

When comparing numbers, especially large ones, or numbers of very different orders of magnitude, it is sometimes useful to have an image of a set of things we can visualize which contains that many objects. Sometimes we may simply want to have a scale so that we can compare the figure for something new to us to compare it with something we are more familiar with. I remember being struck by the fact that an atom is almost all empty space when I was told that if I put a baseball in the middle of St. Peter's in Rome to represent the nucleus, then an electron would be a speck of dust whizzing around the sides of the cathedral. (I had never seen St. Peter's then so I imagined Carnegie Library in Pittsburgh at the time, which seemed to me to be huge.) So I hope you find this list useful in comparing scales of magnitude and new numbers you may come across for yourself or in trying to get some new idea across to someone else.

I have included length, mass, time, (cardinal) numbers and speed. Some objects may not be familiar to you and you may want to substitute with your own reference, or maybe add to the list (especially in those parts that I simply could not come up with something reasonable).

LENGTH

	meters	
proton (diameter)	1.2	10^{-15}
		10^{-14}
		10^{-13}
		10^{-12}
H atom	5	10^{-11}
1 Angstrom		10^{-10}
1 nm		10^{-9}
poliomyelitis virus	1.2	10^{-8}
flu virus, small cell, tobacco smoke particle		10^{-7}
wavelength visible light [.4mm – .8mm]	3	10^{-7}
1 μm , some bacteria		10^{-6}
diameter of rods and cones in human eye	2	10^{-6}
red blood cells	7.5	10^{-6}
typical body cells, lymphocytes, talc particle, fog particle		10^{-5}
sheet of paper (thickness)		10^{-4}
100 microns, fresh water protozoan, LP groove, human hair		10^{-4}
1 mm, raindrop, ballpoint pen point, mite		10^{-3}
ladybug	9	10^{-3}
1 cm, diameter little finger		10^{-2}
bullfrog		10^{-1}
sparrow (perching bird: passeriform)	1-2	10^{-1}
cardinal	2-2.3	10^{-1}
radar	3	10^{-1}
cat (not including tail)	5	10^{-1}
wild horse (height at withers)	1.4	10^0
person's height	1.8	10^0
TV, FM radio waves	3	10^0
dwelling house		10^1
short-wave radio	3	10^1
giant sequoia	8	10^1
tallest trees, Taj Mahal (width)		10^2
Saturn V moon rocket	1.1	10^2
AM radio waves	3	10^2
10 min. walk, 1 km.		10^3

long wave radio waves	3	10^3
Mt. Everest	9	10^3
diameter of a small town		10^4
100 kms.		10^5
moon (radius)	1.7	10^6
earth (radius)	6.4	10^6
Jupiter (radius)	7.2	10^7
distance earth - moon	3.8	10^8
sun (radius)	7	10^8
		10^9
		10^{10}
earth-sun distance, 1 A.U.	1.5	10^{11}
orbital radius of Pluto	6	10^{12}
diameter of the solar system		10^{13}
		10^{14}
1 light year	9.5	10^{15}
radius Oort cloud orbit	1.5	10^{16}
1 parsec	3.09	10^{16}
distance to α -Centauri	4.3	10^{16}
		10^{17}
		10^{18}
diameter of the Milky Way	6	10^{19}
		10^{20}
		10^{21}
distance to nearest galaxy	2	10^{22}
distance to observable edge of the universe		10^{28}

MASS

	kilograms
electron rest mass	9.1 10^{-31}
proton r.m.	1.67 10^{-27}
neutron r.m.	1.68 10^{-27}
uranium atom	4 10^{-26}
penicillin molecule	5 10^{-17}
tobacco mosaic virus	2.3 10^{-13}
speck of dust	5 10^{-10}
1 μg	10^{-9}
1 mg, raindrop	10^{-6}
1 g, paper clip	10^{-3}
shrew (smallest mammal)	2.5 10^{-3}
grape	3 10^{-3}
piece of paper	10^{-2}
	10^{-1}
	10^0
	10^1
person	6 10^1
	10^2
elephant	4.5 10^3
	10^4
blue-whale (largest mammal)	1.36 10^5
ocean liner	7.2 10^7
battleship	7.4 10^8
moon	5.98 10^{22}
earth	1.88 10^{24}
Jupiter	1.99 10^{27}
sun	5 10^{30}
Milky Way	10^{41}
observable universe	10^{51}

TIME

	seconds
light crosses proton	10^{-23}
period of oscillation 1 MeV gamma ray	4 10^{-21}
light crosses atom	10^{-19}
half life of neutral pion	2.2 10^{-16}
period of visible light wave	10^{-15}
typical period of rotation of a molecule	10^{-12}
vibration standard cesium clock, oscill. 3 cm. microwave	10^{-10}
ns (nanosecond), light travels 0.3 m	10^{-9}
μ s, half life of muon	10^{-6}
period highest audible sound	10^{-4}
period concert A-tuning fork	2.3 10^{-3}
ms (millisecond), sound travels 0.35 m	10^{-3}
	10^{-2}
period of human heartbeat	8 10^{-1}
	10^0
1 minute	6 10^1
half life free neutron	7.0 10^2
class lecture	10^3
1 hour	3.6 10^3
typical satellite	5.1 10^3
	10^4
1 earth day	8.6 10^5
sun's period of rotation	2.14 10^6
period of revolution of moon	2.36 10^6
1 earth year [$\pi \cdot 10^7 \approx 3.156 \cdot 10^7$ secs]	3.2 10^7
human life expectancy (U.S.)	2 10^9
age of Greek antiquities	10^{11}
pyramid of Cheops	1.2 10^{11}
age of homo sapiens	6.3 10^{12}
since first simian primates	3.2 10^{14}
since first dinosaurs	7.3 10^{15}
age of earth	1.3 10^{17}
age of sun (4.6 billion years)	1.5 10^{17}
age of universe	10^{18}

NUMBERS

	pure numbers	
number of atoms:		
in a cell		$10^{12} - 10^{14}$
in DNA		$10^8 - 10^{10}$
in a human being		10^{31}
to make up the earth	4	10^{51}
in the sun		10^{57}
in the universe		10^{80}
cells a person is composed of		10^{16}
neurons a human brain is composed of		10^{10}
cells a human brain is composed of		10^{11}
sensors in human eye (rods and cones)		10^6
optical fibers from eye to brain	1.25	10^8
species of birds	9	10^3
species of mammals	4	10^3
species of insects described		10^6
number of species of insects that may exist	5	10^6
members of colony (Hymneoptera: ants, bees, wasps) upper limit		10^6
number of facets in eye of housefly	4	10^3
number of facets in eye of dragonfly	2.8	10^4
number of chemical elements		10^2
identified isotopes		10^3
identified chemical compounds		10^6
stars in our galaxy	1.6	10^{11}

SPEEDS

	meters/second	
speed of light (in vacuum)	3.0	10^8
speed of sound (dry air)	3.3	10^2
earth around the sun	3	10^4
solar system around galaxy	2.2	10^5
our galaxy towards Andromeda	2.7	10^5
our net speed w.r.t. Andromeda	3	10^5
solar system w.r.t. local group (about 30 galaxies)	3.0	10^5
speed (local group towards Antlia) w.r.t. background radiation	6	10^6