The movement of particles in solids, liquids, and gases.

Students will be able to describe the motion of the particles in solids, liquids, and gases.

Content statements:
- The particles of a gas move quickly and are able to spread apart from one another.
- The particles of a liquid are able to move past each other.
- The particles of a solid are not able to move out of their positions relative to one another, but do have small vibrational movements.

General Information

Subject(s): Science
Grade Level(s): 8
Intended Audience: Educators
Instructional Time: 1 Hour(s)
Freely Available: Yes

Keywords: Solid, liquid, gas, particles

Instructional Component Type(s): Lesson Plan, Problem-Solving Task
Instructional Design Framework(s): Guided Inquiry (Level 3)
Resource Collection: iCPALMS

Lesson Content

Lesson Plan Template: Guided or Open Inquiry

Learning Objectives: What will students know and be able to do as a result of this lesson?
Students will be able to describe the motion of the particles in solids, liquids, and gases.

Content statements:
- The particles of a gas move quickly and are able to spread apart from one another.
- The particles of a liquid are able to move past each other.
- The particles of a solid are not able to move out of their positions relative to one another, but do have small vibrational movements.

Prior Knowledge: What prior knowledge should students have for this lesson?
From earlier years:
SC.5.P.8.2 Investigate and identify materials that will dissolve in water and those that will not and identify the conditions that will speed up or slow down the dissolving process.
SC.5.P.8.3 Demonstrate and explain that mixtures of solids can be separated based on observable properties of their parts such as particle size, shape, color, and magnetic attraction.

Guiding Questions: What are the guiding questions for this lesson?
What are the characteristics of a solid? ...a liquid? ...a gas?
Does your model fit your description of a solid? ...a liquid? ...a gas?
How would you describe the movements of the particles within a solid? ...liquid? ...gas?
Introduction: How will the teacher inform students of the intent of the lesson? How will students understand or develop an
**investigable question?**

Students are in groups of 3. Each chooses a number – 1, 2, or 3.

**Ask:** How would you describe a solid? Groups discuss and #2's write their answers on the groups' white wipe boards. The teacher can ask additional questions while moving around the classroom seeing and hearing their answers, such as “Are all solids hard?”

**Ask:** How would you describe a liquid? Groups discuss and #1's write their answers on the groups' white wipe boards. The teacher can ask additional questions while moving around the classroom seeing and hearing their answers, such as “Are all liquids clear?”

**Ask:** How would you describe a gas? Groups discuss and #3's write the answers on the groups' white wipe boards. The teacher can ask additional questions while moving around the classroom seeing and hearing their answers, such as “Are all gases colorless?”

Randomly call on students to share groups' answers.

At this point, most answers will be describing the states of matter in terms of shape and volume.

**I investigate: Will the teacher do to give students an opportunity to develop, try, revise, and implement their own methods to gather data?**

Students are in groups of 3.

Teachers should have available for the students to use: small sealable plastic bags, popcorn kernels, glue, and tape.

**Questions to ask as students are working on their models:**
- In your models, what do the popcorn kernels represent?
- Your model of a liquid has spaces between the kernels. Are the atoms or molecules of a liquid that spread apart (not touching)? If we put them back to touching, how is this model different from the model for the solid?
- Pick up your bag and move it back and forth. Does your model of a solid fit your description? If no, what can you do to make it match your earlier description?
- Pick up and move your bags containing the models of a liquid and a gas. How can you make them appear different?

**Analyze: How will the teacher help students determine a way to represent, analyze, and interpret the data they collect?**

Eventually, the students should come up with the idea that movement is a necessary part of their models to differentiate between the states of matter. They are to write descriptions of their models on the white wipe boards.

**Expected outcomes/models:**
- The kernels are glued together to make a model of a solid. Then when it is placed in the bag and the bag is moved, the object moves as a whole piece and keeps its shape. The kernels do not move around each other.
- The kernels in the liquid model stay at the bottom of the bag when it is moved back and forth.
- In order for the gas model to look different from the liquid model, the bag must be shaken more vigorously so that the kernels move apart and more independent of each other.

**Closure: Will the teacher do to bring the lesson to a close? How will the students make sense of the investigation?**

**Direct instruction:**
The particles in a solid are tightly packed and locked in place. Although we cannot see it or feel it, the particles are moving = vibrating in place. The particles in a liquid are close together (touching) but they are able to move/slide/flow past each other. The particles in a gas are fast moving and are able to spread apart from each other.

**Exit card:** The students draw three squares on their paper. Using nine circles in each square, the students are to draw a model of a solid, liquid, and gas. (The circles represent atoms or molecules.) Add to each of the drawings arrows, etc. to illustrate the movement of the particles.

**Feedback to Students**
Throughout the activity, the teacher is able to assess student learning by viewing the groups' answers written on their white wipe boards. In addition to answering the guiding questions and during activity questions, the teacher can ask additional questions based on group responses he/she sees or hears. After the content is taught/clarified (in Closure), student responses to the Exit card questions can also be used for assessment - the teacher can read and respond to each card, returning the cards back to the students in a day or two.

**Accommodations & Recommendations**

**Accommodations:** Students with learning needs are working in groups with knowledgeable peers.

**Extensions:** Students are in groups of 3. Each student chooses a number – 1, 2, or 3.

The following numbers write the groups' answers to that question on the groups' white wipe boards:
- #1's: Put the three states of matter in order from least to greatest in terms of the space between the particles.
- #3's: Put the three states of matter in order from least to greatest in terms of the movement of the particles.
- #2's: Put the three states of matter in order from least to greatest in terms of the particle's energy. (In the models with the popcorn and bags, which model took the most energy to show the motion of the particles?)

**Special Materials Needed:**
White wipe boards with different colored markers.
For the Investigation activity:
Small sealable plastic bags (such as Ziploc snack bags)
Popcorn kernels
Glue and tape

Source and Access Information

**Contributed by:** Lora Lindsey  
**Name of Author/Source:** Darlene DePalma  
**District/Organization of Contributor(s):** Marion  
**Is this Resource freely Available?** Yes  
**Access Privileges:** Public  
**License:** CPALMS License - no distribution - non commercial

### Aligned Standards

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>SC.8.P.8.1</td>
<td>Explore the scientific theory of atoms (also known as atomic theory) by using models to explain the motion of particles in solids, liquids, and gases.</td>
</tr>
</tbody>
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### Aligned Access Points

<table>
<thead>
<tr>
<th>Access Point Number</th>
<th>Access Point Title</th>
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<tbody>
<tr>
<td>SC.8.P.8.Su.1</td>
<td>Recognize three states of matter, including solids, liquids, and gases.</td>
</tr>
<tr>
<td>SC.8.P.8.Pa.1</td>
<td>Recognize examples of the gaseous state of matter, such as steam or smoke.</td>
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