Energy

- Energy

Gas

