

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

$$2.0 \times 10^6 = \underbrace{2000000}_{\text{red wavy line}}$$

Small numbers

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


Move the decimal point 5 places
to the left

$$7.0 \times 10^{-5} = \underbrace{0.000007}_{\text{red wavy line}}$$

Length scales in Nature

1 mm



Grain of sugar, small insects, etc

1 km



Brooklyn bridge

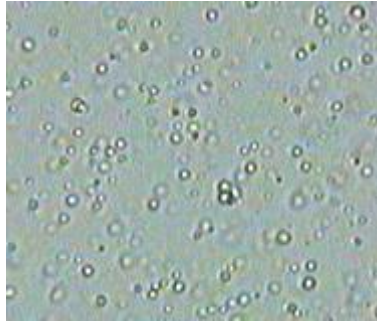
10^{-3} m

1 m

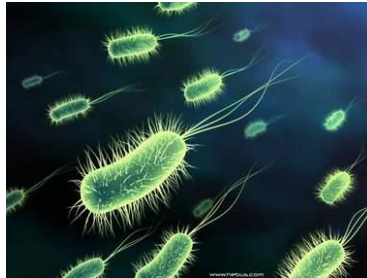
10^3 m

1 micron ($1\mu\text{m}$)

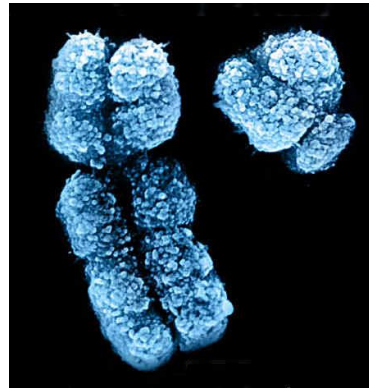
Particles in smoke, milk, etc
($1\text{--}20\ \mu\text{m}$)



Bacteria
($1\text{--}10\ \mu\text{m}$)



Human Chromosome
($2\text{--}10\ \mu\text{m}$)



1000 km



10^{-6}

10^{-3}

1 m

10^3

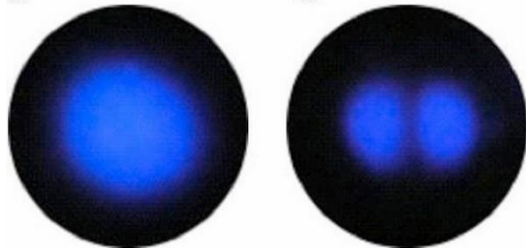
10^6

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

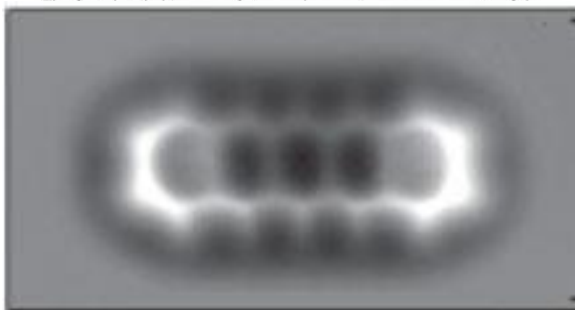
a

b

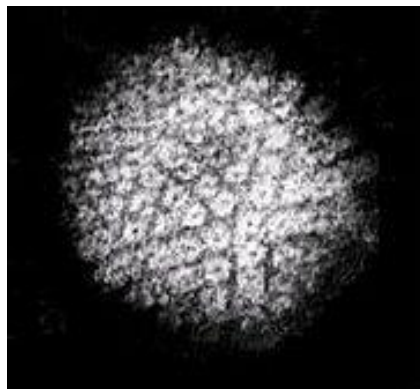
Atom (1 Å)



Molecule
(1nm)



Virus (>10 nm)



1,000,000 km
(3 light seconds)



10^{-9}

10^{-6}

10^{-3}

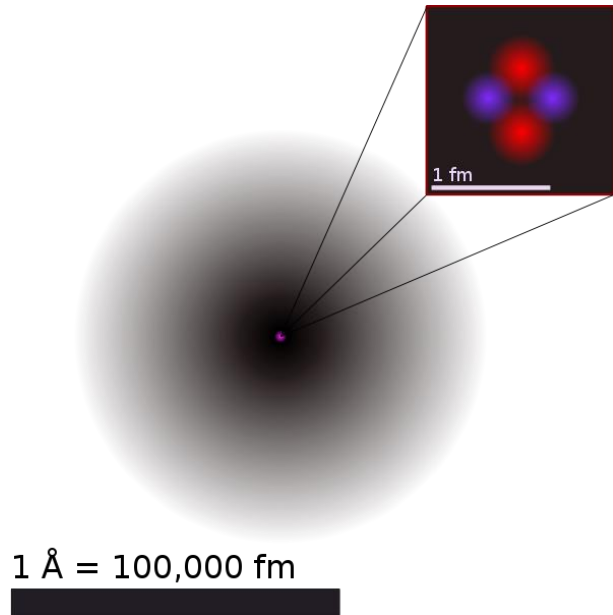
1 m

10^3

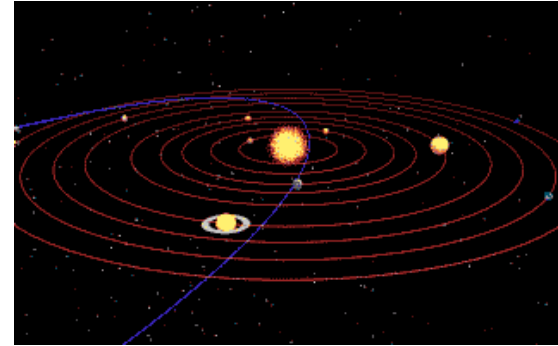
10^6

10^9

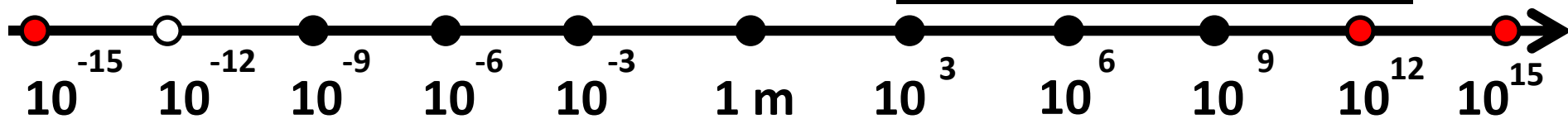
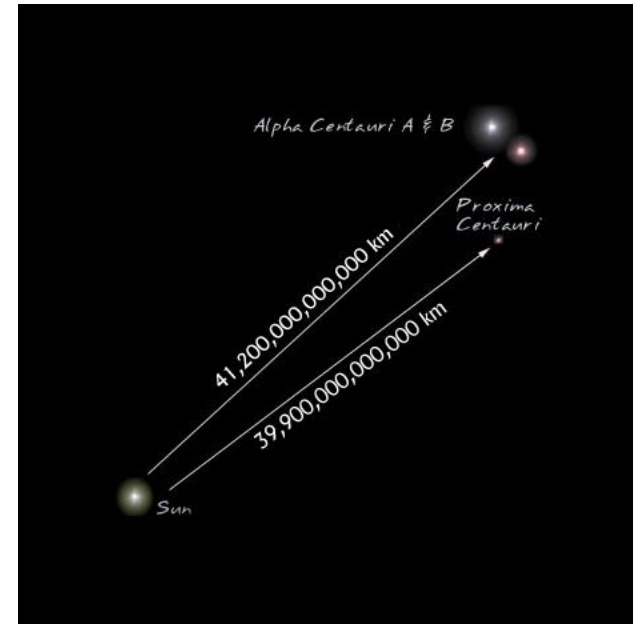
Proton, neutron, atomic nucleus



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



10^{16} m $\approx$ 1 light year



Homework 1

Problem 0.

Watch the documentary called “Cosmic Voyage” at

<https://www.youtube.com/watch?v=GTiDfxATYa4>

paying particular attention to the length scales displayed.

Now, it is time for you to explore the different scales of the universe by going to

<http://htwins.net/scale2/>

Problem 1. Write the following quantities using scientific notation:

$$1,340,000,000 \text{ kg} = \underline{\hspace{2cm}}$$

$$540,000,000 \frac{\text{m}}{\text{s}} = \underline{\hspace{2cm}}$$

$$0.000,000,000,000,0015 \text{ in} = \underline{\hspace{2cm}}$$

$$0.000,000,025 \text{ s} = \underline{\hspace{2cm}}$$

Homework 1

Problem 2. Express the following quantities in decimal notation:

$$1.87 \times 10^7 \text{ lb} = \underline{\hspace{2cm}}$$

$$7.681 \times 10^6 \text{ \AA} = \underline{\hspace{2cm}}$$

$$6.8 \times 10^{-4} \text{ g} = \underline{\hspace{2cm}}$$

$$9.979 \times 10^{-2} \text{ N} = \underline{\hspace{2cm}}$$

Problem 3. Carry out the following operations and express the result in scientific notation:

$$(2.1 \times 10^4) \times (5.6 \times 10^2) =$$

$$(7 \times 10^5) \times (2 \times 10^{-4}) =$$

$$\frac{4.4 \times 10^4}{2 \times 10^4} =$$

$$\frac{5 \times 10^5}{5 \times 10^{-5}} =$$