SCALES OF MAGNITUDES

Physical magnitudes may span over many decades in the scale. Taking the usual units (SI units) one soon realises that the basic ones (like time, length and mass) are anthropometric ("Man is the measure of everything", Protagoras, 500 BC), are additive (the measure for two equal systems is twice the value), and have no zero-value, with the exception of temperature which, has an absolute zero, is non-additive, and has a special metrology. Derived units, like pressure and energy, are no longer anthropometric because nowadays it has been found preferable to use straightforward-derived units without compensating factors (e.g. $p=F/A$ and $dE=Fdx$, with $F=ma$, gives the pressure unit called the pascal, Pa=1 N/m^2, instead of the more familiar 1 atm=101 kPa or 1 bar=100 kPa, and the energy unit called the joule, J=N·m, instead of the more familiar 1 kWh=3.6·10^6 J).

Magnitude	Value	Example
Time and duration		
[s]	$53.9\cdot10^{-45}$	smallest duration from physics (Planck's time*, $(Gh/c^5)^{1/2}$
	$0.1\cdot10^{-21}$	period of nuclear vibrations
	10^{-15}	period of visible-light vibrations
	10^{-12}	period of atomic vibrations in a solid
	$0.1\cdot10^{-9}$	mean time between molecular collisions in ambient air
	$3.8\cdot10^{-3}$	period of middle-DO sound vibrations
	10^{0}	human heart beat, human foot-step period
	$86.4\cdot10^{3}$	one day (period of Earth rotation)
	$31.5\cdot10^{6}$	one year (period of Earth translation)
	$2\cdot10^{9}$	human lifespan (average)
	$0.2\cdot10^{12}$	human history span (since some 4000 BC)
	$0.14\cdot10^{18}$	Earth age
	$0.4\cdot10^{18}$	Universe age (since Big Bang)
Length and distance		
[m]	$16.16\cdot10^{-36}$	smallest length from physics (Planck's length*, $(Gh/c^3)^{1/2}$
	$0.1\cdot10^{-18}$	size of quarks
	10^{-18}	size of electrons
	10^{-15}	size of protons and neutrons
	$10\cdot10^{-15}$	size of atomic nuclei
	$0.1\cdot10^{-9}$	size of atoms and small molecules (e.g. $0.152\cdot10^{-9}$ m is the H-H distance in H_2O)
	$10\cdot10^{-9}$	size of viruses
	$0.1\cdot10^{-6}$	mean free path of molecular collisions in ambient air, size of large macromolecules
	$0.5\cdot10^{-6}$	wavelength of light (visible range: 0.4..0.7 μm)
	$10\cdot10^{-6}$	size of bacteria, size of red blood cells 6.7 μm
	10^{0}	human size, human foot-steps
	$10\cdot10^{3}$	largest height/depth of Earth surface
	$12.7\cdot10^{6}$	Earth diameter
	$1.4\cdot10^{9}$	Sun diameter
	$0.15\cdot10^{12}$	Sun-Earth distance (astronomical unit)
	$10\cdot10^{12}$	size of the solar system
	$1.4\cdot10^{21}$	size of the Milky Way

	$0.9 \cdot 10^{27}$	size of the Universe (proper distance)
Mass [kg]	$0.9 \cdot 10^{-30}$	mass of electrons at rest
	10^{-27}	mass of proton, mass of neutron
	10^{-21}	mass of viruses
	10^{-15}	mass of bacteria
	$0.1 \cdot 10^{-9}$	mass of smallest living being (microplasma)
	10^{0}	mass of (human) throwing or handling object
	$0.2 \cdot 10^{6}$	mass of largest living being (blue whale)
	$5.9 \cdot 10^{9}$	mass of the Great Pyramid of Giza
	$5 \cdot 10^{18}$	mass of the atmosphere
	$1.7 \cdot 10^{21}$	mass of the hydrosphere
	$20 \cdot 10^{21}$	mass of the Earth crust
	$74 \cdot 10^{21}$	mass of the Moon
	$6 \cdot 10^{24}$	mass of the Earth
	$2 \cdot 10^{30}$	mass of the Sun
	10^{42}	mass of the Milkyway
	10^{51}	mass of the Universe
Temperature [K]	10^{-9}	macroscopic quantum state of matter (Bose–Einstein condensate)
	$1.7 \cdot 10^{-3}$	present limit of long-term refrigeration (helium-3/helium-4 dilution)
	2.7	empty space background radiation temperature
	20	normal boiling-point of hydrogen
	82	dew-point temperature of dry air (liquid air)
	194	carbon-dioxide freezing point (dry ice)
	273.15	water freezing point (0 ºC)
	288	biosphere mean temperature
	310	internal human-body temperature
	373	water normal boiling point
	$2 \cdot 10^{3}$	typical combustion temperature, long-term limit of materials working temperature
	$3 \cdot 10^{3}$	incandescent lamp-filament temperature
	$5.8 \cdot 10^{3}$	Sun-photosphere temperature
	10^{6}	plasma (fully ionised) typical temperature
	10^{9}	star temperatures
	$10 \cdot 10^{9}$	supernova (stellar explosion)
Amount of substance [mol]	$1.66 \cdot 10^{-24}$	moles for one unit (one particle)
	$0.1 \cdot 10^{-15}$	moles of cells in human body ($0.1 \cdot 10^{9}$ cells)
	$10 \cdot 10^{-15}$	moles of humans ($6 \cdot 10^{9}$ persons population)
	$10 \cdot 10^{-12}$	moles of stars in our galaxy ($0.2 \cdot 10^{12}$ stars in the Milky Way)
	$0.4 \cdot 10^{-6}$	moles of air molecules in 1 mm^3 at 288 K and 100 kPa
	1	mol of water molecules in 0.018 kg of water ($1 \text{ mol} = 6.022 \cdot 10^{23}$ particles is Avogadro's constant)
Pressure [Pa]	10^{-6}	space vacuum
	$5 \cdot 10^{-6}$	solar radiation pressure, at Earth
	10^{-3}	high vacuum (terrestrial)
	$0.1 \cdot 10^{0}$	100 km altitude Earth atmosphere
	$0.6 \cdot 10^{3}$	water pressure at its triple point

	$0.7 \cdot 10^{3}$	Mars surface atmosphere
	10^{3}	meteorological fluctuations
	$26 \cdot 10^{3}$	10 km altitude Earth atmosphere
	$0.1 \cdot 10^{6}$	sea-level pressure
	$9 \cdot 10^{6}$	Venus surface atmosphere
	$22 \cdot 10^{6}$	critical pressure of water
	$0.11 \cdot 10^{9}$	ocean deepest point (11 km)
	$15 \cdot 10^{9}$	highest sustained in laboratory (diamond anvil)
	$0.4 \cdot 10^{12}$	centre of Earth, explosive shaping
	$20 \cdot 10^{15}$	centre of Sun
Energy [J]	$6 \cdot 10^{-24}$	hyperfine transition in the fundamental state of $^{133}_{55}\mathrm{Cs}$
	10^{-21}	kinetic energy of room-temperature air molecule
	$0.1 \cdot 10^{-18}$	kinetic energy of a photon of visible light
	$2.2 \cdot 10^{-18}$	hydrogen atom ionisation
	$10 \cdot 10^{-12}$	fission of one atom of $^{235}_{92}\mathrm{U}$
	$0.5 \cdot 10^{0}$	human heartbeat
	10^{0}	lighter spark
	$10 \cdot 10^{3}$	X-ray lethal dose. Riffle bullet.
	$10 \cdot 10^{6}$	human daily food consumption
	$50 \cdot 10^{6}$	heating power of 1 kg typical fuel
	$100 \cdot 10^{6}$	thunder strike
	$4.2 \cdot 10^{9}$	ton of TNT (4.2 MJ/kg)
	$6.3 \cdot 10^{9}$	barrel of oil (159 litres)
	10^{12}	Shuttle launch
	$0.42 \cdot 10^{15}$	atomic bomb (100 kilotons)
	$0.42 \cdot 10^{18}$	hydrogen bomb (100 megatons)
	10^{21}	asteroid that caused dinosaurs extinction
	$0.1 \cdot 10^{30}$	Earth rotation about its axis
	$2 \cdot 10^{33}$	Earth translational around the Sun
Power [W]	$100 \cdot 10^{-3}$	mobile phone (standby)
	$0.1 \cdot 10^{3}$	human metabolism (adult)
	$2 \cdot 10^{3}$	averaged human consumption of commercial energy
	10^{9}	typical power station (one nuclear group or a few fuel ones)
	$0.17 \cdot 10^{18}$	solar flux on Earth (70% of that is absorbed)
	$0.4 \cdot 10^{27}$	solar emission
Heat flux [W/m^2]	$0.05 \cdot 10^{3}$	human metabolism
	10^{3}	solar irradiation
	$0.1 \cdot 10^{6}$	powerful electronic circuits
	10^{6}	flames, powerful microwaves
	$10 \cdot 10^{6}$	oxyacetylene torch; fission reactor rods
	$100 \cdot 10^{6}$	plasma arc; fusion reactor
	$100 \cdot 10^{9}$	welding and cutting lasers

*G, h and c are Newton's gravitational constant, Planck's constant, and the speed of light in vacuum, respectively.