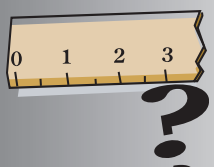

Pre-visit

Activity Strand:
NanoAnalogies: Size and Scale

Overview: Use analogies to introduce students to the nanometer and to familiarize them with just how small the nanoscale is.

Analogies include:
• Did you know a dime is 1,000,000 (1 million) nanometers thick, or just one millimeter?

• A normal person can walk about 32 kilometers in one day. If that person were shrunk so that they were 1 nanometer tall, it would take them about 24 years to walk the length of a dollar bill.

• Conduct this experiment to understand how small a nanometer is: 1) pluck a hair form your head, 2) split it from end to end, 3) split it again, 4) repeat until you have 50,000 pieces. This could take you awhile. Each piece will be about 1 nanometer wide.

• There are more nanometers in the length of your hand then there are cars in the United States.

• Hold a hair in your hand. If your body size was reduced to the point where the size of your hair was just one nanometer thick, you would be about as tall as the thickness of the hair you are holding.

• A nanometer is how far your fingernail grows in one second.

Purpose: To familiarize students with the units and scales that are presented in the NanoZone exhibition.

Concepts: Metric measurement especially the nanometer (1/1 billionth of a meter).

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Pre-visit

NanoAnalogies: Size and Scale

Activity I: Presentation of Analogies

Materials: Analogy Cards

Estimated Time: <5 minutes

What To Do:
Read the NanoAnalogy cards aloud to your class. Post the cards where everyone can see them. Presentation of the analogies can be spread out so that one is presented each day during the week(s) prior to your visit.

Variations:
• Simply post NanoAnology cards in the classroom and let your students discover them

• Read all of the analogies on the bust ride to LHS

Extensions:
• Have a brief discussion about each analogy. Do students understand it? What is their reaction? Are they surprised?

• Ask students to write a short statement about their reaction to one or more of the analogies.

• Challenge students to come up with their own analogies.

• Continue with Activity II and/or III.

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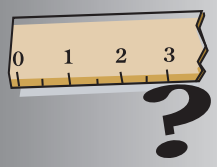

Pre-visit

NanoAnalogies: Size and Scale

Activity II: Size Puzzle

Overview:
Students cut out and assemble a puzzle that contains several analogies

Materials:
• Photocopies of puzzle pieces
• Scissors

Estimated Time:
20 minutes

What To Do:
Hand out puzzle photocopies – one to each group of two or three students. Students cut out pieces and assemble the puzzle.

Extensions:
• Review the completed puzzle as a class.

• Challenge students to add a column to the puzzle using their own analogy. For example: a pair of students might choose to add a column representing 1 centimeter. The center square would read "10 million nanometers OR 1 centimeter"; the top square would contain a picture and the name of an item that has a measurement of 1 centimeter (e.g. the width of their little finger). The bottom square would have an analogy that related something that is 1 centimeter to the nanoscale(e.g. If you had to sit and wait 1 second for every nanometer in this distance, you would be waiting for over four months!); this is the hard part. The column would be positioned between 1 millimeter and 3.6 centimeters (jigsaw tabs/slots would need to match the pieces on either side).

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NanoAnalogies: Size and Scale

Activity III: Calculation and Measurements

Materials: NanoCalculation Worksheet

Estimated Time: 1 hour

What To Do: Ask students to complete the NanoProblems

A fingernail grows about 1 nanometer in one second. How far does it grow in:
a) one minute
b) one hour
c) one day
d) one year

How long would it take a finger nail to grow:
one micrometer (1000 nanometers)
one millimeter (1 million nanometers)
one centimeter (10 million nanometer)
one meter (1 billion nanometers)

A normal man can walk about 32 kilometers in one day. If he were shrunk so that he was 1 nanometer tall, it would take him about 24 years to walk the length of a dollar bill.

A) The same guy can run 80 kilometers per day. How long would it take him to go the length of the dollar bill if he were running?

B) He can drive 800 kilometers per day. How long would it take him to go the length of the dollar bill if he were driving?

There are 1 million nanometers in a millimeter.
Measured in nanometers:
a) What is the length of a paperclip?
b) What is the width of a piece of paper?
c) How tall are you?

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Nano Analogies

Did you know a dime is 1,000,000 (1 million) nanometers thick, or just one milimeter?

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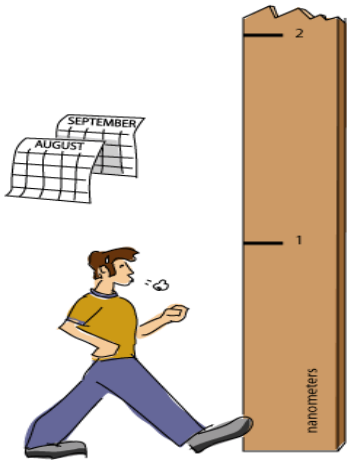
Nano Analogies



A normal person can walk about 32 kilomters in one day. If that person were shrunk so that they were 1 nanometer tall, it would take him/her 24 years to walk the length of a dollar bill.

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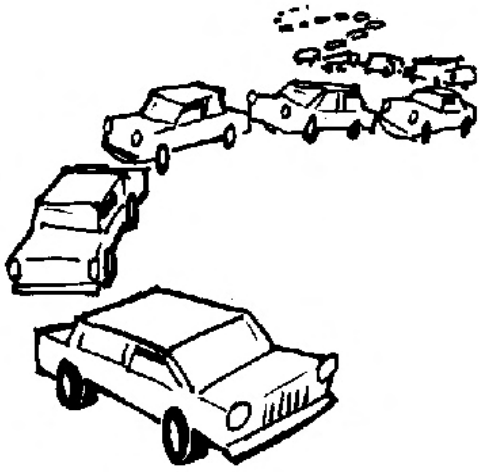
Nano Analogies



There are more nanometers in the length of your hand than there are cars in the United States.

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Nano Analogies

A nanometer is how far your fingernail grows in one second.

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Nano Analogies

Conduct this experiement to understand how small a nanometer is :
1) Pluck a hair from your head
2) Split it from end to end
3) Split it again
4)Repeat until you have 50,000 pieces (This could take you a while)
Each piece wil be about 1 nanometer wide

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Nano Analogies

Hold a hair in your hand. If your body size was reduced to the point where the size of your hair was just one nanometer thick, you would be about as tall as the thickness of the hair you are holding.

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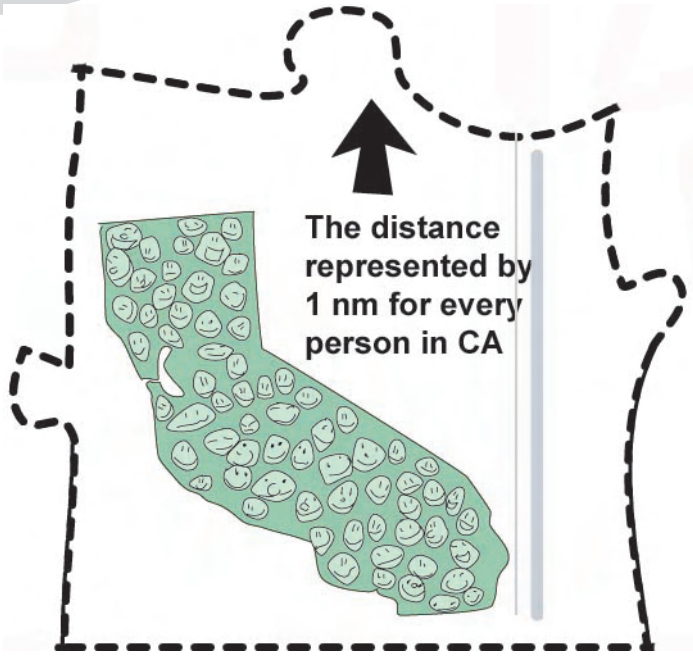
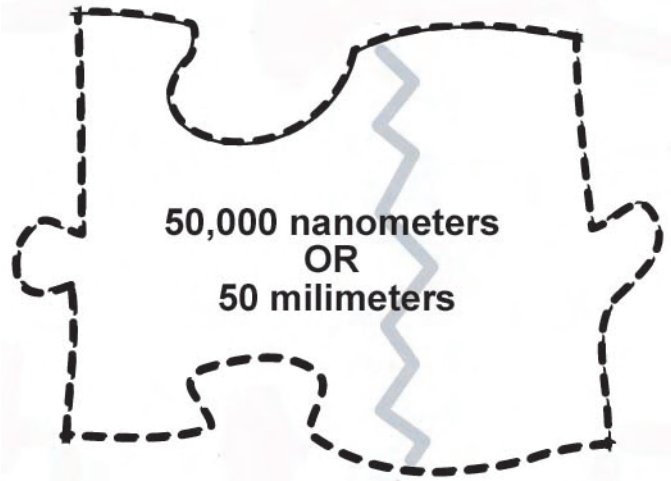
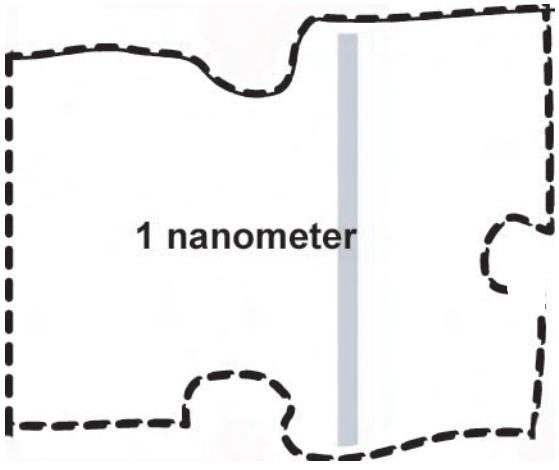
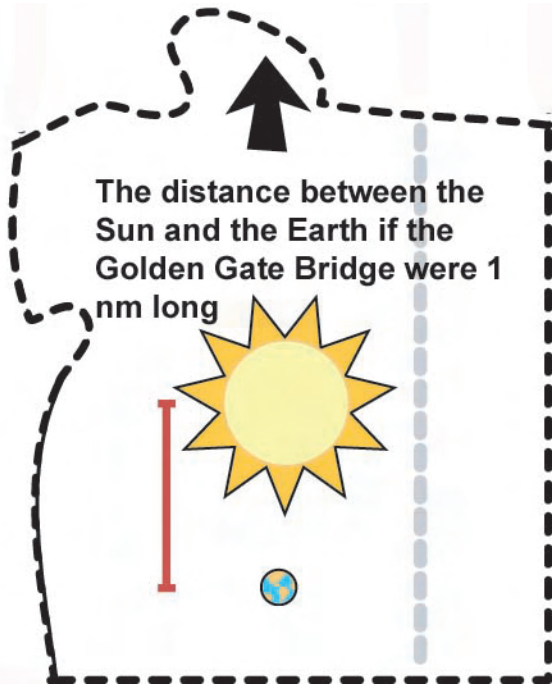
NanoPuzzle

Cut out the puzzle pieces and match the pictures with the correct mesurements





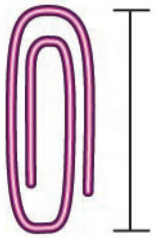


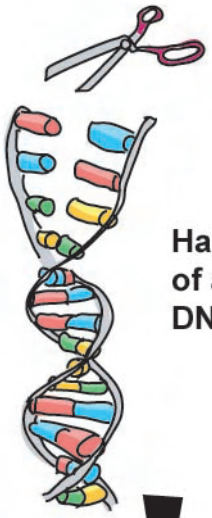


The thickness of a dime

1 million nanometers
OR
1 milimeter

The length of a paper clip





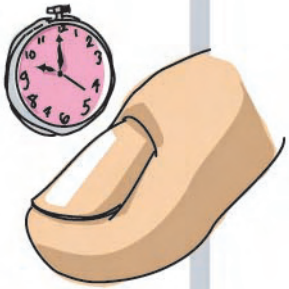
Half the width
of a strand of
DNA

36,000 nanometers
OR
3.6 centimeters

Your height if each hair on
your head was 1 nm thick

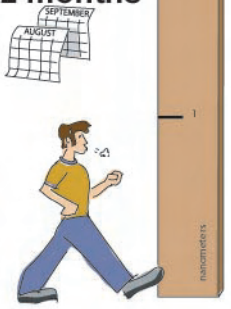
The width of one hair

How long your fingernail grows in one second

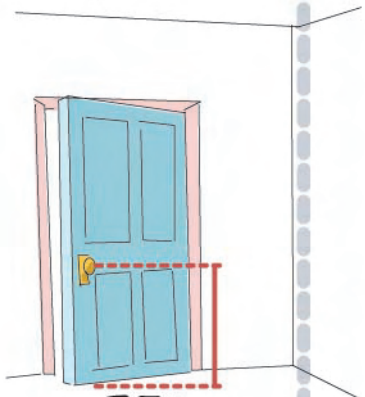


1 billion nanometers
OR
1 meter

The distance an average man shrunk to 1 nm tall could walk in 2 months



The height of a doorknob



NanoProblems Worksheet

1. A fingernail grows about 1 nanometer in one second. How far does it grow in:
a) one minute
b) one hour
c) one day
d) one year

How long would it take a finger nail to grow:
a) one micrometer (1000 nanometers)
b) one millimeter (1 million nanometers)
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2. A normal man can walk about 32 kilometers in one day. If he were shrunk so that he was 1 nanometer tall, it would take him about 24 years to walk the length of a dollar bill.

a) The same guy can run 80 kilometers per day. How long would it take him to go the length of the dollar bill if he were running?

b) He can drive 800 kilometers per day. How long would it take him to go the length of the dollar bill if he were driving?

3. There are 1 million nanometers in a millimeter.
Measured in nanometers:
a) What is the length of a paperclip?
b) What is the width of a piece of paper?
c) How tall are you?

Hint: Simply measure in millimeters and multiply by 1,000,000 or measure in centimeters and multiply by 10,000,000.

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