Freshwater Tool Kit

WATER WORKS: H_2O Olympics

*Students compete in a Water Olympics to investigate two properties of water, **adhesion** and **cohesion**.*

Adapted from *"Project Wet"*

Activity Time - After station set-up:
30-40 minutes

Grades; 4-6th

Water Words:
Adhesion, cohesion, capillary action and surface tension

Materials -
Teacher Demo:

- 2 large plastic cups
- Yarn – 12 inches, soaking wet
- Food Coloring
- Water – 10oz.

Materials-
Student Activities: (Materials are listed by event). Set up stations for students to rotate through in groups. If time is limited, have groups perform one event and share with class in a discussion. **Students should enter results in their Water Log.**

Event 1 – Pole Vaulting:

- Water – 8oz.
- Clear plastic cup
- Paper clips

Event 2 – The Balance Beam:

- Straw-used as dropper
- Penny

Event 3 – The Backstroke:

- Paper clips
- Fork
- Magnifying lens
- Clear plastic cup

Event 4 – The Slalom:

- 2 kinds of paper towel-white and brown
- Large plastic cup
- Tape
- Ruler
- Scissors
- 2 Pencils

Background
The design of a water molecule causes the molecule to be attracted to other water molecules as well as to molecules of other substances. Without this design, plants could not get water from the ground and blood would have difficulty traveling through the body. The attraction between water molecules (similar molecules) is called **cohesion**. The attraction of the water molecule to other materials like glass, yarn or soil is called **adhesion**.
Evidence of water's attraction to itself can be seen by simply looking at its surface. If a glass is filled to the brim with water and more water is gently added, the level of the water will exceed the top of the glass. The cohesive force between water molecules causes the water surface to behave as though it is covered by a thinly stretched membrane that is always trying to contract. This phenomenon is called **surface tension**. In many ways, surface tension is like water's skin.
Water's surface is so strong it can even support paper clips. Surface tension is important to the survival of many

aquatic organisms, including insects. The water strider lives on the surface of freshwater. Wood can float in water; however, paper clips and water striders are not actually floating, they are held up by bonds between water molecules. Learn more about bonds in the Hangin' Together activity.

Floating objects break the surface tension of water. Objects stay afloat because water molecules deeper in the water can support the weight of the objects. Soap also breaks surface tension. The soap reduces the pull of water molecules on each other.
The same forces that cause water to be attracted to itself cause it to adhere to other substances. If this didn't happen, water would slide off everything like water off a duck's back.

Water appears to defy gravity as it moves up a paper towel, through spaces among soil particles or along a piece of yarn as demonstrated in the teacher's demonstration. This is called **capillary action** and results from water molecules being attracted to molecules of the towel or yarn or soil. However, the molecules can only travel so far before the force of gravity overcomes the attraction of water to itself and to other molecules.

Getting Started – Teacher Demo

Students will learn about <u>adhesion (water molecules attracted to other molecules)</u>, <u>cohesion (water molecules attracted to each other)</u> and <u>capillary action (adhesion and cohesion moving water molecules)</u>.

Gather the teacher demo supplies. Fill a clear plastic cup ¾ full of water with a few drops of any color dye. Practice this demo before showing class. The key is to pour slowly.

DEMO: Tell students you are going to make water defy gravity as it walks a "tightrope" (the yarn). Show students a clear plastic cup partially filled with colored water, an empty cup and yarn. Place the empty cup on the table. Hold up the plastic cup filled with colored water about 18 inches above the cup on a table. Place the yarn so that it passes over the top of the plastic cup with colored water and then down into the plastic cup on the table. **<u>Slowly</u>** pour the water from the clear glass down the yarn, squeezing the plastic cup so it acts like a spout. Can your students explain how the water moves along the yarn? By capillary action.

Cohesion of the water molecules to each other and adhesion of the water molecules to the yarn allow it to defy gravity and walk down the yarn. Tell students if water is poured too quickly, gravity will overcome the adhesion and cohesion forces.

Getting Wet – Olympic Events

Students will perform a series of investigations that will help explain adhesion and cohesion and other interesting feats of water.

Set up each of the stations with the supplies outlined above. Label the station (labels included below) and place an H2O card at each station with directions (cards with instructions included below).

Students should rotate through the stations and document their answers and drawings on the H2O Olympics page of their Water Log (if used), or on a piece of paper with their name.

Play Olympic music to introduce the events to add a festive element. You can also set up a score board in the front of the class for the teams to fill-out.

Complete all events.

Wrap Up:
Have students compare results from different events. Ask them to explain the role of **adhesion and cohesion.** Remind them of water walking the tight rope demo – capillary action.

Assessment:
Have students:
- Define cohesion and adhesion
- Explain the events using cohesion and adhesion and where these forces occurred
- Draw the tightrope demonstration and label where cohesion and adhesion occur.

Station Labels and Activity Cards
Label each station with the event label and place instructions by each station.

H_2O Olympics
Olympic Event 1
Pole Vaulting Over the Top

Olympic Event 1 - Pole Vaulting Over the Top

Completely read the directions before you begin.

Directions: Fill a clear plastic cup with water until it is even with the rim. Gently add paper clips to the surface of the water, one at a time. Keep track of the number of paper clips added. Continue until the water spills over the side.
Answer the questions below and place your answers in the Water Log if you have one or on a piece of paper. Also draw what you observe.

How many paper clips do you think you can add to the full cup of water before it spills over the top?________.

Actual number of paper clips added:________.

H_2O Olympics
Olympic Event 2
The Balance Beam

Olympic Event 2 - The Balance Beam

Completely read the directions before you begin.

Directions: Using a straw, place as many drops of water on top of the penny as possible without spilling over the edge. Keep track of the number of drops. Continue until water spills over the penny. Answer the questions below and place your answers in the Water Log if you have one or on a piece of paper. Also draw what you observe.

How many drops of water do you think you can place on top of the penny?____.

Number of drops of water_______.

H_2O Olympics
Olympic Event 3
Backstroke

Olympic Event 3 - Backstroke

Completely read the directions before you begin.

Directions: Try placing a paper clip on the surface of water. (This works best if you place the paper clip on the fork and gently and slowly lower the fork into the water.) When you have a paper clip floating on the water observe the surface with a magnifying lens. Answer the questions below and place your answers in the Water Log if you have one or on a piece of paper. Also draw what you observe.

How many paper clips can you suspend on the surface of water?____.

Number of paper clips suspended_____.

H_2O Olympics

Olympic Event 4

Slalom

Olympic Event 4 - Slalom

Completely read the directions before you begin.

Directions: Cut 2-inch strips of the different paper towels provided. Tape one end of each paper strip to a pencil. Lay the pencil on top of a tall container of water so that the paper towel is inside the container. Determine how much water you will need to add to the cup so the bottom end of each strip is immersed in ½ inch of water. Remove the pencil with the paper attached, add the water and place the pencil back on top of the container so that the paper towel ends are in the water. Let the paper towels absorb water until the water stops rising. Use a ruler to measure the height absorbed for each towel. Answer the questions below and place your answers in the Water Log if you have one or on a piece of paper. Also draw what you observe.

Which towel do you think will absorb the most water?________________.

Height of first towel:____________.

Height of second towel:__________.