

NNCI—Nanoscale Science and Engineering

Exploring Forces— Gravity vs Intermolecular

Explore!

Part 1

1. Take the full size cup and dip it into the water.
2. Now pour the water back into the container. What happens?
3. Take the tiny cup and dip it into the water.
4. Now pour the water back into the water container. What happens?



Part 2

1. Take a tablespoon of granulated sugar and pour it into the plastic cup.
2. Now pour the sugar back into the container. What happens?
3. Next pour a tablespoon of 10X sugar into the plastic cup.
4. Now pour the sugar back into the container. What happens?



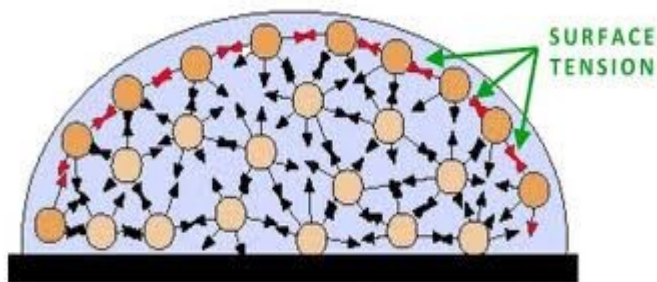
Demo adapted from Jones et al (2007) Nanoscale Science: Activities for Grades 6-12, NSTA Press and <http://www.nisenet.org/catalog/programs/exploring-forces>.

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Exploring Forces— Gravity vs Intermolecular

At the nanoscale, size is very important. Size can actually affect the way things behave. In this activity, you are examining how different forces are operating depending on size.

The water is easy to pour out from the big cup but not the tiny cup. Gravity is the dominant force on the water in the big cup. There is much more water for gravity to act upon. With the smaller cup, surface tension



Molecules inside a water drop are attached in all directions. Drops on the surface are attracted to the sides and inward.

<http://quest.nasa.gov/space/teachers/microgravity/image/66.gif>



http://commons.wikimedia.org/wiki/File:Water_strider_in_a_pond.jpg

plays a more important role than gravity.

With a small amount of water, surface tension (the cohesive property of water) is the more important force.

Thus the water “sticks” to the cup. A water strider takes advantage of the stickiness of water to walk on the surface.

The same thing happens with the two forms of sugar—larger granules versus smaller granules. With the superfine 10X sugar granules the electrostatic forces between the sugar and the surface of the cup are stronger than gravity. Therefore it is more difficult to pour out the 10X sugar.

Scientists and engineers are using these unique properties at the nanoscale to make new materials and devices. Lotusan® is a coating for buildings which causes water to run off and collect dirt along its path, keeping the surface clean.

