NanoDays
The Biggest Event for the Smallest Science!

Exploring Size—Ball Sorter

Try this!

1. Look at the white balls in the container. How many sizes do you see? How could you sort the balls by size?
2. Stack the sieves in size order. Put the sieve with the largest screen holes on the top and the one with the smallest holes on the bottom.

   Tip: To stack and lock two sieves, fit the bump from the top sieve into the notch of the bottom sieve, and turn.
3. Slowly pour the balls into the stacked sieve set.
4. Keeping the sieve set on the table, gently shake it back and forth.
5. Carefully separate the sieves. What happened to the balls?

What's going on?

Using sieves with different-sized holes, you sorted the balls by size! There are lots of tools to sort and separate materials by size. In everyday life, we use strainers, screens, and filters. The right sorting tool depends on the kind of materials you're sorting and how big they are.

In the field of nanotechnology, researchers study and make tiny things that are measured in nanometers. A nanometer is a billionth of a meter. That's very, very small—the size of atoms and molecules! Researchers are developing new technologies that can sort nano-sized things, including filters with nano-sized holes.

Many water filters can get out relatively big things like dirt and bacteria, but only filters with very small pores can remove tiny things like viruses and salt ions. These special filters can be used to purify water all over the world.

Researchers are also investigating the natural, nano-sized pores in the human body to better understand how our bodies filter materials. This is allowing them to develop new medical treatments that use the body's built-in filtration system to get medication to the right places.

How is this nano?

Nano water filter

A nanometer is a billionth of a meter. Nanoscale science focuses on things that are measured in nanometers, including atoms and molecules, the basic building blocks of our world.

In the field of nanotechnology, researchers study and make tiny things that are measured in nanometers. (A nanometer is a billionth of a meter.)

New nanotechnologies include water filters with nano-sized pores and medications that use the human body's natural filtration system.

Learning objectives

1. A nanometer is a billionth of a meter.
2. New nanotechnologies include water filters with nano-sized pores and medications that use the human body's natural filtration system.

Materials

- Nesting sieves with three screen sizes
- Small balls in three sizes
- Container for balls

Nesting sieves are available from www.pioneermining.com (sizes 4, 6, and 30 work with the balls included in the NanoDays kit).

Delrin balls are available from www.mcmaster.com (1/8" balls #9614K58, 3/16" balls #9614K54, and 3/8" balls #9614K52).

Notes to the presenter

Have visitors pour the balls into the sieve slowly—they can bounce out if they're poured too quickly.

Children and persons with limited dexterity may need assistance with this activity.

This activity can also be used to introduce potential societal and ethical issues related to nanotechnology:

> *Some people are concerned that the size of nanoparticles may make a difference in how safe they are. Our bodies have natural filters and barriers to keep out things that could harm us, including our skin, nose hairs, cilia, and cell walls. Nano-sized particles are so small that they can get through our natural defenses. We can use this to our advantage, by developing new medications that go directly to the part of the body where they're needed. But we also need to think about whether nanoparticles in other kinds of nanotechnologies might get through our bodies' natural defenses by mistake, and whether that might be harmful.*

Related educational resources

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

- Public programs include *Cleaning Our Water with Nanotechnology, Cutting it Down to Nano* and *Tiny Particles, Big Trouble!*
- NanoDays activities include *Exploring Size—Measure Yourself, Exploring Size—Memory Game, Exploring Size—Powers of Ten Game, Exploring Size—Scented Balloons, Exploring Size—StretchAbility Game,* and *Exploring Size—Tiny Ruler.*
- Media include the poster and book *How Small is Nano?*, *Image Scaler Software, Scale Ladder*, and *Societal and Ethical Implications Poster* "Will nanotechnology improve living conditions around the world?".
- Exhibits include *At the Nanoscale* and *Three Drops.*

Credits and rights

Image of water filter courtesy Lifesaver Systems, Ltd.

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