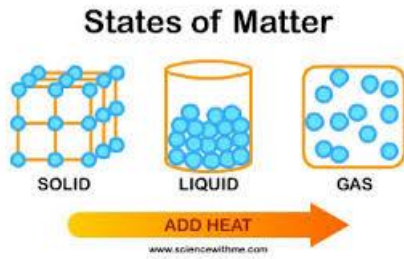


Simulating Matter

By Shelley Cook



Grade 5

Core Concept/Science/Dance

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

**Grade 5 Core Curriculum Science:
Standard 1:**

Students will understand that chemical and physical changes occur in matter.

Objective 2: Identify the physical properties of matter (e.g., hard, soft, solid, liquid, gas)

Grade 4 Core Curriculum Dance:

Standard 2: The student will identify and demonstrate movement elements in performing dance.

Objective 1: Expand dance vocabulary with movement experiences in space.

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 holds shape vs. fits shape of container). You may have to do some demonstrating.

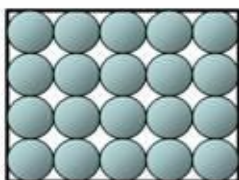
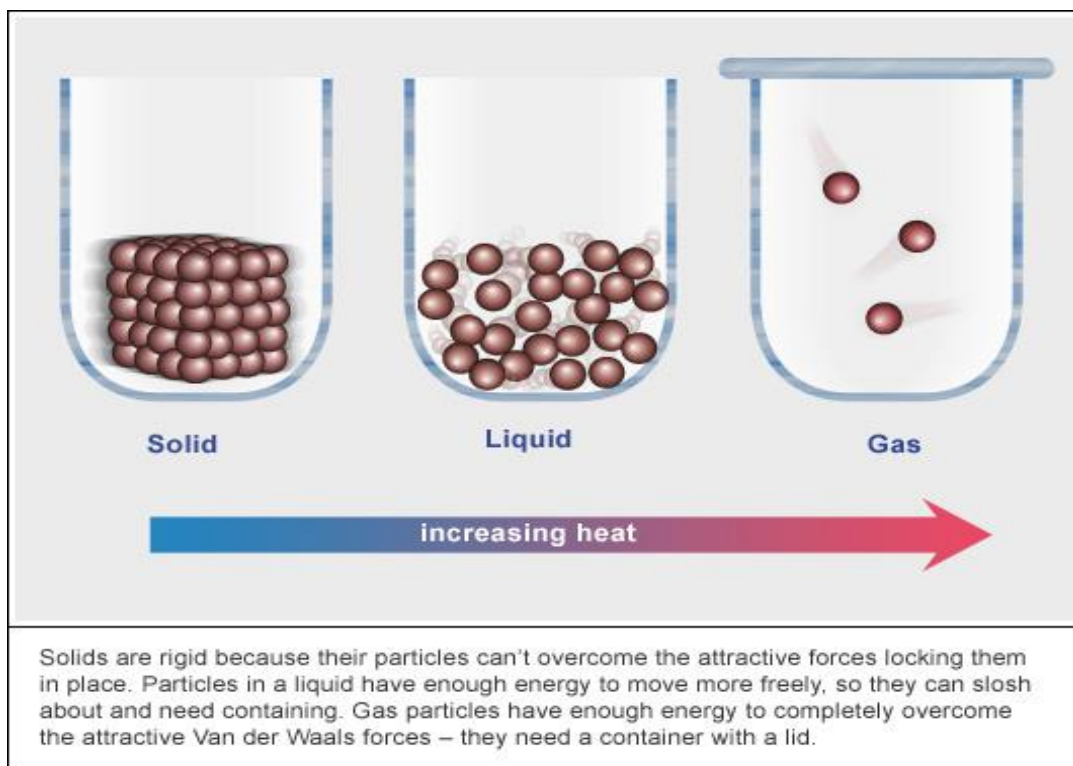
Here are some ideas:

Object	State of Matter	“Hard” vs. “Soft” When I push on it will it easily change shape/let me put my finger through it, or not?	Does it hold its shape, fit its container, or spread out to fill the container?
wooden block	solid	no	Holds its shape
Water (in a bottle?)	liquid	yes	Fits container
Balloon filled with my air	gas	yes	Fills container
carrot	solid	no	Holds shape
Dish soap	liquid	yes	Fits container
Etc.....			

2) Have the students generalize their observations into rules:

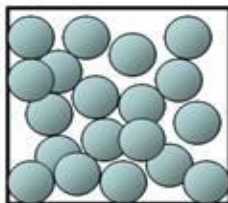
- a) Solids are hard and they hold their shape.
- b) Liquids are soft and they fit their container.
- c) Gases are soft and they fit their containers.

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.abc.net.au/science/basics/img/Solid_liquid_gas_withcaption.jpg



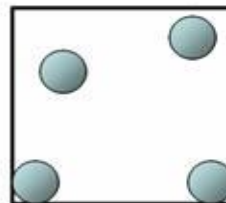
Solid State

Ordered and dense
Has a definite shape and volume.
Solids are very slightly compressible.



Liquid State

Disordered and usually slightly less dense.
Has a definite volume and takes the shape of the container.
Liquids are slightly compressible.



Gas State

Disordered and much lower density than crystal or liquid.
Does not have definite shape and volume.
Gases are highly compressible.

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 off 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.

Equipment and Materials needed:

Wooden block
Bottle of water
Ballon 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.