

States of Matter

Teacher Lesson Plan



Background Information

What is Matter?

- Matter is anything that has volume (takes up space) and has mass. It is all around you.
- All matter is made of atoms, the building blocks of the universe. Atoms can chemically combine to form molecules.
 - As there are 26 letters in the alphabet combining to form words, there are 117 elements made up of atoms that combine to form thousands of molecules (refer to *NEED Elementary Infobook*).
 - Water is a common molecule to 3rd graders. The water molecule is a combination of 2 hydrogen atoms and 1 oxygen atom.
- Matter can be found in different states - solid, liquids and gases.
 - Solids – Particles are tightly packed and do not move freely. They vibrate in place and have a low amount of energy.
 - Liquids – Particles are loosely packed and can slide past each other or flow. They take the shape of the container. Liquids have a medium amount of energy and are constantly moving. They have an indefinite shape but a definite volume.
 - Gases – Particles are far apart, have a high amount of energy and are constantly moving fast. They have no definite volume or shape. The particles flow. They will spread out in all directions and fill as much space (volume) as they as permitted.
 - Plasma is considered a fourth state of matter. It is superheated matter that has a charge because electrons have been stripped away forming an ionized gas. It is affected by magnetic material. Because it can require high temperature and pressure, it is mainly found in stars and in space. It may occur in the Earth's ionosphere caused by lightning. It is also the cause of the Aurora Borealis. Electrons may also be stripped from the nucleus with the energy from electricity. This takes place in a fluorescent light bulb. Electronics will use this type of plasma for neon lighting and plasma television screens.
 - ❖ You may note this with your students, but it is not part of third grade science standards.
 - ❖ [Video: Introduction to Plasma](#)
- We are all made of the 3 major states of matter:
 - What are examples of solids in you? Bones, some organs
 - What about liquids? Blood, water
 - What about gases? Air in our lungs, gases in our stomach (air bubbles)

Introduction/Engage

1. States of Matter Pre-Poll
2. Three States of Matter Balloon Activity
 - Lesson Materials – 6-inch balloon, empty water bottle, white vinegar, baking soda
 - Explain the procedure to your students. Have them complete the prediction on the student worksheet.
 - Steps:
 - Pour 1 inch of vinegar into an empty water bottle.
 - Add 2 tablespoons of baking soda into the balloon. Using a funnel helps.
 - Quickly put the balloon over the bottle. You may need to shake the balloon to get the baking soda to fall into the bottle. Watch the balloon enlarge showing the gas formation in the bottle and balloon. A solid (baking soda) was added to a liquid (vinegar) and produced a gas (carbon dioxide).
 - Post demonstration – Have them complete their observations and questions.
 - Answer Key –
 - Answers will vary for Predictions, Observations and Drawings
 - 1. liquid
 - 2. solid
 - 3. gas
 - 4. combining the vinegar and baking soda.
 - 5. The gas is carbon dioxide, however, any type of gas is an acceptable answer at this point.

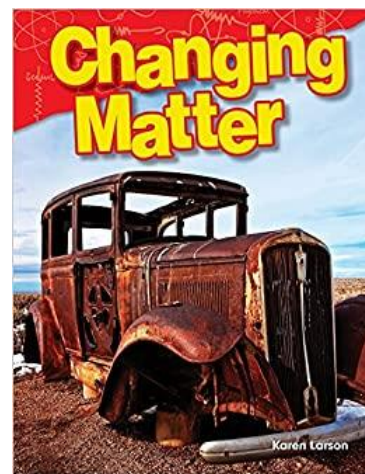
Changing Matter by Karen Larson

Key Vocabulary:

- *Atom*-Tiny particles that make up all matter.
- *Chemical Change*-A change that results in a new substance.
- *Molecules*-The smallest possible amounts of a particular substance that have all the characteristics of the substance.
- *Physical Change*-A change that does not form a new substance.
- *Properties*-Special qualities or characteristics of something.

Book Talk

Can you imagine a world without ice cream? I wouldn't want to. Thanks to energy, we can mix up some milk, sugar and other ingredients and freeze it to an icy concoction. Placing that icy treat on our warm tongue will melt it into a delicious treat. You changed a state of matter by eating that treat. Our planet wouldn't exist without states of matter. Water changes from vapor to liquid water to ice all the time all over the Earth. Plants and animals need it to survive. What makes liquid water different from ice? What makes ice different from water vapor? It's just one word? Can you guess what it is? Let's read the book "*Changing Matter*" by Karen Larsen and see if you are right.



Read *Changing Matter*

- Before reading the book, pass out discussion questions to students. Have students pre-read the questions to get an idea of what they should be listening for while you read.
- While reading book, students answer discussion questions
- Give time to complete questions after reading.
- Discuss answers to questions.
- Additional Ideas for Discussion Questions:
 - If the entire page of questions is too much for your students, consider breaking up the questions, assigning each student 1-2 questions to answer while you read.
 - When you are done reading have students find someone with the SAME question and meet to discuss their answers, looking for similarities and differences in their thinking
 - Likewise, you may choose to have students find someone with a DIFFERENT question and meet to share their answers.

Reinforcement

1. Act It Out

Students can also use their bodies to act out the three states of matter.

- Solid: Wiggle or sway in place
- Liquid: Arms apart waving and slowly walking around
- Gas: Walk or jump fast around waving arms

For a challenge, call out Solid, Liquid or Gas. Students must switch movements to match the state of matter.

2. With the class, take your students for a walk around the school grounds and have them identify examples of solids and liquids, such as the water fountain, milk in a container, books, desks, etc.

Discuss observations by asking the following questions.

- How did you use your senses to observe physical properties of solids and liquids?
 - I can touch and feel if something is hard”
 - I can look at it and see if it is something wet.
- What similarities and differences determine how a solid and liquid should be classified?
 - Solids are hard and liquids are not.
 - You can pour a liquid.
 - Solids keep their shape and liquids take the shape of the container.

3. Activity Ice Melt Challenge: Divide students into 10 groups.

Materials:

- Prepare an ice cube in a zip loc bag for each group. Smaller ice cubes will speed up results.
- Timer projected on Smart Board
- Student Worksheet: Ice Melt Challenge

Explain to your students that the goal of this activity is to melt their ice cube as fast as possible. Instruct them that they may use anything in the classroom to accomplish this goal. .

Procedure:

- Allow students to record their plan on their data sheet.
- Ice cubes should be zipped in bags before distributing. They can be kept in a cooler.
- Students will predict and record the time it takes for the ice cube to completely melt.
- Record time after ice cube has melted.
- Share class data and make a bar graph with results.
- Answer data sheet questions.
- Discuss methods students used to melt their ice cube.

Student Worksheet Answer Key

Answers will depend on the gathered mass and time of melting. Each student will have their own plan to melt the ice cube.

Next time we would...**Students will come up with a new plan to melt their ice.**

- Ice began as a **solid** and changed to a **liquid**.
- This process is called **melting**. **Heat** was added to cause the change.

Assessment

Lesson Materials:

- States of Matter Wall Graphics
- Student Worksheet: States of Matter Wall Graphic

Begin to post the states of matter graphics on the wall. Near each sign for solid, liquid and gas, students can place the definite/indefinite shape and volume cards and the high/medium/low energy cards.

Procedure:

1. Water can change states by adding or taking away heat energy. Using the states of matter cards, have students use the word arrows to show how energy is transferred to change states of matter.
 - Melting – if an ice cube is left on the counter, the ice will take heat ENERGY IN (show with red arrow on solid ice to liquid) from the air and will MELT to form water.
 - Evaporation/Boiling- If the water is left on the counter, it will take ENERGY IN from the air and EVAPORATE. If the cube is put on a hotplate, the water will take ENERGY IN (show with red arrow on liquid to gas) and will BOIL and turn into a gas or steam.
 - Condensation - if we take ENERGY OUT (show with red arrow on gas to liquid) of a GAS, it will become a liquid again or CONDENSE.
 - Freezing – if we take ENERGY OUT (show with red arrow on liquid to solid) of a liquid to go back to an ice cube, the liquid will have to go into the freezer to remove even more heat energy. The water will reach the freezing point and become an ice cube.

2. Add the melting/boiling/freezing/condensation arrows to the graphics.
3. Add the Energy In/Energy Out Arrows to the graphics.



Evaluation

1. Life Cycle of a Snow Man – Students will write and illustrate the 3 steps of the building, melting and finally evaporating the water that makes up a snowman.
2. States of Matter Cut & Sort – Using the student worksheet, students cut apart the different words and sort them into the correct category of solid, liquid or gas.
3. States of Matter Post-Poll

Other Activities:

- Make Jell-O reinforcing the three states of matter. It starts with a solid (the powder), add water (liquid) and through boiling, a gas is produced. After putting it in the refrigerator (taking energy out), the Jell-O has turned back into a solid.
- Three balloons-Make them all the same size.
 - ❖ Fill one with water and freeze overnight
 - ❖ Fill one with liquid water
 - ❖ Fill one with air

Ask students to use their knowledge of solids, liquids and gases to prove which state of matter is in each balloon.

- Make a Venn diagram, showing the relationship between states of matter.
- Using three different size/shape clear plastic bottles, fill each with 1 cup of colored water. Students can see that liquids look different in each container, reinforcing that liquids take the shape of their container, but have a definite volume, which was measured.
- Host a *“What’s-the-Matter”* Party by making root beer floats. Start with ice cream (solid), add root beer (liquid), and you get the carbonation in the root beer (carbon dioxide gas).