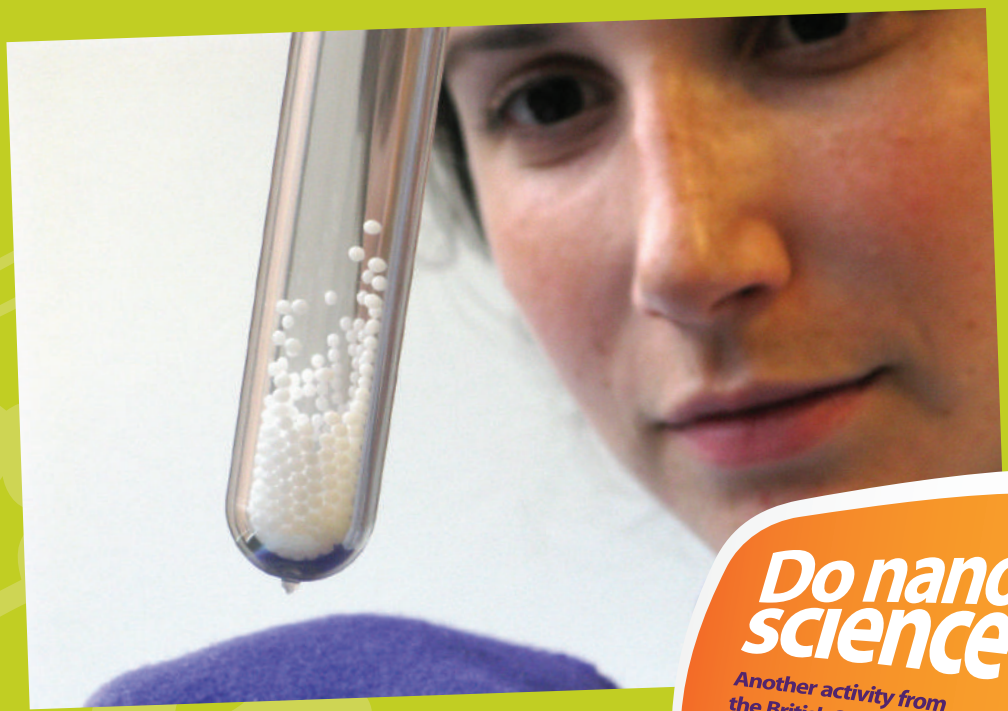
BRITISH SOCIETY FOR NANOMEDICINE

Exploring Forces: Static Electricity

Can static electricity beat gravity?



Do nano science!

Another activity from the British Society for Nanomedicine and NISEnet.

BRITISH SOCIETY FOR NANOMEDICINE

Do nano science!

a range of education packages from our American partner NISE Net

The British Society for Nanomedicine has teamed up with an American partner to bring teachers, and children, a valuable, interesting and enjoyable range of classroom based activities.

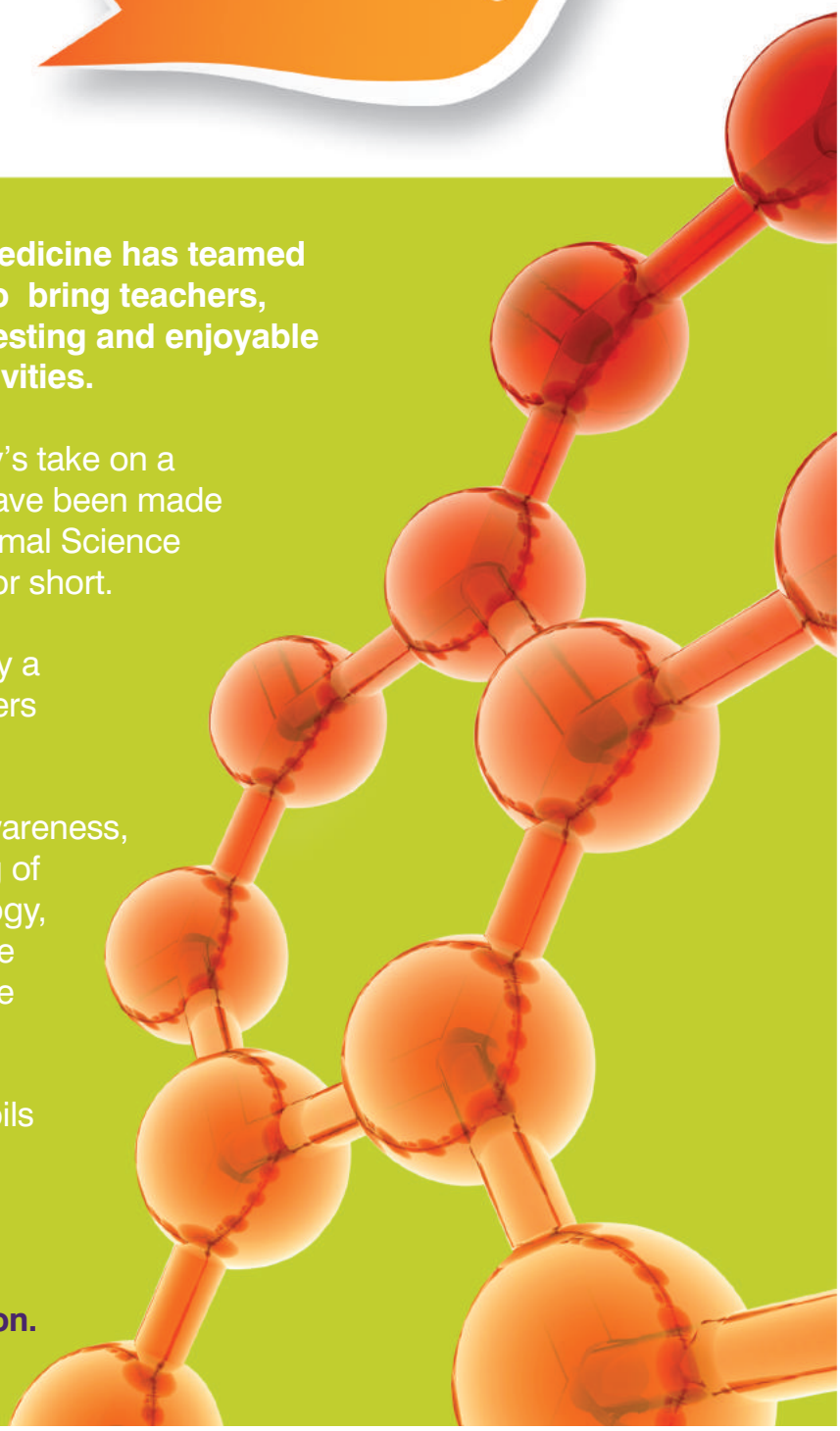
“Do nano science” is the society’s take on a range of digital packages that have been made available by the Nanoscale Informal Science Education network – NISE Net for short.

The organsiation is supported by a national community of researchers and informal science educators.

Dedicated to fostering public awareness, engagement and understanding of nanoscale science and technology, NISE Net has agreed to allow the society to offer the exciting range of activties for children.

We hope that you, and your pupils enjoy this particular activity, and come back to experience more of the growing range.

We’d love to hear how you got on.



NanoDays
The Biggest Event for the Smallest Science!

Exploring Forces—Static Electricity

Try this!

1. Hold the tube of small balls by the cap.
2. Use the piece of fleece to rub the sides of the tube.
3. Stop rubbing, and hold the tube right side up. What happens? Look closely at the balls.
4. Now hold the tube of large balls by the cap, and rub it with the fleece. Does the same thing happen?

What's going on?

Many of the small balls are suspended inside the tube, but most of the larger ones fall to the bottom. That's because size can affect the way a material behaves. The size of the balls determines which force is more important, gravity or static electricity.

When you rub the tubes with fleece, the two forces work against each other. Gravity pulls the balls down to the bottom of the tube. Static electricity pushes the balls apart, and makes them cling to the sides of the tube.

The force of the static electricity has a big effect on the small balls, but it barely affects the larger balls. That's because static electricity builds up on the surface—or outside—of the balls.

Each of the tubes contains the same volume of balls, but the smaller balls have a lot more surface area. This means that more static electricity can build up on the small balls. The larger balls have a lot less surface area for the same volume—so the force of gravity pulls them down.

You also see static electricity at work when your hair stands on end after you pull off a fleece, or when you get a shock after walking across a carpet.

Static electricity builds up on slides

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. In the nano world, static electricity is much more important!

The small balls are pretty little, but they're still much, much bigger than things measured in nanometers. One small ball is about two millimeters across, which is two 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.

Learning objectives

1. A material can act differently when it's nanometer-sized.
2. Different physical forces dominate when things get very, very small.

Materials

- Tube of large balls
- Tube of small balls
- Polar fleece

Tubes with caps (baby soda bottles) are available from www.SteveSpanglerScience.com (#WBSB-150).

Delrin balls are available from www.mcmaster.com (3/32" diameter #9614K51 and 3/16" diameter #9614K54). You'll need 300 small balls and 40 large balls. They come in packs of 100.

Silica gel dessicant (optional) is available from silicagelpackets.com (2-4 mm beads). If you use dessicant, you'll need just a couple of beads per tube.

Notes to the presenter

Holding the tube by the cap helps the static electricity build up in the tubes. Hold the tubes by the cap while you're trying to charge them with the fleece.

Touching the tubes near the bottom helps discharge the static electricity. Hold the tubes by the bottom and swirl the balls to help discharge them.

You don't need to completely discharge the tubes between visitors. It's more important for visitors to see the difference between the large and small balls when they're both charged than it is for them to compare charged and uncharged balls.

Static electricity builds up better when the air is dry, so there are a couple of clear beads of silica gel dessicant in each tube.

Related educational resources

The NISE Network online catalog (www.nisenet.org/catalog) contains additional resources to introduce visitors to the fundamentals of nanoscale science and technology:

- Public programs include *Intro to Nano, Nano Dreams and Nano Nightmares, Surface Area* and *Wheel of the Future*.
- NanoDays activities include *Exploring Forces—Gravity* and *Exploring Properties—Surface Area.*
- Media include the *Intro to Nanotechnology* video.
- Exhibits include *At the Nanoscale, Three Drops,* and *Unexpected Properties.*

Credits and rights

This project was supported by the National Science Foundation under Award No. ESI-0940143. 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.