Water Olympics
Activity Description

Discusses surface tension and how it applies to the outside world with three demonstrations

Take Home Message

The molecules of water make a very strong bond together called a hydrogen bond. The bond is so strong that organisms and small objects can float on the water surface. Water molecules can also cling to other materials.

Massachusetts Frameworks

Physical Science

Properties of Matter #2

Supplies

- Pennies
- Pipettes
- Dry paperclips
- Small plastic cups: short wide ones work best. (Condiment cups are awesome)
- Dishwashing soap (in a contact lens case or other small container) and toothpick
- Spice (cinnamon, pepper)
- Sponge
- 1 bucket clean water
- 1 bucket for dumping
- Towels, one large to cover table, and one small one for each workstation

Set-Up

First lay out a towel on the table. Set up for each student: cup 1/2 filled with water on the small towel. Place one pipette next to each cup along with a penny and stack of paper clips. **Place the signs where the kids can see them, "Caution scientists at work, don't move the table".** (These signs aren't very effective, and don't tend to stay, but might be worth attempting anyway.) Have a similar setup for yourself, so you can demonstrate. Have a few bent paperclips available, also set up the pepper trick (cup of water, packet of pepper, toothpick with dab of soap.

Activity Procedure/Script

- Introduce yourself and ask for the students' names. **Ask them if they know what a water molecule is.**
    - If not, then explain that it is the smallest possible "piece" of water.

- **Ask if they know what the shape of a water molecule is.**
    - Tell them that it looks like a Mickey Mouse head, and explain that the two ears are hydrogen, and the face is oxygen.

- **Explain that this Mickey Mouse shape creates hydrogen bonds and water molecules become attracted to each other. This is called <u>cohesion</u>.**
    - Tell them, "Cohesion makes water do some cool things that we'll see in our games."

- **Ask the students to see how many water drops they can fit on top of a penny.**
    - Make sure that each student knows how to use a pipette, and have them practice to make sure they have good control and can let the water out one drop at a time (some don't know how to work a pipette.)
    - Now tell them that they have to be very considerate scientists, and be VERY careful not to wiggle the table. You'll have to remind them a few times.
    - Have them slowly add drops of water to the penny.

- **After that, ask them what was happening as they dropped the water.**
    - They should have seen a bubble forming on top of the penny.
    - As they added more drops the bubble should have started to expand until it reached the edges of the penny and then it should have expanded upward.
    - After they put enough drops, the bubble broke.
    - Explain that the water was able to "bubble up" over the side of the penny because of **cohesion**: it was holding itself together.

- **Tell the students, "Before we play our next game, does anyone know of a bug that walks on top of the water?"**
    - Answer: water bug/ water strider. Ask why they can do this.
    - Explain that they can do this because of **<u>surface tension</u>**: basically cohesion at the surface of the water.

- **Show them how to float paper clips in your cup and help them to do the same.**
    - Go slow, and keep the clip parallel to the surface. If it bends, it will break the tension, but if it is totally flat it will float.)
    - After you demonstrate, have them try it a few times. See who can get the most paper clips to float on the surface of the water. The paper clips are floating on the surface "skin" of water.

- **Ask the students, "What does it look like the paper clip is trying to do?"**
    - It's pressing down into the water, but the surface tension is keeping it afloat.
    - Have them note what the water looks like around the edges of the paper clips. They should be able to see how each molecule is attaching to the paper clip without actually breaking the surface tension.

- (If you want,) explain that the clips tend to stick together because each one creates a little dip in the surface of the water. As you add more, each one creates its own dip, and when they connect each one of the paperclips feels the water surface is slightly tilted, so they slide together.

- **Ask the students what they think will happen if you add soap to the cup with the floating clips.**
  - After the clips sink, ask why they sank.
  - Explain that the soap molecules push the water molecules apart and break the surface tension, so the water molecules no longer adhere to the clips, causing them to sink.

- **Review with them!** (While they're getting the paper clips out of their cups.) Ask:
  - "What's a water molecule?"
  - "What's it shaped like? What atoms make the ears? The face?"
  - "What does that mean water molecules like to do?" (Stick together)
  - "What's it called when they stick together?" (Cohesion)
  - "What do we call cohesion on the surface?" (Surface tension)

Tips

- Use bent paper clips to lower the other clips into the water.
- Use a clear cup for yourself, small condiment cups for the students.
- Don't use the pepper: it's too messy.
- Make sure the clips are dry between groups.
- Tell the students not to worry if the clips sink, as they will get them out at the end.
- Change out the water in the cups every 3-4 groups.
- Don't add soap to any student's cup. They'll all want to do it and it will take too long to clean up each time. Also, once the cups get soapy, the clips will no longer float because it's hard to get them totally clean again.
- When the students first arrive, ask them if they have been to the bubble booth yet. If so, do a quick concept review. (Many of the concepts overlap: the structure of a water molecule, cohesion, surface tension, etc.)
- **Always** review after the activity.
- If they arrive with edible aquifers, have them put them somewhere else while at your station.

Clean-Up

During the festival

- After a few groups, dry the paper clips and pennies.
- Rinse out the cups, the water gets gross from kids fingers.
- Refill the cup of water about 1/2 full.

After the festival

- Empty all the water from the cups.
- Thoroughly dry the paper clips and pennies.
- Pack everything up neatly in the box.
- The only supply that you may need to replenish is the soap in the little container, and toothpicks. You can get soap from Fred the Fish, or the Bubble Booth. A tablespoon or two should last all year.

NOTES: While surface tension is a simple principal, it is an excellent opportunity to talk about the amazing properties of water. You will have to emphasize that the kids need to be very careful to not shake the table. Try to pick the most level table to begin with.