

Nanometer Scaling Activity

Introduction

A meter is the base unit of measuring length in the metric system. Based on this unit, prefixes are added to signify a larger or smaller unit of length. It is easy to visualize a meter since it is fairly similar to a yardstick (about 3 feet). When you get down to a nanometer, it can be harder to visualize. A nanometer is 1 billionth of a meter. How small is that?

Examples include

Our fingernails grow at a rate of 1 nanometer per second.

A head of a pin is approximately 1 million nanometers across.

Human hair is about 80,000 nanometers in diameter.

The transistor of a latest-generation Pentium Core Duo processor is 45 nanometers.

Unit	Symbol	Magnitude (in meters)	About How Big?
Megameter	Mm	$10^6 = 1000000$	Approximately the distance from New York City to Chicago
Kilometer	km	$10^3 = 1000$	A little over half a mile
Meter	m	$10^0 = 1$	A bit bigger than a yardstick
Centimeter	cm	$10^{-2} = 0.01$	Width of a fingernail
Millimeter	mm	$10^{-3} = 0.001$	Thickness of a dime
Micrometer	μm	$10^{-6} = 0.000\ 001$	A single cell
Nanometer	nm	$10^{-9} = 0.000\ 000\ 001$	10 hydrogen atoms lined up
Angstrom	Å	$10^{-10} = 0.000\ 000\ 000\ 1$	1 large atom

Table 1. Common size units and examples (NanoSense)

In this activity you will explore the relationship between the length of a nanometer and a meter.

Procedure

You will be selecting an item of your choice to represent 1 nanometer (nm). Your goal is to determine how long 1 micrometer, 1 centimeter and 1 meter would be if the item you chose equaled 1 nanometer.

There are multiple ways to approach this activity.

Questions to Consider

1. What did you initially measure to be your nanometer?
2. Based on your initial measurement, how far was a meter? What did that compare to?
3. How did you compare the size of a nanometer to a meter before and after this activity?
 - a. Was the length of 1 meter larger or smaller than you expected when you used your item to represent 1 nanometer?
4. What approach did you take to completing this activity?
 - a. What other ways can this activity be approached?

References

http://nanosense.sri.com/activities/sizematters/sizeandscale/SM_Lesson2Student.pdf

<http://www.nano-link.org/nano-infusion-project/nanoscience-fundamentals> (free registration before download)

http://nanoyou.eu/attachments/188_Module-1-chapter-1.pdf