

Capillary Action Activities Worksheet

Part I: The Meniscus

Purpose

Cohesive and adhesive forces can affect water at its surface. Cohesive forces cause water molecules to be attracted to each other and hold the water together providing as little surface area as possible. Adhesive forces, on the other hand, encourage water molecules to “stick” to solid objects. The relative strength of these two forces determines how water behaves at a water-air-solid boundary.

Equipment

- graduated cylinder

Procedure

1. Fill a graduated cylinder half full of water.
2. In the space below, sketch the shape of the water’s surface. Label the water, glass and air in your sketch. This curvature of the water is known as the meniscus.

Questions—The Meniscus

1. Water is strongly attracted to glass. How does this explain the shape of the meniscus?
2. Why doesn’t the water climb higher along the glass?
3. Liquid mercury, unlike water, is repelled by glass. If you filled your cylinder with mercury instead of water, what would the surface of the mercury look like? Sketch your idea below and label the mercury, glass and air in your sketch.

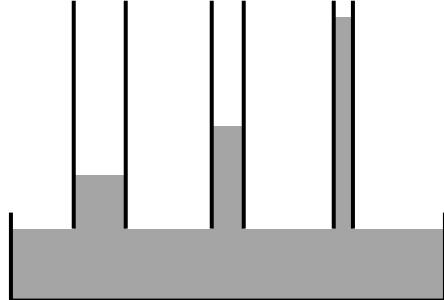
Part II. Capillary Tubes

Purpose

Consider a glass tube placed in a cup of water. Inside the tube, adhesive forces draw the water up the sides of the glass tube to form a meniscus. Cohesive forces then try to minimize the surface area by drawing water up the tube against gravity. This rise in the water level in a tube due to adhesive and cohesive forces is known as *capillary action*.

Equipment

- ring stand with support ring attached
- 3 capillary tubes of different diameters
- large Petri dish
- twist-ties
- water with dark food coloring
- ruler



Procedure—Climbing Water

1. **Place** an empty Petri dish directly below the support ring.
2. On the lab bench, **arrange** the glass capillary tubes in order of increasing inner diameter (ID) as noted on their tags.
3. **Attach** each capillary tube to support ring using a twist-tie. *Caution: Capillary tubes are delicate—handle with care.*
4. **Arrange** the capillary tubes so that each *almost* touches the bottom of the Petri dish.
5. **Fill** the Petri dish with water dyed with food coloring.
6. Watch as water begins to rise quickly in each capillary tube. **Wait** two minutes, or until the water stops rising. **Record** the water height in each capillary tube, below:

Inner Diameter (mm)	Maximum Height of Water (cm)
0.60	
0.31	
0.20	

Questions—Climbing Water

1. What happened when you put the end of a capillary tube into water?
2. If you want water to climb higher, would you use a thin tube or a thick tube?
3. Is the relationship between the inner diameter and the height of the water linear or exponential? Consider the ratio between each differing diameter and its respective height.

Part III: Using Capillary Action

Purpose

Water moves through any confined space by capillary action. When you place a paper towel on a water spill, the water is drawn into the paper as it moves into the small gaps between paper fibers. These small gaps give cloth, sponges and paper towels their absorbency.

The capillary action through materials such as cloth, paper or rope can be used to purify water by transferring water through the wick material from a “cloudy” source into a clean container. In this part of the lab, you will design your own “capillary siphon” and test how well it works overnight.

Equipment

- various types of paper, cloth and string
- paper towels
- scissors
- tape

Procedure

1. Your teacher has provided various possible materials for your team to use to create a capillary siphon. You are free to choose any material or design, but the finished length must be no longer than 30 cm and must weigh no more than 100 g. Sketch your design below:

2. When you have finished your design, use a piece of string to attach a team name label to your siphon and bring your siphon to the front table to be measured for meeting requirements.

weight: _____ length: _____

3. At the end of class, drape your siphon over two buckets, one full and one empty. The following day, at the beginning of class, measure how much water has been transferred between the two buckets by capillary action through the siphon.

water transferred: _____

4. Record your team’s findings on the board along with a brief description of your siphon.

Question—Using Capillary Action

Looking at the results from each group, can you draw any conclusions about which materials or designs worked the best?