

What is Nanotechnology?

Nanotechnology is the understanding and control of matter at the nanoscale, at dimensions between approximately **1 and 100 nanometers**, where unique phenomena enable novel applications.

What is a nanometer?

A nanometer is **one billionth** of a meter or 10^{-9} m

A normal person can walk 32 kilometers or about 20 miles in one day. If a person were shrunk so that they were one nanometer tall, how long would it take them to walk the length of a dollar bill?

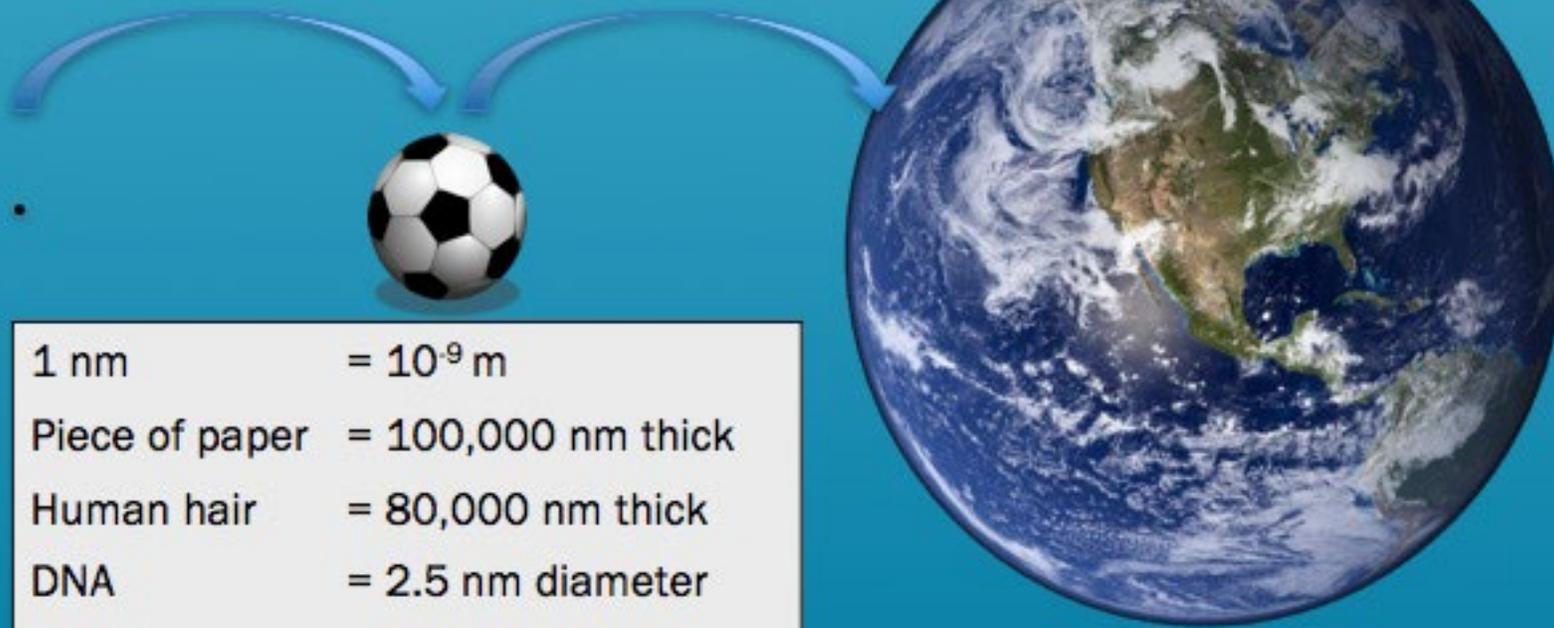
24 years



How small is “nano”?

10^8 meters

10^8 meters



1 nm	= 10^{-9} m
Piece of paper	= 100,000 nm thick
Human hair	= 80,000 nm thick
DNA	= 2.5 nm diameter
Gold atom	= 0.3 nm diameter

Scavenger Hunt Instructions

- We will show an object.
- You will have 2 minutes to gather it and show it to us.
- We will explain how it relates to nanotechnology.



Nanosilver socks. These socks absorb sweat and kill bacteria which helps eliminate unpleasant foot odor. They were originally produced for the military for soldiers in Desert Storm. They were able to wear them for 3 months without having to wash them and they didn't stink.



Fun Fact

Fingernails: Your fingernails grow one nanometer every second.



Nano Toothbrush. The manufacturer is calling this “nano” because it has 80 micron diameter wire that composes the 12,000 bristles. They claim it cleans your teeth better by covering more surface area of your teeth and deep cleans hard to reach areas on your teeth.

1 micron=1,000 nanometers

80 microns=80,000 nanometers



Braces. Nitinol is a metal alloy of nickel and titanium with unique “shape memory” properties. That means nitinol can remember its original shape and return to it when heated. It also shows great elasticity under stress. The heat from your body is causing the wires in the braces to want to go back to their original shape. Therefore causing your teeth to move.



Tennis ball. Some tennis balls are double-cored, the inner core is coated with clay nanoparticles. Acting as a sealant, it makes it far more difficult for air to escape and the ball retains its pressure and bounce for twice as long as ordinary balls.



Fun Fact

DNA: A DNA double helix is about 2.5 nm from one side to the other.



Tennis Racquet and Baseball Bat. Nanomaterials such as carbon nanotubes (CNTs) are being incorporated into various sports equipment to improve their performance. Nanomaterials are responsible for an added advantage such as high strength and stiffness, durability, reduced weight, and abrasion resistance.



Sunscreens. Nanoparticles of titanium dioxide and zinc oxide not only retain their highly effective UV light-absorbing capacity, but also absorb and scatter visible light, making them transparent on the skin.



Cellphones. There are so many nano components in a cellphone, from the transistors, the “switches” computers use to work, to the fingerprint sensor that unlocks your phone. Some touchscreens contain silver nanowires which use the heat from your finger to make the screen operate. The accelerometer and gyroscope are electronic devices at the micro and nanoscale your phone uses to adjust the direction of your screen.



Pants. A coating/finish named Nanotex® modifies fabric at the molecular level to provide the greatest degree of spill protection available. This makes the fabric hydrophobic and it also repels odors. There are other fabrics that use nano whiskers which are a structure instead of a coating.



Sunglasses. Nanotechnology offers scratch-resistant coatings based on nanocomposites. Other nano coatings include anti-glare and transition lenses. These coatings are transparent, ultra-thin, ideal for everyday use, and need simple care.



Fun Fact

Invisibility Cloak: Scientists are using nanotechnology to create an invisibility cloak. Nanotube sheets, at extreme temperatures, cause light to bend away from objects making them “disappear.” Nanoantennas can be adjusted to make light appear to reflect off a flat surface.



Band aids. Silver nanoparticles are woven into threads that are placed within the bandage's central pad. This stops bacterial growth by disrupting the cell membrane, binding to the DNA of cells, and blocking the metabolism of the bacteria.



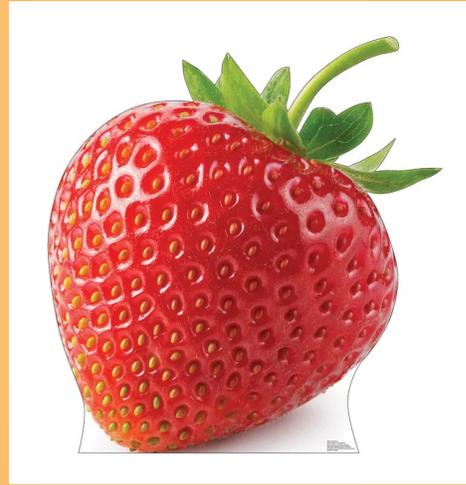
Paper Money. Magnetic ink is used in the printing of the currency. A ferrofluid is used in the manufacturing of the magnetic ink. A ferrofluid consists of nanoscale particles of iron. Each denomination has a different magnetic signature. ATM's and vending machines recognize bills by their magnetic signature.



Tea Bag. Instead of being filled with black or green tea, this bag contains active carbon granules and is made from nanofibers treated with biocide, which kills bacteria rather than simply filtering them from the water. This project is currently taking place in South Africa and will bring nanotechnology to poor people in need of clean water and it will make a difference in their lives.



Plastic Soda Bottles. A resin coating is used to make plastic beverage bottles. Clay particles, about a nanometer thick, are dispersed throughout the plastic so that there is no straight path for carbon dioxide molecules to flow out of the bottle, keeping the beverages fresher and bubblier longer.



NanoBiosensor in Food Packaging. The ripeSense® sensor changes color by reacting to the aroma released by fruit as it ripens. The sensor is initially red and changes to orange and finally yellow. By matching the color of the sensor with their eating preferences, people can accurately choose fruit as ripe as they like it.

Nanobiosensors are devices that measure a biochemical or biological change using an electronic, optical, or magnetic signal in a compact probe.