

1. The picnic took place near a lakeside in Chicago, with a view of 1 m^2 from a distance of 1 m. In the scenes that follow, the distance increased by a factor of 10 every 10 seconds. Why was 10 used rather than some other number?

2. Convert the distances in the first column to scientific notation and write your answers in the second column in meters (see the sample calculations below). The video described transitions from great activity to relative inactivity. What does that mean?

Increasing Distances

Distance	Scientific notation	Event	Visible
100 m		distance a man can run in 10 seconds	
1,000 m = 1 km		distance a racing car can travel in 10 seconds	the city of Chicago
10,000 m		distance a supersonic airplane can travel in 10 seconds	Lake Michigan
100,000 m		distance an orbiting satellite covers in 10 seconds	clouds and the midwestern U.S.
1,000,000 m			the entire U.S. then the entire Earth
10,000,000 m			the entire Earth and some stars
100,000,000 m			orbit of the Moon
1,000,000,000 m			part of Earth's orbit
10,000,000,000 m			orbits of Venus and Mars
100,000,000,000 m			orbits of Mercury and the

Distance	Scientific notation	Event	Visible
			Sun
1,000,000,000,000 m		pass the outer planets	
10,000,000,000,000 m		pass Pluto and comets	
100,000,000,000,000 m			solar system as a single point
1,000,000,000,000,000 m			4 southern constellations
10,000,000,000,000,000 m		1 ly	
100,000,000,000,000,000 m		10 ly, pass Arcturus	some stars in the Big Dipper
1,000,000,000,000,000,000 m		100 ly	clouds of gas
10,000,000,000,000,000,000 m		1,000 ly	part of the Milky Way
100,000,000,000,000,000,000 m		10,000 ly	larger part of the Milky Way as a flat spiral
1,000,000,000,000,000,000,000 m		100,000 ly	entire Milky Way
10,000,000,000,000,000,000,000 m		1 million ly	Magellanic clouds
100,000,000,000,000,000,000,000 m		10 million ly, pass the Virgo cluster	galaxies
1,000,000,000,000,000,000,000,000 m		100 million ly	emptiness

3. Convert the distances in the first column to scientific notation and write your answers in the second column in meters (see the sample calculations below).

Decreasing Distances

Distance	Scientific notation	Event	Visible
10 cm			patch of skin
1 cm = 10^8 Å (angstroms) = 10^5 μ (microns)			surface of the hand
1 mm = 10^{-1} cm		enter the skin	
100 μ			outer layer, capillary
10 μ		enter the white cell	
1 μ = 10^{-4} cm = 10^4 Å			cell nucleus, DNA
1,000 Å			double helix of DNA
100 Å		atomic scale	
10 Å			hydrogen and carbon atoms
1 Å = 10^{-8} cm			outer electrons
0.1 Å			inner electrons
0.01 Å			carbon nucleus
0.001 Å			protons and neutrons
0.0001 Å			single proton
0.00001 Å		inside a proton	
0.000001 Å		limit of understanding	

4. Sample calculation to convert 10,000 m to scientific notation: the decimal point must be moved 4 places to the left so $10,000 \text{ m} = 10^4 \text{ m}$.

5. Sample calculation to convert 10 cm to m:

$$10 \text{ cm} \times \frac{1 \text{ m}}{100 \text{ cm}} = \frac{10 \text{ cm m}}{100 \text{ cm}} = .1 \text{ m} = 10^{-1} \text{ m}$$

6. Sample calculation to convert 10μ to m:

$$10 \mu \times \frac{10^{-5} \text{ cm}}{1 \mu} \times \frac{1 \text{ m}}{100 \text{ cm}} = \frac{10^1 \times 10^{-5} \mu \text{ cm m}}{10^2 \mu \text{ cm}} = \frac{10^{-4} \text{ m}}{10^2} = 10^{-6} \text{ m}$$

7. Sample calculation to convert 0.01 \AA to m:

$$0.01 \overset{\circ}{\text{A}} \times \frac{10^{-8} \text{ cm}}{1 \overset{\circ}{\text{A}}} \times \frac{1 \text{ m}}{100 \text{ cm}} = \frac{10^{-2} \times 10^{-8} \overset{\circ}{\text{A}} \text{ cm m}}{10^2 \overset{\circ}{\text{A}} \text{ cm}} = \frac{10^{-10} \text{ m}}{10^2} = 10^{-12} \text{ m}$$