5th grade Science Strand 5.2  
Properties and Changes of Matter  
Standard 5.2.2: Ask questions to plan and carry out investigations to identify substances based on patterns of their properties. Emphasize using properties to identify substances. Examples of properties could include color, hardness, conductivity, solubility, or a response to magnetic forces. Examples of substances could include powders, metals, minerals, or liquids. (PS1.A)

**Objective:** We will understand how the properties of solids, liquids, and gas are affected by their physical structure.

**Equipment and Materials needed:**
- Wooden block
- Bottle of water
- Balloon filled with my air
- Dish soap
- Carrot
- Paper and pencil for each group
- Diagrams enlarged for students to see
- Tape
- Poster paper
- Markers, crayons, etc.

**Instructional Steps:**

1) After you have introduced the concepts of liquid, gas, and solid through a text or lecture, provide students with examples of each form of matter and allow them to classify them on a chart according to their properties (hard vs. soft and hold shape vs. fits shape of container). You may have to do some demonstrating.

Here are some ideas:

<table>
<thead>
<tr>
<th>Object</th>
<th>State of Matter</th>
<th>“Hard” vs. “Soft” When I push on it will it easily change shape/let me put my finger through it, or not?</th>
<th>Does it hold its shape, fit its container, or spread out to fill the container?</th>
</tr>
</thead>
<tbody>
<tr>
<td>wooden block</td>
<td>solid</td>
<td>no</td>
<td>Holds its shape</td>
</tr>
<tr>
<td>Water (in a bottle?)</td>
<td>liquid</td>
<td>yes</td>
<td>Fits container</td>
</tr>
<tr>
<td>Balloon filled with my air</td>
<td>gas</td>
<td>yes</td>
<td>Fills container</td>
</tr>
<tr>
<td>carrot</td>
<td>solid</td>
<td>no</td>
<td>Holds shape</td>
</tr>
<tr>
<td>Dish soap</td>
<td>liquid</td>
<td>yes</td>
<td>Fits container</td>
</tr>
<tr>
<td>Etc. . . .</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2) Have the students generalize their observations into rules:

a) Solids are hard and they hold their shape.
b) Liquids are soft and they fit their container.
c) Gases are soft and they fit their containers.

3) Now pose the question: Why does each state of matter have these properties? Use the following diagrams (or something similar) to explain the structure of the molecules in each state of matter:


source: http://www.trivedichemistry.com/WebMovie/1Chap1_files/image002.jpg
4) **Simulation**: Have the students create each form of matter with their bodies as molecules. You can use tape of the ground to create a large round “container.” Either split the students into groups, or have part of the class demonstrate while the rest watch.

   a) **Solid** (9 students) Instruct the students to stand in three rows of three, then have them all face inward toward the one student in the middle. Have the students on the outside of the square put their left arm around the shoulder of the person next to them and the right arm on the shoulders of the center person. This way they are all connected. Then let a few students try to walk through the “solid object” (without pushing and shoving).

   **Discuss**: a solid is rigid and hard because the molecules hold on to each other. The solid has its own shape, it doesn’t change based on the container (the solid is square, the container is round).

   b) **Liquid**: (~13 students, or how many you need to fill container) “Pour” the students into the container and instruct them to move around slowly past each other; have them make what they imagine as “watery” movements. They should not hold onto each other. Then allow a few students to try and walk through the “liquid.”

   **Discuss**: in a liquid the molecules are free to move around within the container. They can fit the shape of the container. Also, it is easy for something to pass through a “soft” liquid (imagine putting your hand through a stream of water from the faucet) because the molecules can move away or part.

   c) **Gas**: (~3 students) Instruct the students to move around quickly in the container and bounce of the “walls” of the container. They should try to use all the space in the container. Then allow a few students to try and walk through the “gas” (which should be very easy).

   **Discuss**: gas molecules can spread out and they move quickly because they have more energy than liquids or solids. They can fill a whole container; if the container gets smaller they could still fit, and if it got larger they could spread out and use all the space. A gas is “soft” or very easy to move through (imagine walking through the air like we do everyday).

5) **Assessment**: You can have students create their own informational poster where they draw diagrams of gas, liquid, and solid, and then describe the properties of each.