

## ORDERS OF MAGNITUDE – TIME &amp; SIZE

**1. Size Scales:** Put the following distances in rough order, smallest to largest. Estimate a *typical* size for them, in cm, km, lightyears, etc. Don't worry about being exact; write down an order of magnitude *only* (e.g., the Earth's diameter is  $\sim 12,000$  km, but let it be  $10^4$  km for our purposes.) Use scientific notation where appropriate. Work in groups of 3-4.

$$1 \text{ ly} = 1 \cdot 10^{18} \text{ cm} = 10^{13} \text{ km}; \quad 1 \text{ km} = 10^5 \text{ cm}$$

$$1 \text{ AU (Astronomical Unit = Earth-Sun distance)} = 150 \text{ million km} = 1.5 \cdot 10^{13} \text{ cm.}$$

Rank	Size Scale	Object
_____	_____	Molecule
_____	_____	Solar System
_____	_____	Local Group of Galaxies
_____	_____	Red blood cell
_____	_____	Sesame seed
_____	_____	VW Bug
_____	_____	Universe
_____	_____	Smoke particle
_____	_____	Planet Earth
_____	_____	Brontosaurus
_____	_____	Earth-Moon System
_____	_____	Milky Way Galaxy
_____	_____	Atom

**2. Timescales:** Order from shortest to largest, and *estimate* a time or age in seconds. Order of magnitude only; use scientific notation.

$$1 \text{ yr} \sim 10^7 \text{ s}$$

Rank	Timescale	Object
_____	_____	Orbit of Earth around Sun (year)
_____	_____	Lifetime of a mosquito
_____	_____	Vibration time of a light wave
_____	_____	Pentium chip clock cycle
_____	_____	Age of Universe
_____	_____	Radioactive half-life of Uranium 234
_____	_____	Human heartbeat
_____	_____	Lifetime of a neutron
_____	_____	Hummingbird heartbeat
_____	_____	Lifetime of a Galapagos tortoise
_____	_____	Lifetime of a star
_____	_____	Fastest possible atomic process
_____	_____	Length of Beethoven's 5th symphony
_____	_____	Orbit of Star around galaxy
_____	_____	Age of Earth
_____	_____	Rotation of earth (day)