

Floating, Surface Tension & Densities



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Learn about the qualities of water and what factors allow certain things to float, while others cannot.

Duration

Preparation: 15 minutes (Ice cubes need to be frozen the night before)

Activity: 45-90 minutes (Will vary depending on which activities are completed)

Supplies

- Clear plastic tubs of water
- Modeling clay (oil-based)
- Paper towels
- Pennies
- Plastic cups
- Sheet of aluminum foil
- Toothpicks
- Liquid detergent
- Pepper
- Large clear container
- Food coloring
- Ice cube tray
- Hot pot (if hot tap water is not available)
- Clear sealable containers (ex: small soda/water bottles)
- Liquids of different densities (ex: water, oil, syrup)
- Small items to float on/in liquids (ex: beads, glitter)
- Book "Who Sank the Boat" by Pamela Allen (optional)

Background

Not all liquids have the same properties. One quality of water is surface tension. Surface tension is the tendency of liquid surfaces to shrink into the minimum surface area possible. Surface tension allows insects, usually denser than water, to float and slide on a water surface.

Night Before: Freeze a tray of ice cubes using colored water.

Just Before: Plug in hot pot to get water hot (if hot tap water is not available).

Activity 1: Making Boats

Materials:

- clear plastic tubs with water
- modeling clay (oil-based)
- pennies
- paper towels
- “Who Sank the Boat?” By Pamela Allen (optional)

Pre-lesson: Discuss how weights in a boat need to be balanced to keep the boat from tipping over, but also that boats can only carry so much weight. If available, read the book “Who Sank the Boat” by Pamela Allen.

Activity Preparation:

1. Have students form groups (3-4 students per group).
2. Each group receives a tub of water, lumps of modeling clay, paper towels, and pennies.

Activity Steps:

1. Ask: Will the lump of clay float?
2. Students demonstrate with their clay and water.
3. Ask: How can we make this clay float?
4. Show students how to form a simple boat (see image →).
5. Now groups will compete to carry the most pennies in their boat.



Activity 2: Surface Tension

Materials:

- sheet of aluminum foil
- container of water
- plastic cups
- pennies
- toothpicks
- liquid detergent
- pepper
- paper towels

Pre-lesson Discussion: Show students that an aluminum foil sheet can float when flat on the surface of the water. Explain that this is an example of surface tension – the stickiness of the surface of the water (due to water molecules sticking together).

Activity Preparation:

1. Students form pairs.
2. Each group gets a plastic cup, pennies, paper towels, and pepper.

Activity Steps for Experiment #1 (Testing surface tension in a cup)

1. Fill plastic cups to the rim with water.
2. Students will carefully add one penny at a time to the cup, counting as they go.
3. Stop as soon as the water spills over the edge try to see how many dry pennies they can add, one at a time, before the water spills over the edge.
4. Remove and dry off the pennies.

Activity Steps for Experiment #2 (Breaking surface tension)

1. Fill plastic cups to the rim with water.
2. Students add a little pepper to their cup of water, letting the pepper rest on top of the water. (**Make sure the students do not stir the water. The pepper should naturally stay at the surface due to the surface tension.**)
3. Students dip the toothpick into the top of the water and see what happens ▪ (**Nothing should happen**)
4. Students dip the toothpick into the liquid detergent and then into the top of the water and see what happens ▪ (**The pepper should move very quickly to the edges.**)

Follow-up discussion: Explain that water molecules stick to each other due to *cohesion*, a hydrogen bond between water molecules. This creates a “skin” on the water’s surface, called *surface tension*. Liquid detergent breaks this surface tension (by breaking the chemical bonds between water molecules), causing pepper to move away from the liquid detergent-dipped toothpick.

Activity #3: Water Molecules in Action Activity

(Demonstration: Densities of water at different temperatures)

Pre-lesson discussion: Ask students if ice sinks or floats and ask why they think this is.

Materials:

- ice cubes with food coloring (frozen the night before)
- large clear plastic container
- hot water

Activity Steps:

1. Fill large clear container with hot tap water (or hot water from hot pot).
2. Place an ice cube into the water, allowing it to float at the top.
3. Students will see the colored water move to the bottom of the container.

Follow-up discussion: Discuss with students how water is unusual because it floats (has lower density) when in its solid phase (frozen). Discuss that ice melts in warmer water, and the melted liquid then sinks (density increases). As ice melts to liquid water its density increases. This makes it sink to the bottom of the container. There it mixes with the water in the container. It becomes less dense and moves back toward the surface.

Vocabulary

Surface Tension: the tendency of liquid surfaces to shrink into the minimum surface area possible. Surface tension allows insects, usually denser than water, to float and slide on a water surface.

Cohesion: a hydrogen bond between water molecules.

Density: the amount of mass per unit of volume.

Extension

Densities of various liquids container (Supplies not in master materials list**)**

Materials:

- Clear sealable containers (ex: small soda/water bottles)
- Liquids of different densities (ex: water, oil, syrup)
- Small items to float on/in liquids (ex: beads, glitter)
- Food coloring

Activity Steps:

1. Students pour liquids into containers (pouring the densest first) and allow them to settle.
2. Add drops of food coloring after the liquids have settled to see how it reacts with the different liquids.
3. Students drop small items into the different liquids to compare how they react in the different liquids.
4. Discuss findings and have students record by writing or drawing.
5. Put tight tops on containers, shake, and enjoy!