



Exploring Forces—Gravity

Try this!

1. Fill the full-size cup by dipping it in the water.
2. Try to pour the water back into the container. What happens?
3. Now fill the miniature cup with water. Can you pour the water back out?



What's going on?

It's easy to pour water out of a regular-sized cup, but not out of a miniature cup. That's because size can affect the way a material behaves. The size of the cup—and the amount of water it holds—determines which force is more important, gravity or surface tension.

When you tip the regular cup, the force of gravity pulls the water out of the cup. But with a small amount of water, surface tension can counteract gravity. So when you tip the miniature cup, gravity isn't strong enough to overcome the natural tendency of water molecules to stick together, and the water stays in the cup.

How is this nano?

A material can act differently when it's nanometer-sized. Different physical forces dominate when things get very, very small. For example, gravity is very apparent to us on the macroscale, but it's hardly noticeable at the nanoscale.

The miniature cup is tiny, but it's still much, much bigger than things measured in nanometers. The tiny cup is about seven millimeters across, which is seven million nanometers! (A nanometer is a billionth of a meter.)

Nanotechnology takes advantage of the different physical forces at the nanoscale to make new materials and tiny devices. Nanotechnology allows scientists and engineers to make things like smaller, faster computer chips and new medicines to treat diseases like cancer.





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Learning objectives

1. A material can act differently when it's nanometer-sized.
2. Different physical forces dominate when things get very, very small. For example, gravity is very apparent to us on the macroscale, but it's hardly noticeable on the nanoscale.

Materials

- Regular teacup
- Miniature teacup
- Container for water

Note to the presenter

Before beginning this activity, fill the container with water.

Credits and rights

This activity was adapted from: Jones, M. Gail, Michael R. Falvo, Amy R. Taylor, and Bethany P. Broadwell. "Shrinking Cups: Changes in the Behavior of Materials at the Nanoscale." In *Nanoscale Science: Activities for Grades 6-12*. pp. 89-94. Arlington, VA: NSTA Press.



This project was supported by the National Science Foundation under Grant No. ESI-0532536.

Any opinions, findings, and conclusions or recommendations expressed in this program are those of the author and do not necessarily reflect the views of the Foundation.

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