


Scientific Notation

Provides a compact way of expressing very large and very small numbers


Large numbers

$$2.0 \times 10^{\textcircled{6}} = 2,000,000$$


Move the decimal point 6 places to the right

$$2.0 \times 10^6 = \underbrace{2000000.}$$

Small numbers

$$7.0 \times 10^{\textcircled{-5}} = 0.000007$$


Move the decimal point 5 places to the left

$$7.0 \times 10^{-5} = \underbrace{0.000007}$$

Length scales in Nature

1 mm



Grain of sugar, small insects, etc

1 km



Brooklyn bridge

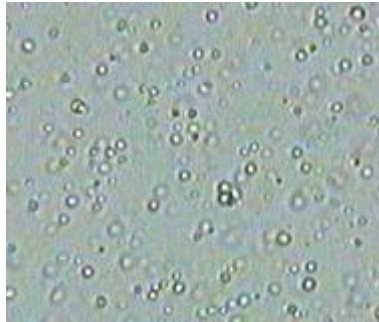
10^{-3} m

1 m

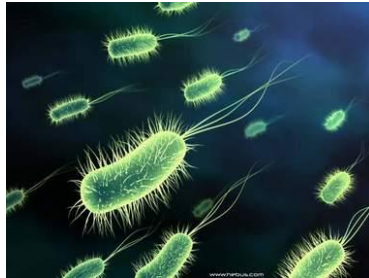
10^3 m

1 micron (1 μ m)

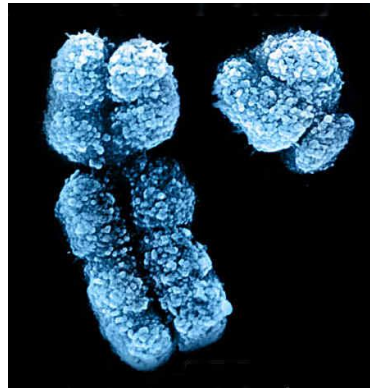
Particles in smoke, milk, etc
(1-20 μ m)



Bacteria
(1-10 μ m)



Human Chromosome
(2 - 10 μ m)



1000 km



10⁻⁶

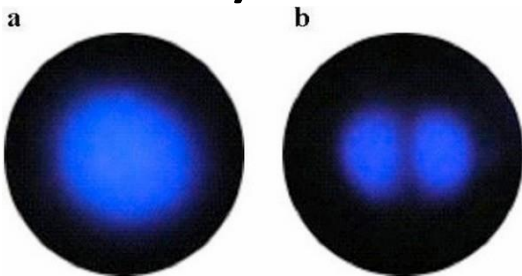
10⁻³

1 m

10³

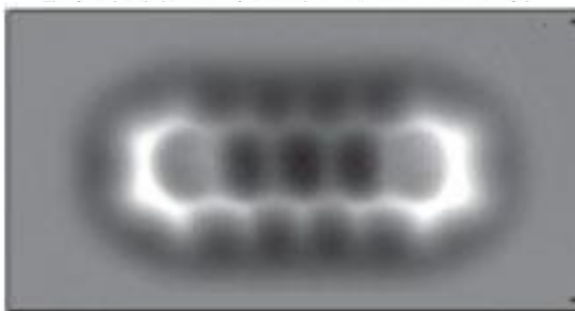
10⁶

**1 nanometer = 10 Angstrom
(1 nm = 10 Å)**

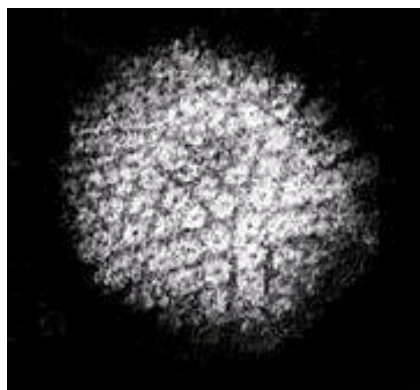


Atom (1 Å)

**Molecule
(1nm)**



Virus (>10 nm)



**1,000,000 km
(3 light seconds)**



10^{-9}

10^{-6}

10^{-3}

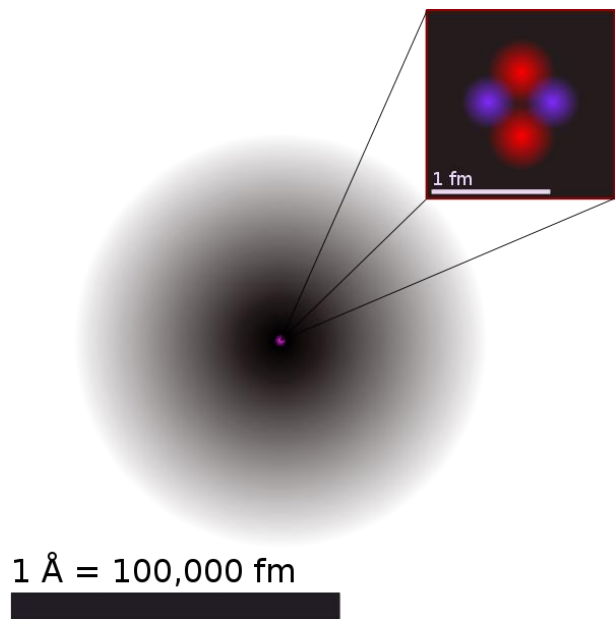
1 m

10^3

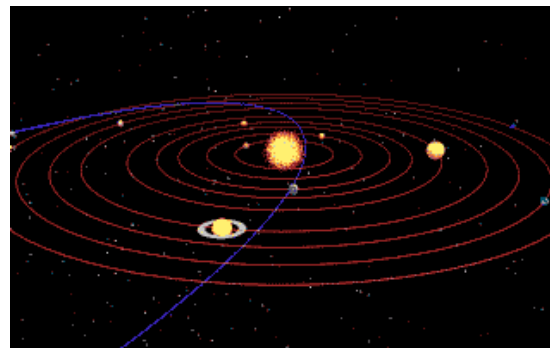
10^6

10^9

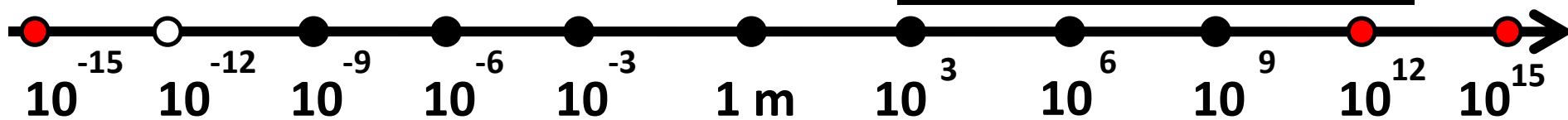
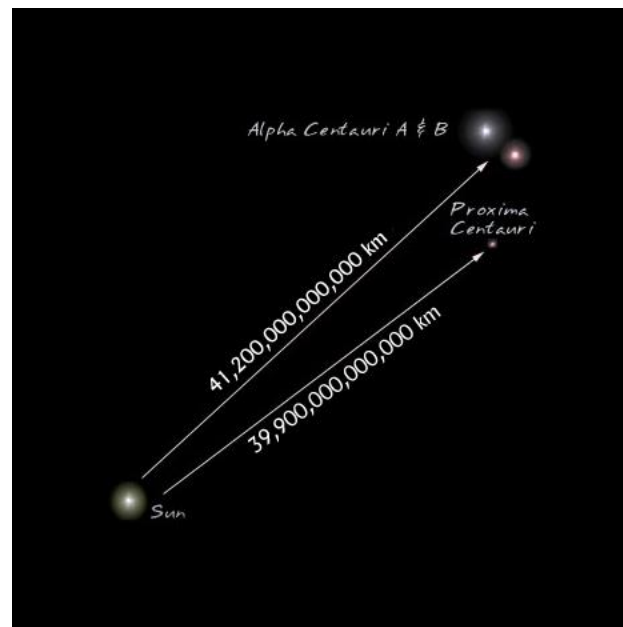
Proton, neutron, atomic nucleus



10^{12} m = 1 billion km \approx 1 light hour



10^{16} m \approx 1 light year



Homework 2

Problem 1.

Estimate the number of atom in a grain of salt. Assume the grain to be a cube 1x1x1 mm, and each atom to be a cubic brick.

Problem 2.

Estimate the number of cells in your body, if a typical human cell is about 10 micron in size.

Problem 3 (optional, but fun).

Come up with a way to experimentally measure width of a sheet of paper. Explain your method, perform the measurement using your method and report the results. Please write which type of paper did you use (book, printer paper, etc.)