**Matter**

**Lesson #3:** **States of Matter (Solids, Liquids, and Gases)**

**Time Frame:** 45 minutes

**Learning Standards:**

*Science*

Physical Science: Observable Properties of Objects and States of Matter

1. Sort objects by observable properties such as size, shape, color, weight, and texture.
2. Compare and contrast solids, liquids, and gases based on the basic properties of each of these states of matter.

Skills of Inquiry

1. Ask questions and make predictions that can be tested.
2. Keep accurate records while conducting simple investigations or experiments.
3. Recognize simple patterns in data and use data to create a reasonable explanation for the results of an investigation or experiment.

**Student will be able to:**

1. Describe, observe, model, and draw the different states of matter: solid, liquid, and gas.
2. Observe, make predictions, record results, and explain what happens when different types of matter are mixed together.

**Resources and Materials:**

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| **Item** | **Amount** |
| Science notebooks |  |
| States of matter overhead | 1 (in binder) |
| States of matter color copies | 30 (in bin) |
| Small plastic containers of salt | 8-12 (in bin) |
| Small plastic containers of water | 8-12 (in bin) |
| Balloons | 2 bags (in bin) |
| Wooden blocks | 15-20 (in bin) |
| Different containers (glass vases, plates) | 1 of each, 3 total (in bin) |
| Paper (not provided) | (in classroom) |
| Big (adjustable) loop of rope | 1 (in bin) |
| Funnel | 1 (in bin) |
| Erlenmeyer flask | 1 (in bin) |
| Masking tape | 1 (in bin) |
| Beaker | 1 (in bin) |
| Vinegar | 1 jug (in bin) |
| Baking Soda | 1 box (in bin) |

**Focus Activity:** Place a small container of salt, a wooden block, a small container of water, and an inflated balloon on each table.  Ask students to observe what is inside each container and explain how each thing is similar and how each thing is different in their science notebooks.  Students may draw a picture of each object.  Lead a discussion as a class reviewing matter, molecules and atoms and introducing the idea that the salt and wooden blocks are solids, water is a liquid, and the carbon dioxide in the balloon is a gas.  This should tie in with the atomic models from the last lesson.

**Introduction:** Write the words solid, liquid, and gas on the board and have students discuss what types of matter belongs on each list.  Some students may recognize that water is liquid but it can be a solid too (ice).  Gas will probably be the shortest list.  Ask students why it is hard to think of examples of gas.  Then flesh out the specific characteristics of each state of matter as a class using the materials from the focus activity.  Remind students that both the salt and the wooden block are solids.  You may let them poke the water and poke the salt to get ideas about how they are different.  You can also do some of the simple demonstrations with matter described below.

**Solids:**shape does not change, volume does not change

*Demonstration:  cut or tear a piece of paper, or break a stick in half to show that solids can change shape when force is applied.*

**Liquids:**take on the shape of the container, volume does not change

*Demonstration: Pour the same amount of water into different sized containers to show that the water takes on the shape of the container. Use glass vases and plates.*

**Gases:**  take in the shape of the container, volume spreads out to fill its container

*Demonstration:  Blow up a balloon in front of the class and then pop the balloon.  Ask the students what happens to the carbon dioxide?*

Remind the class that all matter has volume and mass and relate this to the states of matter definitions.  Ask the class what makes up matter (whether or not it is a solid, liquid, or gas) and review the idea that matter is made of atoms and molecules.  Tell them that these atoms and molecules are constantly moving.  In a solid they move more slowly because they are packed in close together, in a liquid they move faster because they are less packed together, and in a gas they move very fast because they are spread far apart.  Use the overhead and handout about the states of matter to reinforce the definitions of solids, liquids, and gases.

**Activity:**

1. Move aside the desks and tape a large circle of rope to the floor.  Tell the students that this circle represents a container for a type of matter.  Ask all of the students to stand in the circle and tell them that they will represent the atoms and molecules that make up matter.
2. First, ask the students to represent the matter in the wooden block. Encourage students to discuss and work together to figure out that they need to stand in one area very close together.  However, remind them that they should be moving slightly because all matter at moving at room temperature.  Relate this to the characteristics of solids.
3. Then, ask the students to represent the matter in the liquid water. Encourage students to discuss and work together to figure out that they need to spread out to fill the container.  Liquids flow.  However, remind them that they should be moving more because all matter at moving at room temperature.  Relate this to the characteristics of liquids.
4. Finally, ask the students to represent the matter in the balloon. Encourage students to discuss and work together to figure out that they need to spread out to fill the container.  However, remind them that they should be moving constantly and bumping off the sides of the container because gas molecules move the fastest.  At room temperature, the gas molecules in air move at around 1,000 miles per hour.  Simulate a break in the container and ask the students what the gas atoms and molecules would do in the classroom.  Relate this to the characteristics of gases.
5. Have the students return to their seats for a demonstration on changing states of matter.  At the front of the classroom, you should have a beaker with a small amount of baking soda and an Erlenmeyer flask with about 50mL of vinegar.
6. Ask the students to describe in their science notebooks the different types of matter that they observe.  Ask the students to make a prediction about what they think will happen when all the substances are mixed together.
7. Use a funnel to fill a balloon with baking soda.  Then cover the top of the flask with the balloon and pour the baking soda in the balloon into the vinegar.  Let the beaker sit, undisturbed, and observe what happens.  The solid baking soda and liquid vinegar undergo a chemical reaction to produce carbon dioxide, the gas that fills the balloon.  Tell the students to describe and/or draw the results in their science notebooks (again labeling or describing the solids, liquids, and gases present) and explain what they observe.
8. Discuss as a class.  Compare the results to the initial student predictions. Why did bubbles form?  Why did the balloon fill up?  What does that tell you about what happened?  You may explain that this is a chemical reaction between the vinegar and baking soda that changes them both into something else.

**Closure:** Tell the students to draw 3 equal sized shapes in their science notebooks. Students may trace an object or use a ruler to make sure the sizes are the same. Using dots to represent atoms and molecules and arrows of different sizes to represent speed of movement, ask students to draw a diagram of a solid in one shape, a liquid in one shape, and a gas in the final shape. Discuss the diagrams and draw an example on the board.

**Assessment:** Science notebook responses, states of matter models and drawings, and participation in class discussions

