

Welcome to Family Science Night!

## **A Penny For Your Thoughts!**

**What is cohesion?  
What is surface tension?**

Have you ever watched raindrops on a window? The drops will cling to the window, trickling together to form larger drops. The drops will more than likely join together than split apart.

Glue and tape can be used to stick objects together. These adhesives cause the objects to cohere or (or adhere) together. Water has a certain “stickiness” to it. Cohesion is a sticking force that holds a material together. It occurs on common everyday objects. Rain sticking on a car window, dust on a ceiling fan, and chewing gum on the carpet are all examples of cohesion.

**Questions** to ponder:

- ◇ How do water molecules behave cohesively?
  
- ◇ How are surface tension and cohesion related?

**Materials:**

Pie Tin  
Cup of Water  
Eye Dropper  
Penny  
Liquid Soap  
Spray Cooking Oil (Pam)

Yarn  
String  
Thread  
Scissors  
Measuring Tape

**Investigate:**

1. Place a clean dry penny in the pie tin.
2. Partially fill a dropper with water. Note that you take water into the dropper by squeezing the plastic or rubber bulb, placing the tip of the dropper well under the surface of water in a cup. Release your squeeze to let water into the dropper. Let drops out of the dropper by gradually squeezing the plastic bulb. Before beginning the experiment, practice using the dropper over the cup of water, letting drops out only one at a time.
3. Hold the plastic dropper vertically about 1 centimeter above the penny. Place drops of water on the penny one by one.
4. Count the drops of water carefully, as they are squeezed on the penny. Watch from the side as the water builds up. The surface tension of the water will eventually break, causing the water to spill off the penny.
5. Carefully empty the water from the pie tin back into the cup.
6. Dry the penny and pie tin with paper towel. Try a second trial.
7. Record results in the data chart below. Write the maximum number of drops of water that you were able to get onto the penny at one time.

**Guess how many drops of water can be placed on the surface of a penny without it spilling over: \_\_\_\_\_**

## Surface Tension Tests

Test	Maximum Number of Drops	Observations Describe what you see.
Trial 1		
Trial 2		
Trial 3		

### Extend:

#### **A. Coat the penny with cooking spray or oil.**

Follow the same procedures above.

Does the water fall off the penny with fewer drops? Does the water fall off with more drops?

#### **B. Coat the penny with liquid soap.**

Follow the same procedures above.

Does the water fall off the penny with fewer drops? Does the water fall off with more drops?

#### **C. Squeeze smaller drops of water from the eye dropper on a clean penny.**

Follow the same procedures above.

Does the water fall off the penny with fewer drops? Does the water fall off with more drops?

**More questions** to ponder:

- ◇ Which investigation resulted in more drops of water cohering on the penny (greater surface tension)?
- ◇ Which investigation resulted in fewer drops of water cohering on the penny (less surface tension)?
- ◇ How would you describe the property of water called surface tension?

**Try This:**

*Stretch at least 2 feet of yarn at an angle. A person should hold the yarn at each end.*

*Place a cup at one end of the string.*

*Squeeze drops of water on the piece of yarn.*

*Watch the water.*

*Does the water travel or transport across the string and empty into the cup?*

Try a shoelace! Does water travel across a shoelace?

Try thread!

Try twine!

How does the water travel?

**Water molecules have a strong cohesion, or attraction, to other water molecules. The molecules stick together. Cohesion is stronger for water than for most other liquids. Cohesion is very important in plants. Trees depend on cohesion to help transport water from their roots to their leaves. Cohesion helps water rise against the force of gravity. Plants are able to drink water and survive.**

**The oxygen end of water has a negative charge and the hydrogen end has a positive charge. The hydrogen of one water molecule are attracted to the oxygen from other water molecules. This attractive force is what gives water its cohesive and adhesive properties. Because of the way hydrogen and oxygen atoms are joined within a water molecule, water molecules are attracted to or pulled toward one another. Cohesion results from this attraction of atoms and molecules.**

**The cohesive force of the like-molecules of water forms a skin-like surface called surface tension. Surface tension helps a drop of water hold its shape. Surface tension is a measure of how difficult it is to stretch or break the surface of a liquid. Hydrogen bonds give water an unusually high surface tension, making it behave as though it were coated with an invisible film. A water molecule at the surface is attracted mostly by water molecules beneath it. A water molecule below the surface is attracted in all**

directions by the water molecules around it. This attraction holds many water molecules together.

Surface tension allows some water striders to walk or “skate” across the surface of water. If you try floating a pin or a paperclip on top of water in a glass, it will float because of surface tension. A metal pin or paper clip is heavier than water, but because of the surface tension the water is able to hold up the metal. Soap reduces surface tension. Soaps will cause less drops of water to hang about on a penny.

The attraction between molecules decreases as the distance between the particles increases. Cohesion is highest in solids. Liquids are less cohesive than solids, and gases are practically noncohesive.

Water can also be attracted to other materials by *adhesion*. Water is able to cling to itself and pile up on a surface.