NanoDays
The Biggest Event for the Smallest Science!

Exploring Size—Get in Order!

Try this!

1. Find 6-8 people to play this game.
2. Each person gets a card with an object on it. Some of the things are big and others are small.
3. Try to line up in order of size. How fast can you get in order?
4. Take a look at the symbols on the bottom right-hand corner of the cards. What tools do we use to observe the different objects?

What's going on?

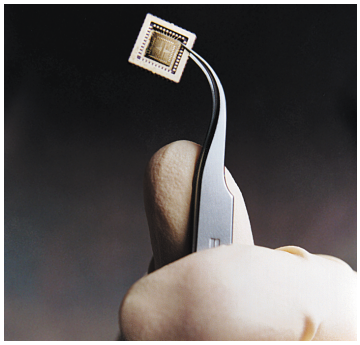
Things in the universe come in different sizes—and size is important! The objects on the cards are organized according to powers of ten.

Each number on the scale represents a ten-fold change in size. An object marked with a 0, like a person, is about a meter tall. An object marked with a +3, like a blue whale, is around a thousand times bigger than a person. An object marked with a -3, like a pea, is around a thousand times smaller than a person.

Really tiny objects, like DNA, are marked with even lower numbers. DNA (-9) is so tiny it's measured in nanometers! A nanometer is a billionth of a meter. In the emerging field of nanotechnology, scientists work with very tiny things measured in nanometers.

Scientists use special tools and equipment to work on the nanoscale. The icons on the corner of the cards show what tools are used to study things of different sizes. We use satellites and telescopes to study very large objects, like planets and moons. We use our eyes and other senses to observe bicycles and people. We use microscopes to look at things that are too small to see using our eyes. To study things on the nanoscale, scientists use special tools such as scanning electron microscopes (SEMs) and atomic force microscopes (AFMs). These tools allow researchers to detect and make images of individual atoms and other tiny things.

How is this nano?



Computer chip

A nanometer is a billionth of a meter. That's really tiny! Nanometers are used to measure things that are too small to see, like atoms and molecules, the basic building blocks of our world.

Nanoscale science focuses on things that are measured in nanometers. Scientists use special tools and equipment to work with things that have nanometer-sized parts, such as microchips.

In the field of nanotechnology, scientists and engineers make new materials and tiny devices. Nanotechnology allows them to make things like smaller, faster computer chips and new medicines to treat diseases like cancer.

Learning objectives

1. A nanometer is a billionth of a meter.
2. Scientists use special tools and equipment to work on the nanoscale.

Materials

- "Get in Order" cards
- "Order of Magnitude" sheet

Notes to the presenter

A set of eight cards is provided in this activity. If you have fewer players, you can omit some of the cards. Be sure to include the universe (the largest object), the pirate (the one-meter baseline), and DNA (the smallest object). After players are in line, you can show the additional cards and ask where they would go.

To play this game with more players, you can print out additional cards. The cards are based off of the activity *Sizing Things Down* and are available in the NISE Net online catalog, www.nisenet.org/catalog.

For older audiences, you can introduce additional vocabulary, explain the scientific notation system, or provide additional information:

- Nanometers, centimeters, and meters are all part of the metric system. This measuring system uses units based on powers of ten. Scientists use the metric system because it makes calculations easier.
- The metric system is a *logarithmic* scale. Each ten-fold increase in size is called an *order of magnitude.*
- The numbers on the top left corner of the cards indicate the approximate length of the different objects in meters. For example, objects with a -9 are measured in nanometers. They're about 10^{-9} meters across.
- The colored circles on the bottom right corner of the cards indicate some of the tools used to see objects of different sizes.

Related educational resources

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

- Public programs include *Shrinking Robots!*
- NanoDays activities include *Exploring Size—Measure Yourself, Exploring Size—Memory Game, Exploring Size—Scented Balloons, Exploring Size—Powers of Ten Game, Exploring Size—StretchAbility Game,* and *Exploring Size—Tiny Ruler.*
- Media include *How Small is Nano?*, *Image Scaler Software, Intro to Nano, Multimedia Zoom into a Human Hand, Multimedia Zoom into a Nasturtium Leaf, Scale Ladder*, *Zoom into a Butterfly Wing, Zoom into a Computer Chip,* and *Zoom into the Human Bloodstream.*
- Exhibits include *At the Nanoscale*.

Credits and rights

This activity was adapted from *Sizing Things Down,* developed by the Oregon Museum of Science and Industry for the NISE Network. The original program is available at www.nisenet.org/catalog. Another adaptation of this game, "Exploring Size—Powers of Ten Game," is also available in the online catalog.

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