Solids, Liquids, and Intermolecular Forces **Name**_____

Liquids: Surface Tension, Capillary Action, and Viscosity

Read from Lesson 2 Properties of Liquids in the Chemistry Tutorial Section, Chapter 11 of The Physics Classroom **Part c: Surface Tension** **Part d: Capillary Action** **Part e: Viscosity**

Have you ever wondered why small insects can stride across water or how water rises in a thin glass tube? These phenomena illustrate the significance of **surface tension**, **capillary action**, and **viscosity** — all are key properties that show how intermolecular forces govern the behavior of liquids. **Surface tension** results from **cohesive** forces among molecules at the liquid's surface, minimizing surface area and creating a strong intermolecular network. **Capillary action** is driven by **adhesive** forces between the liquid and a solid surface, such as glass, combined with **cohesive** forces within the liquid itself, enabling movement against gravity. **Viscosity** reflects a liquid's internal resistance to flow, directly influenced by the strength and nature of intermolecular forces, like hydrogen bonding or London dispersion forces. Together, these properties show how microscopic intermolecular forces shape the macroscopic behavior of liquids.

Penny Lab

Molly Cule and Mark Eury are investigating adhesion, cohesion, and surface tension. They place a clean penny on a flat surface and add drops of water (at room temperature) to the surface of the penny. They count the number of drops the penny can hold until the water spills over. They repeat for another two trials. Then they repeat this procedure using cold water, hot water, soapy water, rubbing alcohol, and olive oil. *(This is also a fun lab to do with your chemistry class!)*

Use this data from their lab to answer the questions below:

Liquid	Trial 1	Trial 2	Trial 3	Average Number of Drops
Room Temp H_2O	30	32	31	31
Cold H_2O	35	33	34	34
Hot H_2O	25	26	25	25
Soapy H_2O	12	14	11	12
Rubbing Alcohol	19	19	20	19
Olive Oil	8	10	9	9

1. The most drops of which type of water could be placed on the surface of the penny? The fewest drops? Explain in terms of cohesion, surface tension, and intermolecular forces.

2. Why did olive oil hold the fewest drops on the penny? Explain in terms of cohesion, surface tension, and intermolecular forces.

3. Compare the intermolecular forces between water (H_2O), rubbing alcohol (C_3H_7OH), and olive oil (long hydrocarbon chains). What is the relationship between intermolecular forces and the number of drops that can be placed on top of the penny?

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More Questions

1. A florist needs to create blue carnations. She adds blue food coloring to a pitcher of water and places the carnations into the pitcher. Why does the dye travel up the stems of the carnations? What factors influence the speed of this movement?

2. Why does water bead up on a freshly waxed car?

3. Why do small insects like water striders manage to walk on water without sinking? What intermolecular forces allow this, and what conditions could disrupt this ability?

4. Compare the viscosity of lava during a volcanic eruption to that of water. How does silica content (SiO_2) affect the lava's viscosity, and why?

5. When measuring the volume of liquids in a graduated cylinder, Ellie Ment notices that water forms a concave meniscus while liquid bromine forms a convex meniscus. Explain the intermolecular forces, etc. responsible for the different meniscus shapes and predict how this difference might affect the accuracy of volume measurements.