



## States of Matter - Grades K-2

### *Nebraska Science Standards*

*2.2.1 Students will observe and describe properties of objects and their behavior.*

*2.2.1.a Observe physical properties of objects (freezing and melting, sinking and floating, color, size, texture, shape, weight)*

*2.2.1.d Identify solids and liquids and recognize that liquids take the shape of their container*

**Objective:** The objective of this lesson is for students to explore and describe the physical properties of matter. Emphasis will be placed on the unique properties of liquid/water. Students will identify the differences between mixtures and pure substances, physical properties of matter and demonstrate the concept of density.

### **Materials**

*Provided by CSM:*

- Capillary Action
  - 3 clear cups
  - Paper towel
  - Water
  - Food coloring
  - Pipettes
  - Colored toothpicks
- Density (shares a station with the lava lamp)
  - Clear container, filled over half way with water
  - Various objects: ping pong ball, rock, feather
- Penny Experiment
  - Pennies
  - Paper cups with water
  - Pipettes
  - Paper towels
- Lava Lamp Demonstration
  - Water
  - Oil
  - Food coloring
  - Light
  - Alkaseltzer

### **Worksheets:**

[Picture Worksheet](#) (for grades K or 1)

[What's the Matter](#) (for grades 1 or 2)

## Discussion:

### What is Matter?

- A physical substance that occupies space and has a definite mass
  - All matter is made up of molecules; molecules are very small and can be really close together or really far apart
- Mass is kind of like weight (difficult concept to explain to young children so this is fine to say)

### What are the three basic states of matter? *Ask the students for some examples of each*

- Solid- definite shape, volume and mass
- Liquid- not a definite shape, definite volume and mass
- Gas- not a definite shape, volume, or mass

### What are the transitions between each state? *Ask the students for examples.*

- Solid-liquid= melting, ice cream melting
- Liquid-gas= evaporation, ocean water evaporating into the sky
- Gas-liquid= condensation, fogging mirrors or dew on the grass

--Have the children do the worksheet--

### Provide and ask for examples with each question below

#### What is density?

- Basically, density is how compacted something is
  - When something is dense we might think it is heavy -- density can explain why a rock will sink to the bottom of the water and a feather will float. Gases are VERY light which is why Helium balloons float into the air!
- Density helps determine what state the matter is --- this might be difficult to explain/understand
  - Molecules that are very close together are solids and they are very dense -- these molecules are slow
  - Molecules that are a little further apart are liquids
  - Molecules that are very far apart are gas -- these molecules are the most active!
- --**DEMONSTRATION** -- Ask for a few volunteers -- they will be the molecules
  - Have them stand with their hands down super tight to their sides and ask them to stand very close to each other --- this is very dense, this is what the molecules of a solid are like
  - Have them take 2 steps apart, each in a different direction --now that they have more room they can move their arm a little. They might notice their arms can still touch --this is like a liquid, there is a little more room (or personal space!) to move around in
  - Finally, have them take 3 more steps out -- they shouldnt be able to touch each other. You can explain that this is a gas -- remember how gas molecules are really active? Have them move around a little bit in a small area...they might bump into each other still but for the most part they wont --just like a gas!

### Liquids have some unique properties - Discuss them here:

- Adhesion- liquid molecules can "stick" to other non-liquid molecules or surfaces

- Solids cant do this -- try to stick the a pencil to the wall...it wont work-- but if you spray windex on the window it will
- Cohesion- Water molecules come together and “stick” to other water molecules
  - This hard to understand and will be explored in the penny activity -- an example of this is a raindrop
- Capillary Action / Diffusion
  - Movement of water within the spaces of a porous (explain what porous means) material due to the forces of adhesion, cohesion, and surface tension
  - In other words, it’s the way water can move to where it needs to be
    - It is important to understand for many reasons including how our body gets our nutrients, how plants get water, etc.
  - Think of how you clean up a spill of koolaid -- this action of absorbing the liquid is actually capillary action in action!

**Set Up:** Set up stations for each activity, make sure all required items are there --more than 1 station can be set up depending on the number of students.for each activity. Split the kids into groups, 1 for each station.

**Activity Description:**

**Density & Lava Lamp**

For this activity, the students will see the physical properties of oil and water (density) and will make gas occur when they add the tablet to the mixture.

**Procedure:**

1. Add vegetable oil to the bottle until it is almost  $\frac{2}{3}$  full
  - **Explain to students how the liquid is now taking the shape of the new container**
2. Add water until bottle is nearly full, leaving room for addition of materials
  - **Ask which is more dense - the water or the oil? How do they know?**
3. Add in 2-3 drops of food coloring and glitter
4. Add an alkaseltzer tab to the bottle, make sure the tab is broken in couple of pieces -- 1 should be good but add another if needed
5. **What happens?**
  - A chemical reaction is taking place -- the alka seltzer forms gas which is less dense than both the water and oil.
  - Once the fizzing stops the layers should separate again
6. Let the children take turns putting items in the water -- they should predict if the object will sink or float. Let them talk about the results

### **Pennies**

Students will observe the properties of cohesion and adhesion. Cohesion is when the water molecules stick together. Adhesion is when water molecules stick to other surfaces, such as the penny.

**Set up:** Give students a new paper towel if needed, or they can use the paper towel from the previous activity. Each group or pair should have a cup of water with pipets. Each student gets one penny, which they will return at the end of class.

#### **Procedure:**

1. Carefully drop 3 drops of water onto the penny. Ask the students what they observe. They should notice that the water makes a dome; it does not spill over the surface of the penny.
2. Let the students experiment with how many drops they can fit onto the penny without it spilling over. Do this for about 5 minutes. They may need more paper towels!

### **Capillary Action**

**Set up:** A volunteer should help with this, it should be a demonstration. While the kids wait for the water to diffuse they can do their toothpick stars

#### **Procedure:**

1. Fill each end cup  $\frac{1}{2}$  way with water, leave the middle one empty
2. Add food coloring to each end cup, each one should have a different color
3. Fold two paper towels so they are about 1 inch wide and 12 inches long (hotdog style)
4. Place one end of the first paper towel in the cup on the end, place the other end into the empty middle cup --- there should only be about 2 inches of paper towel above the cups (the "bridge")
5. Place the 2nd folded paper towel in the middle cup and cup on the right
6. It should look like this:



#### **Procedure - Toothpick Stars:**

1. The students snap their 5 toothpicks half-way, so that they are hinged in the middle. Do not separate the two halves of the toothpick; each toothpick should be in a "V" shape.
2. Arrange the toothpicks in a circle on a flat surface (or plate) with the arms of the toothpicks touching each other. Try to arrange the toothpicks as symmetrically as possible for the best result.
3. Carefully squeeze a drop of water into the middle of the toothpicks. Make sure the drop touches the snapped part of each toothpick. You may need to add more water to get it right, but not so much that the toothpicks are floating!
4. Wait several minutes and note what happens. The toothpicks will slowly move into the shape of an open 5-pointed star.