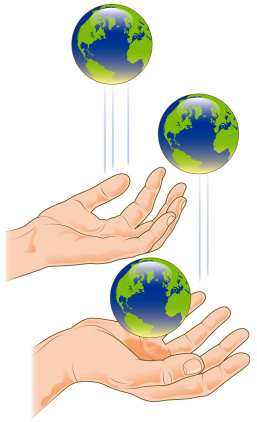
Did you know?

- The size of a nanometer compared to a meter is like the size of a marble compared to the earth?
- The head of a pin is a million nanometers in diameter.
- A sheet of paper is about 100,000 nanometers thick.
- Your fingernails grow one nanometer every second.
- A human hair measures roughly 50,000 to 100,000 nanometers across.
- Ten hydrogen atoms in a row fill a distance of one nanometer.



This project was based on work supported by the National Science Foundation under Grant No. ESI-05322536.

Any opinions, findings, and conclusions or recommendations expressed in this passport are those of the authors and do not necessarily reflect the view of the Foundation.

To learning more about nanoscience visit the NISE Network
www.nisenet.org

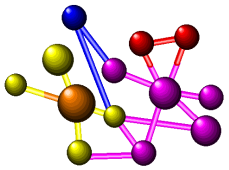
chabot space & science center

A passport to the world of tiny things

At one billionth of a meter
expect things to behave very differently

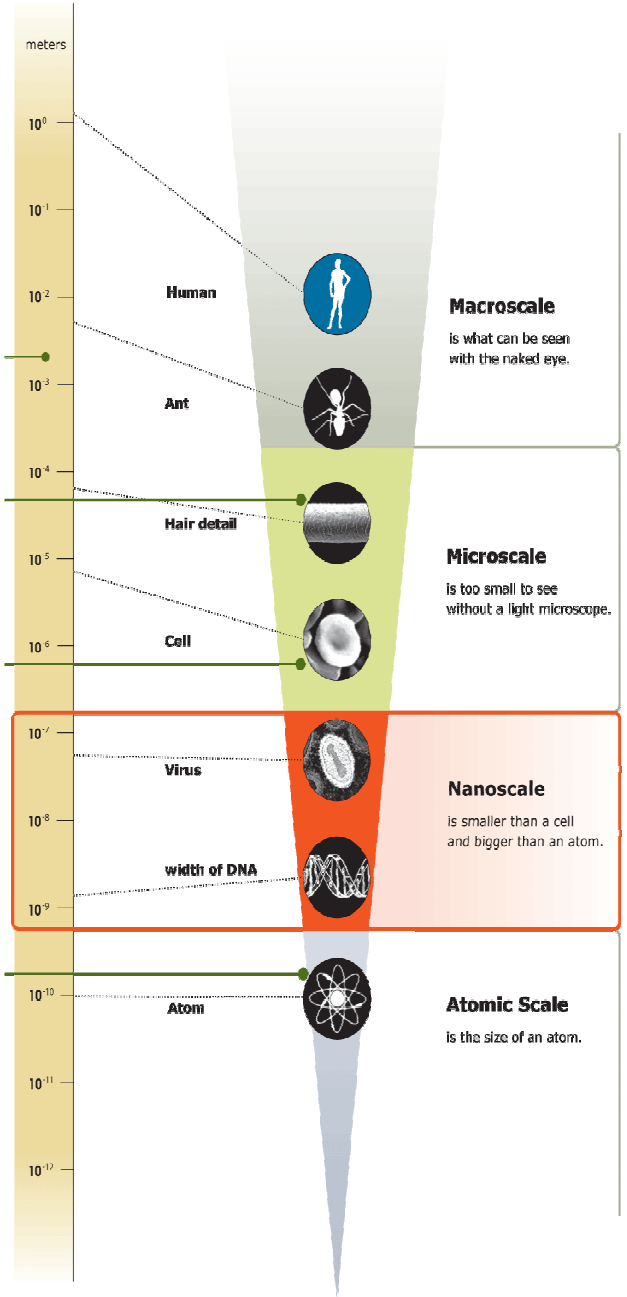
NanoDays

Presented by the Galaxy Explorers
Saturday, March 28, 2009



What is Nanoscience?

Nano is the scientific term meaning one-billionth. It comes from a Greek word meaning “dwarf.” A nanometer is one billionth of a meter (1/100,000,000). At this size, the size of atoms and molecules, materials take on new properties, making possible new applications that could altar everyday items from the clothes we wear to the cars we drive.

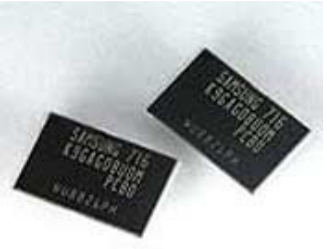


Exploring Consumer Products–Is it Really Nano?

Which products below contain nano technology?

Silver Infrared Anti-odor Socks

YES / NO



16 Gb flash drive

YES / NO

Nano iPod

YES / NO

Sunscreen

YES / NO

Tata Nano Car

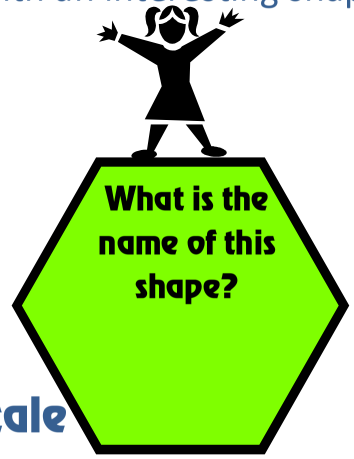
YES / NO

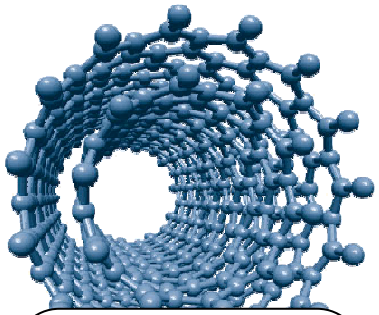
Antibacterial Lock

YES / NO

Exploring Structures

Carbon Nanotubes are a form of carbon with an interesting shape

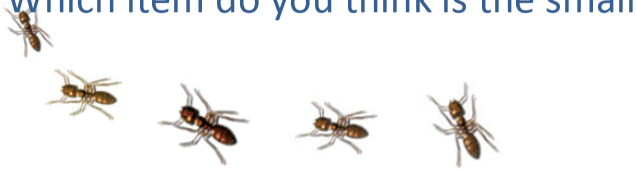




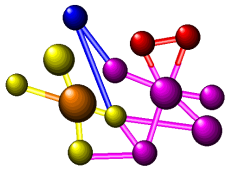
PASSPORT STAMP

Nanoscale

Which item do you think is the smallest?



- ☐ An atom
- ☐ A virus
- ☐ A hair
- ☐ A bacterium
- ☐ An ant
- ☐ A molecule



Answer:

The answer is an atom. Here's the order of the items in the list from largest to smallest: an ant, a hair, a bacterium, a virus, a molecule, and an atom.

Nano Shows (Chemistry Physics Lab)

10:00am **701: Size and Scale**
What is nano? -- How big is one billion and how small is one nanometer? Where is nano?

11:00am **702: Structure of Matter**
Hockey sticks-How do carbon nanotube hockey sticks compare to wood and composite sticks? Butterfly Wings-Why do they change color?

12:00pm **703: Small is Different**
Surface area—how does surface area affect how things react? Stained Glass—how can gold look red and silver look yellow?

1:00pm **704: Forces at the Nanoscale**
Gecko Feet—which lizards are the best climbers? Nasturtium Leaves—why does water bead up on the some leaves?

2:00pm **705: Applications**
Assembly—how can some things at the nanoscale assemble all by themselves? Bone Re-growth—what's the best nanomixture?

3:00pm **706: Nanotechnology and Society**
Water cleanup—can nanoiron clean up the pollution in soil. Nanosilver—does it leak out of socks when they are washed?

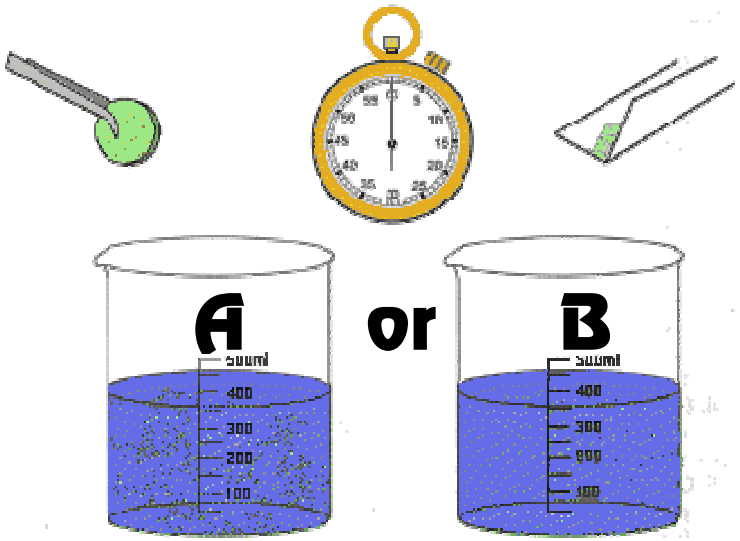
PASSPORT STAMP

4:00pm **701: Size and Scale**

5:00pm **702: Structure of Matter**

Exploring Properties-Surface Area

Which will dissolve faster, **"A"** the whole tablet or **"B"** the crushed tablet?



Exploring Tools – Nanostructures

Do you feel NANO? Try to detect magnetic fields with your probe strip. What do they feel like?

_____

_____

_____

PASSPORT STAMP

Exploring Measurement – The Human Body

To understand nanoscale science, you have to think really, really small. Nanotechnology and nanoscience involve extremely objects that are measured in a tiny unit of measurement, the nanometer. A nanometer is one-billionth (1/1,000,000,000) of a meter—that's really small.

HOW TALL ARE YOU IN NANOMETERS?

PASSPORT STAMP

Exploring Materials – Ferrofluid

TRUE OR FALSE?

The Ferrofluid is a Liquid

PASSPORT STAMP

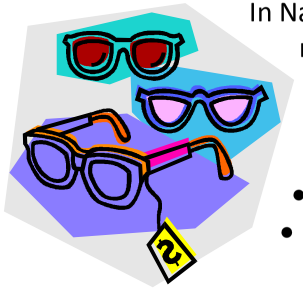
Exploring Forces – Water and Nano Leaves

Use the table below to record your observations and experiments as you compare leaves.

	Hairs	Texture	Drop	Dunk it in
Nasturtium				
Geranium				
Begonia				
Lamb's Ear				

PASSPORT STAMP

Nanomedicine Today



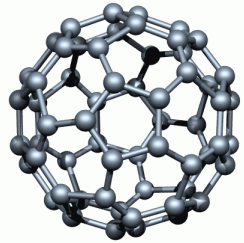
In Nanomedicine biomedical research seeks to use nanoscale tools to improve health. Current medical uses of nanotechnology include

- burn and wound dressings
- a dental-bonding agent
- sunscreens
- protective coatings for eyeglasses

Nanomedicine Tomorrow

- **provide** new drugs that are able to reach sites in the body more effectively and safer.
- **create** tiny sensors that detect diseases in the body.
- **manufacture** incredibly small pumps that can be implanted to deliver lifesaving medications precisely to the cells and tissues that need them.

Exploring Structures – Buckyballs



Buckyballs are just one form of carbon. Where else can carbon be found?

1. _____
2. _____
3. _____

PASSPORT STAMP

Exploring Properties – Sunscreen

Make your own Ultra Violet Detector while testing the effectiveness of various sunscreens

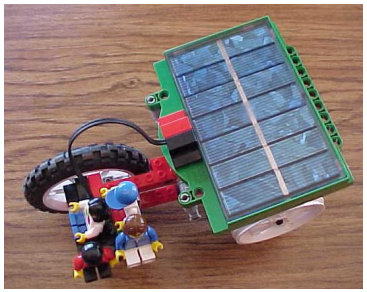
PASSPORT STAMP

Exploring Nanotechnology-Solar Cells

Energy from the sun can be converted to electricity through the use of what kind of cells?

P _ _ _ _ V _ _ _ _ _ _

Make a solar powered car



PASSPORT STAMP

Exploring Materials – Liquid Crystals

Are liquid crystals a ***SOLID***, ***LIQUID*** or ***OTHER***?

Circle the correct answer. Where else are liquid crystals used?_____

_____

_____

PASSPORT STAMP

Exploring Surfaces – Gravity

How does the water in the two cups behave?

Big Cup

_____

_____

_____

_____

_____

Tiny Cup

_____

_____

_____

_____

_____

PASSPORT STAMP