Hydrology Activity Bag

Properties of Water: Student Activity Guide

Have you ever wondered how insects crawl across the water's surface, or how plants manage to pull water from the ground for the rest of the plant to use? In this activity, you will explore a couple of properties of water that allow it to support life.

These directions will get you started. Your teacher will be in contact to guide you and provide information.

Materials From The Bag

- 3 Pennies
- 3 Pipettes
- 5 Plastic Squat Cups
- 6 Napkins
- 2 small spoons
- Purple & Red Powdered Drink Mix (If you have not completed the other activities, save the remaining powder.)

You Will Supply These Materials

- Water
- Soapy Water
- Vegetable Oil

Preparation:

1. Get three plastic cups. Fill one cup ¼ of the way with water, one cup ¼ of the way with soapy water, and one cup ¼ of the way with vegetable oil.
2. Put a pipette, penny, and napkin next to each cup. During the activity, **keep each pipette, penny, and napkin with its own liquid**.

Part 1: How Many Drops?

1. Observe your three liquids and predict which one will allow you to put the most drops of it on the penny, and which one will allow you to put the fewest drops on the penny.
2. Place the napkin on a flat surface. Set the penny, heads up, on the napkin.
3. Use the pipette to carefully drop water on the middle of the penny, **one drop at a time**. Count the drops. Stop when a drop makes the liquid overflow the edge of the penny and do not count the drop that caused the overflow. Record the number of drops.
4. Wipe off the penny and repeat **two more times**, using the same napkin. Record the number of drops for all three trials. On the last trial, before the liquid overflows, place your eye at the table level. View the penny and the water from the side. Draw what you see.
5. Repeat steps 3 and 4 for soapy water and vegetable oil.
6. Calculate the average number of drops for each liquid.

Compare your results and your pictures. What do you notice?

Why does water behave differently than soapy water and vegetable oil? It turns out water has unique properties. Water can be attracted to itself or other substances. When water is attracted to another substance it is called **adhesion**. When water is attracted to water it is called **cohesion**. Cohesion is so strong that the water's surface

creates a tension, called surface tension. *Look at your drawing of the water on the penny. Label where cohesion, adhesion, and surface tension would be.*

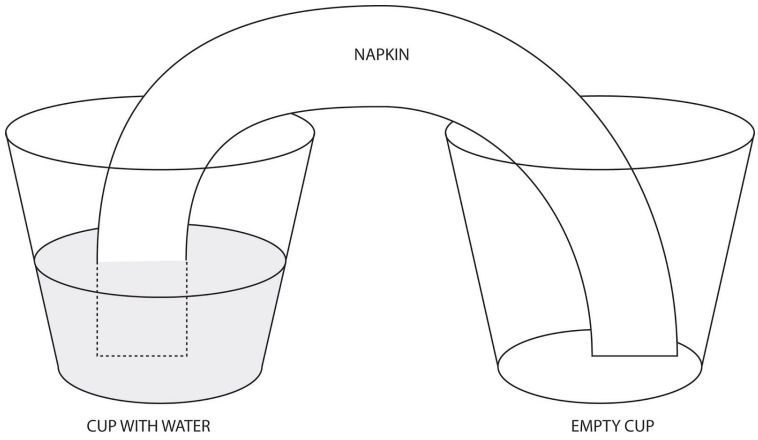
Clean and dry the water and soapy water plastic cup. These will be used in other activities.

Part 2: How Does Water Climb?

In this part, you will investigate how water "climbs".

Exploration

1. Take two clean plastic cups and place them side by side.
2. Use the small spoon to place ½ scoop of purple powder drink mix into **one** of the cups and fill it ⅓ full with water. Stir.
3. Unfold a napkin and cut or tear it into four equal parts. Three pieces will be used in the next parts. Fold a piece of the napkin in half **two** times. Place one end of the napkin in the cup with purple water and fold the other end into the empty cup. Draw your set-up. See diagram.
4. Observe for a few minutes and predict what you think your set-up will look like after 24 hours.
5. After 24 hours, draw your set-up again to record any changes.



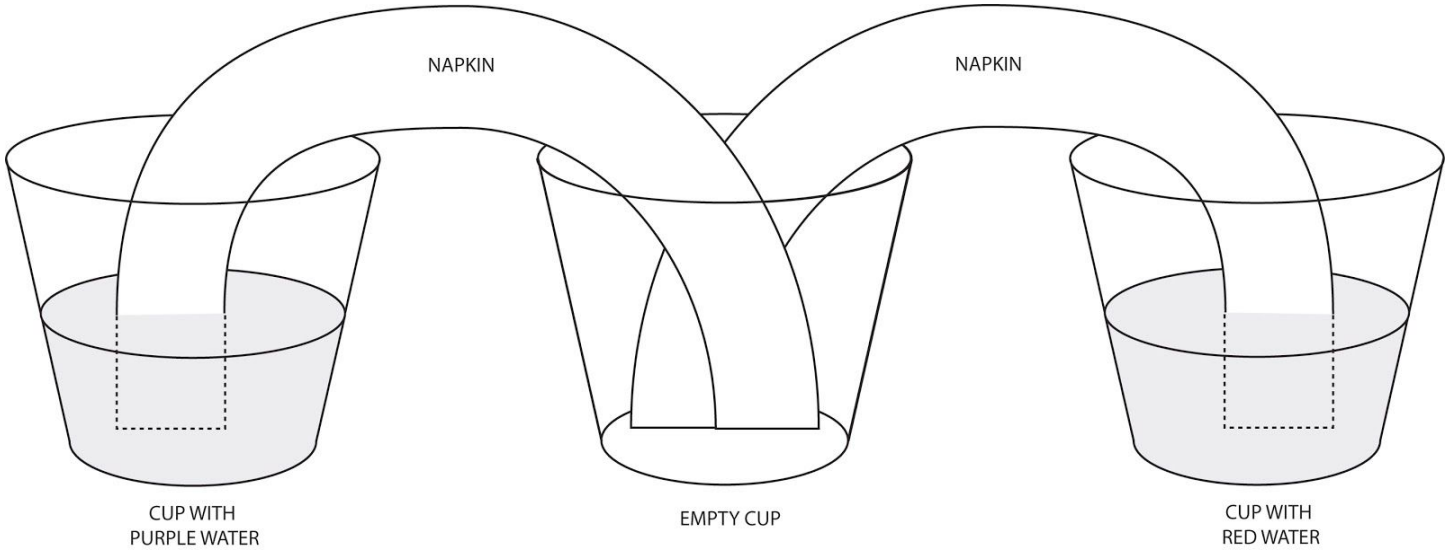
Compare your results to your prediction and describe how your set-up changed over 24 hours.

Throw away your napkin and water. Rinse and dry the cups for the next part.

This process of "climbing" is known as **capillary action**, and would not be possible without water's properties of cohesion, adhesion, and surface tension. Capillary action is vital to the movement of water and all of the things that are dissolved in it.

Predict and Test

1. Take three clean plastic cups and place them side by side.
2. Use the small spoon to place ½ scoop of purple powder drink mix into **the cup farthest to the left** and fill it about ⅓ full with water. Stir.
3. Place ½ scoop of red powder drink mix into **the cup furthest to the right** and fill it about ⅓ full with water. Stir. **The middle cup should not have water in it.**
4. Look at the diagram on the next page and predict what will happen. Fold a piece of the napkin in half **two** times. Place one end of the napkin in the cup with purple water and fold the other end into the empty cup. Fold another piece of the napkin in half **two** times. Place one end of the napkin in the cup with red water and fold the other end into the empty cup.
5. Observe for a couple of minutes and draw your set-up.
6. After 24 hours, draw your set-up again to record any changes.



Compare your results to your prediction. Explain what occurred using evidence and the terms cohesion and adhesion.

Throw away your napkin and water. Rinse and dry the cups for the next part.

Effect of Temperature on Capillary Action

You will need a timer or stopwatch (phone, computer, watch, or stopwatch) for this.

1. Take four clean plastic cups. Label one hot and one cold. *How do you think the temperature will affect how fast capillary action occurs?*
2. Fill the cup labeled cold to about ¼ inch from the top with cold water and 2-3 ice cubes. Place an empty cup next to it.
3. Use the small scoop to place ½ scoop of the purple powdered drink mix in the empty cup. The powder's color will show when the water reaches the other side.
4. Unfold a napkin and cut or tear it into four equal parts.
5. Fold a piece of napkin in half **two** times. Place one end of the napkin in the cup with water and fold the other end into the powder cup. As soon as you place the napkin in the cup with water, start your timer. Record how long it takes for the water to make it to the other cup.
6. Fill the cup labeled hot about ¼ inch from the top with hot water from the tap. Place an empty cup next to it.
7. Use the small scoop to place ½ scoop of the red powdered drink mix into the empty cup.
8. Repeat step 5.

Cold water has less energy than hot water. Adding heat to the water adds energy, causing the molecules in warm water to move faster than molecules in cold water.

Using the information above and evidence from your investigation, explain how temperature affects capillary action.