

# STEAM Education & Leadership Workshops

*Student Activity Lesson Plan - From Solid to Gas: Unlocking the Wonders of Matter in Motion*

**Developed by Ada Barbu - Teach For Romania alumna**

## Age range

6 - 10 years

## Learning objectives

- Children explain that objects are made of particles that cling closer or further to each other and exist in different states: solid, liquid, gas, and plasma (for older children).
- Children can identify the state of matter of objects around them.
- Children can define the states of matter.
- Children demonstrate that particles exist in a state of matter and can change it depending on the temperature they are exposed to.
- Children will reflect on how teamwork can solve complex challenges, similar to how scientists work together to understand and solve global problems like climate change.
- Children will analyze how temperature changes affect matter and link this understanding to global weather patterns and pollution.

## Structure of the lesson

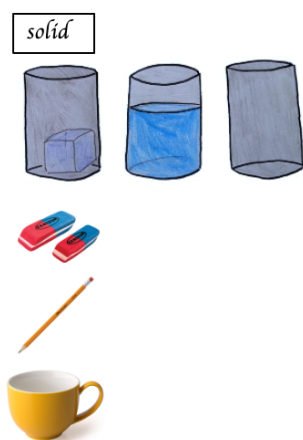

- We give the names of each state of matter emphasizing that all objects are made of particles that cling closely or loosely together.
- We find objects around us corresponding to each state of matter.
- We name and define states of matter.
- We demonstrate that states of matter can change according to the change in temperatures they are exposed to.

















## Duration







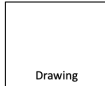
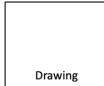
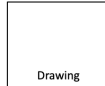
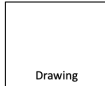
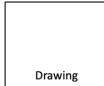
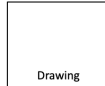
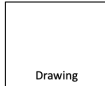
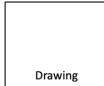
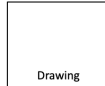

90 minutes

## Note to Educators

- **Matter:** Matter is anything that has mass and takes up space. Mass is the amount of matter in an object. Mass is measured in units called grams (gm) and kilograms (kg).
- **Solid** is a state of matter characterized by particles arranged so that their shape and volume are relatively stable. The constituents of a solid tend to be packed together much closer than the particles in a gas or liquid. Examples: water when temperature below freezing, a brick, a penny, a piece of wood, or a chunk of aluminum metal.
- **Liquid** is a state of matter characterized by particles that flow freely. While a liquid has a definite volume, it does not have a definite shape—examples: at room temperature—water, mercury, vegetable oil, ethanol.
- **Gas** is a state of matter characterized by particles that have neither a defined volume nor defined shape. Examples: air, chlorine at room temperature and pressure, ozone.
- **Vapor** is the term used for water in its gaseous state, especially when diffused in the atmosphere.

Timing	Facilitator's actions	Students outcomes	Technical notes
0-1 min	<p>"Look around you, breathe in, listen to the noises. Everything that surrounds us is matter! Every object, animal, person, drop of rain, air, and wind, takes up space surrounding us."</p>	<p>Students are more aware of their surroundings, the objects, people, air around them.</p>	<p>Introduce the children in a state of wonder, make them close their eyes.</p>
1-7 min	<p><b>SOLID:</b> Point at the 1<sup>st</sup> glass. "I want you to look at this cube! It has a <b>shape</b> of its own. We can see it in the glass! Its particles are packed together very closely! Can you find other objects with a clear shape in the classroom and bring them here?" Children bring objects and place them under the ice cube.</p> <p>"All of these objects you brought, including our ice cube glass, are matter that has a stable shape. We can grab them and transport them without changing them. This is a state of matter called 'solid.'" (We write it on the paper slip)</p> <p>"Let's all hold hands and cling closely together! We look like a solid object too!"</p>	<p><b>solid</b></p>  <p>Children bring objects and place them under the ice cube. They identify solids.</p>	<p>3 identical transparent glasses; ice cube, water, mat, paper slips, pencil; be sure you have objects of all 3 states of matter around you.</p>
7-15 min	<p><b>LIQUID:</b> Point at the 2<sup>nd</sup> glass. "If I put my finger inside, I can go right through it. I can even change its shape if I move the glass left-right. Does it have a stable shape like the cube? What object do you think this is?"</p> <p>"Its particles are packed together too, but not as close! Can you find other objects in the classroom that look like this one in the classroom and bring them here?" Children bring objects and place them under the glass of water.</p> <p>"All of these objects you brought, including our water, are matter that has a less stable shape, we cannot grab them and transport them without a container."</p> <p>"This is a state of matter called 'liquid.'" (We write it on the paper slip)</p> <p>"Let's all hold hands and cling loosely together! We look like a liquid object, too, and we can go around the classroom under the tables, between the chairs! Like water, we take the shape of the solids!"</p>	<p><b>solid</b>      <b>liquid</b></p>  <p>Children bring objects and place them under the glass of water.</p>	<p>3 identical transparent glasses; ice cube, water, mat, paper slips, pencil; be sure you have objects of all 3 states of matter around you.</p>

<p><b>15-25 min</b></p>	<p><b>GAS:</b> Point at the 3rd glass. "Can we even see something here? If I put my finger inside I can go right through it, but I cannot feel a thing! If I turn the glass upside down, that thing might even come out and spread all over the room! Let me breathe air out right into the glass! Can you find such objects, with such loosely clinging particles in the classroom and fetch and bring them to the table?"</p> <p>Children bring objects and place them under the glass of air. They might bring a spray, or just nothing in their hands, or a glass of air from the window. They can get creative.</p> <p>"All of these objects you brought, including our air in the class, are matter that don't have a shape at all. We cannot grab them and transport them without a container. But we can have them around us. Some of them can maybe smell badly or nicely."</p> <p>"This is a state of matter called 'gas.'" (We write it on the paper slip)</p> <p>"Let's not hold hands and just lightly dance like gaseous particles around the classroom, like a smell everyone can feel!"</p>	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p><i>solid</i></p>  </div> <div style="text-align: center;"> <p><i>liquid</i></p>  </div> <div style="text-align: center;"> <p><i>gas</i></p>  </div> </div> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 20px;">    </div> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 20px;">     </div> <p>Children bring objects and place them under the glass of air.</p>	<p>3 identical transparent glasses; ice cube, water, mat, paper slips, pencil; be sure you have objects of all 3 states of matter around you.</p>
<p><b>25-30 min</b></p>	<p>Display the pictures without text. Read the names with the children and match them with the pictures (review of the 1<sup>st</sup> sensorial lesson).</p>	<p>Children can match the names and the pictures.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Solid</p> </div> <div style="text-align: center;">  <p>liquid</p> </div> <div style="text-align: center;">  <p>gas</p> </div> </div>	<p>Pictures without names and name cards</p>
<p><b>30-40 min</b></p>	<p>Read the definitions with the children. Help them understand, and ask questions. Keep in mind different reading levels.</p>	<p>Children can match the names and the pictures.</p> <div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="width: 30%; text-align: center;">  <p><b>Solid</b></p> <p>A solid has particles that are closely packed together. They have a definite shape and a definite volume. They cannot be compressed. A solid has a definite shape and a definite volume. Solid objects do not change their shape easily.</p> </div> <div style="width: 30%; text-align: center;">  <p><b>gas</b></p> <p>Gases have particles that are far apart. They have no definite shape and no definite volume. They can be compressed. A gas has no definite shape or volume. It fills the container it is in. Gases can be compressed.</p> </div> <div style="width: 30%; text-align: center;">  <p><b>liquid</b></p> <p>Liquids have particles that are close together but can move past each other. They have a definite volume but no definite shape. They take the shape of the container they are in. Liquids cannot be compressed.</p> </div> </div>	<p>Pictures with names and definitions</p>

40-50 min	Play matching games.	<p>1. Pictures without name and definitions with name.</p> <div><div><p>A solid has particles that are closely packed together. They have no space between them, so they cannot move. When heat is added, the particles gain energy and start to vibrate. Solids can only change their shape if the particles have an opportunity to do so.</p></div><div><p>When the particles that are close together, it doesn't have that much, but they have when there is a lot of space between them. They can move around a lot.</p></div><div><p>A liquid has particles that are close together but not as close as solids. They can move around a bit. When heat is added, the particles gain energy and start to move faster. They can move around a lot.</p></div></div> <p>2. Definitions without name and pictures with name.</p> <div><div><p>solid</p></div><div><p>gas</p></div><div><p>liquid</p></div></div> <div><div><p>A solid has particles that are closely packed together. They have no space between them, so they cannot move. When heat is added, the particles gain energy and start to vibrate. Solids can only change their shape if the particles have an opportunity to do so.</p></div><div><p>A liquid has particles that are close together but not as close as solids. They can move around a bit. When heat is added, the particles gain energy and start to move faster. They can move around a lot.</p></div><div><p>A gas has particles that are far apart. They have a lot of space between them. They can move around a lot. When heat is added, the particles gain energy and start to move faster. They can move around a lot.</p></div></div> <p>3. Read and draw. Teacher or another child reads the name or the definition and children draw some matching object. Children can play the drawing game even working individually.</p> <table><tr><td>Solid</td><td>liquid</td><td>gas</td></tr><tr><td></td><td></td><td></td></tr><tr><td>Drawing</td><td>Drawing</td><td>Drawing</td></tr></table>	Solid	liquid	gas				Drawing	Drawing	Drawing	All the cards are needed: pictures without text, pictures with text, definitions without text, definitions with text, names, 13 cm x 13 cm papers where they can draw, pencils
Solid	liquid	gas										
												
Drawing	Drawing	Drawing										
50-60 min	<p>Temperature affects state (solid to liquid to gas)</p> <p>Wait until children are able to stay calm during the presentation.</p> <p>Materials can be harmful if you don't make sure they are prepared to do it safely.</p> <p>“Let's put the ice cube in the pan. We don't hold our faces next to the pan.</p> <p>We wait until the ice cube melts away.</p> <p>The temperature decided that the ice cube is not solid anymore; this is its law.</p> <p>The liquid water starts to boil and form bubbles- bubbles are made of some kind of gas.</p> <p>The activity is getting more and more intense until the vapors come out.”</p> <p>Don't rush. Let the experiments go with the flow or in this case, let the water evaporate completely.</p> <p>Language note: vapor – evaporation</p> <p>You can make comments about the activity of the water in the pan.</p>		<p>Some source of heat, apron, goggles if available - it makes them feel like scientists;</p> <p>Protective pad under the source of heat; fire extinguisher if it's possible;</p> <p>Ice in a metal container that is placed in a pan with a long handle.</p> <p>If you have an induction stove, it is even better and safer.</p>									
60-90 min	<p>Understanding natural cycles</p> <p>The carbon footprint</p> <p>Responsibility and safety</p> <p>Eco-friendly habits</p> <p>Activities like freezing food, or the dry and wet in the compost</p> <p>Discussion after the slide presentations</p>	<p><b>Awareness:</b> By learning about how water changes from solid (ice) to liquid (water) to gas (vapor), children gain insight into the water cycle.</p> <p><b>Awareness:</b> Understanding how gases (e.g., CO2) are released into the atmosphere during combustion (solid or liquid to gas) helps children connect everyday activities like driving or energy use to climate change.</p> <p><b>Connectedness:</b> This helps them appreciate the finite nature of water and the importance of conserving it as a group and as individuals.</p>	Laptop, projector optional, speaker, Google Slides, Internet Connection									

		<p><b>Wellbeing: Soil, Air, and Water</b> are everywhere here in Moravia and we enjoy them. We want to feel safe and healthy.</p> <p><b>Experiments and Their Impact:</b> Activities like freezing things will make them understand they can conserve food for a longer time and reduce food waste.</p>	
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