What is an atom?

The word "atom" comes from the Greek word meaning "indivisible" (lit. "not cuttable"). Around 460 B.C., Democritus, a Greek philosopher, developed the idea of atoms by asking: if you cut something in half and then in half again, how many times would you have to do it before you could cut no further? He believed you would end up with a fundamental indivisible unit of matter he called "atoma" from which everything else is made.

EXPERIMENT 1 *Indivisible*

Procedure: Before you begin, read the instructions and guess how many cuts you will be able to make.

Guess _____

1. Cut a sheet of paper in half.
2. Cut it in half again. (Make all cuts perpendicular to the first.)
3. Repeat until you can cut no further.
4. Record the number of cuts you were able to make.
5. Guess how many cuts it would take to obtain a piece of paper as small as an atom.

Record your answer _____

NANOMETER

1 millimeter (mm) = 1,000,000 nanometers (nm)

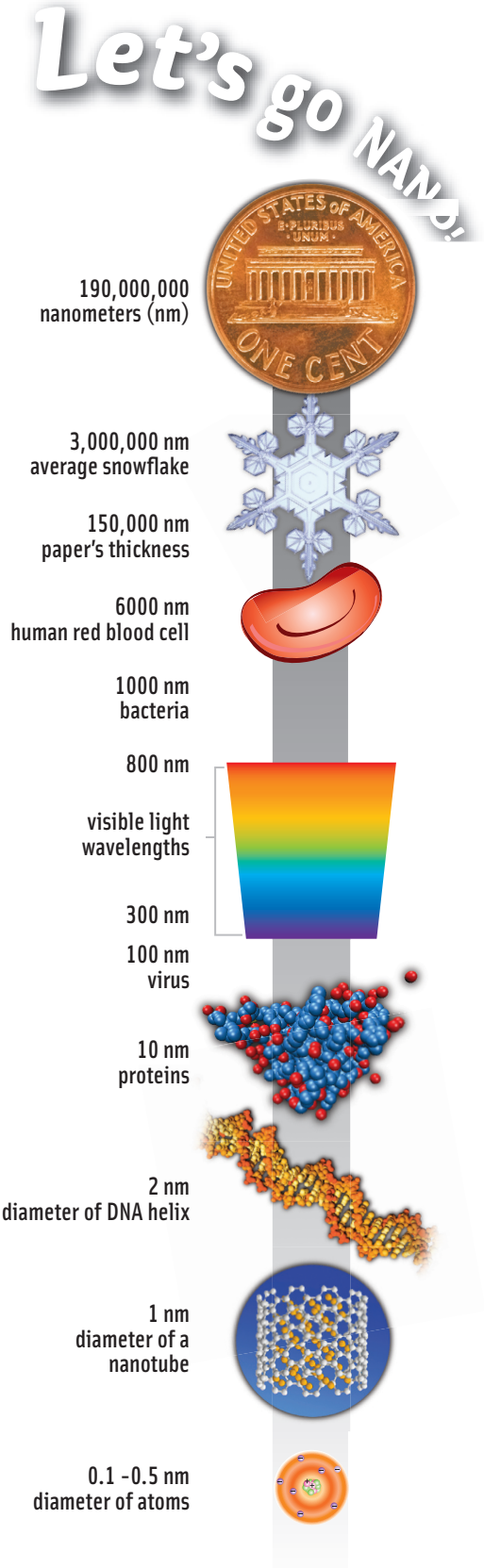
How many nanometers long and wide is this line?

EXPERIMENT 2 *How many atoms thick is a sheet of paper?*

Procedure:

1. Measure the thickness of a stack of 50 sheets of papers in millimeters.
2. Calculate the thickness per page :

   Thickness measured / 50 = _____mm
3. Convert to nanometers = _____nm
4. If an atom has a diameter of 0.1 nm, how many atoms thick is a sheet of paper?
5. How many atoms wide are the things pictured on this page?



Scientific Notation

Working with Big and Small Numbers

Scientists often have to work with very big and very small numbers, especially when talking about atoms. They developed an easier way to express long numbers called scientific notation.

In scientific notation, a number is expressed using a power of 10.

$1000 = 10^3$ (which is said "10 raised to the third power" or "ten to the third")

A number in scientific notation is written as the product of a number and a power of 10.

- The power of ten tells you how many places to move the decimal point. Example: 1.23×10^{11} means the decimal point is moved to the right 11 places (123,000,000,000).
- If the power of ten is negative, the decimal point is moved to the left. This is used for very small numbers. Example: 4.56×10^{-11} means that the decimal point is moved to the left 11 places (0.0000000000456).

The average snowflake has over 4,800,000,000,000,000,000 atoms. (4.8 quintillion)

What do you think?

How many atoms do you think are in the average penny?

How many grains of sand are there on Earth?

Use scientific notation to express the following numbers

1 2,380

2 45,600

3 12,000,000

4 378,000,000,000,000

5 0.001

6 0.00000429

7 0.000000000000000000190

8 8,070,009

9 0.00390005

10 4,800,000,000,000,000,000