Lecture 1.1 Scale of the Universe

Scientific Notation
Even with special astronomical units, measuring the universe involves very, very large numbers. Scientific notation is a way to express large numbers without so many digits. A number in scientific notation is written with one digit to the left of the decimal place and multiplied by 10 to the appropriate power.

For example, the nearest star is about 41,000,000,000,000,000 meters from the sun. This can be written as \(4.1 \times 10^{10}\). Similarly, the radius of our solar system is about 5,984,000,000,000 m or ____________ m.

Metric Prefixes
Writing a number times 10 to some power is not always convenient either. Metric prefixes are a shorthand that is also commonly employed. For example, 1 kilometer is 1000 meters. The approximate distance to the nearest star is then: 4.1 Pm. The wavelength of a red light laser is \(6.50 \times 10^{-7}\) m. This can be written ___________ μm or ___________ nm.

Special Units
The International System of Units (SI) uses the meter as the defining unit of length. A meter is an inconveniently small unit for astronomical distance scales. For convenience and historical precedent, other units are used.

Astronomical Unit: The distance the from the _______ to the _______. 1 AU = ___________ m.
Light Year: The distance light travels in one year. 1 Lyr = ___________ m = ___________ AU.
Parsec: The distance at which one astronomical unit subtends 1 arcsec of degree. 1 pc = ___________ m = ___________ AU = ___________ Lyr.

Mixing Scientific Notation and Metric Prefixes
Many distances and numbers in astronomy will use all three of the conventions above: special units, scientific notation, and metric prefixes. For example, the distance to Quasar QSO 1229+204 is _____ ×10^3 _____ away.

Organizing the Scales of the Universe
What we see in the universe can be placed in one of three different categories. They are:

- Solar System
- ________________
- Universe

Solar System
There are 8 planets (according to the IAU) which counts Pluto as a Dwarf Planet. The planets in order, from the sun are
The terrestrial planets are the first 4 planets and the jovian planets are the last 4. The jovian planets have an average density around that of water. The terrestrial planets have an average density about _________ times that of water.

The terrestrial planets orbit very close to the sun. The earth orbits at a distance of _______ AU.

The jovian planets are farther out. Jupiter starts at about _________ AU going to Neptune at _________ AU.

The solar system can be approximated as being about _________ AU.

Its shape is most like a _________________.

**Beyond the Solar System**

The nearest large star is ______________________ at 4.3 Ly away.

We live in a large grouping of stars – a galaxy – called the Milky Way. We reside about approximately ____ ________________ kpc away from the center of the Milky Way.

The Milky Way has approximately ________ billion stars in it or 1.0 × 10—— stars.

**Beyond the Milky Way**

The Milky Way is one of many galaxies. The nearest grouping of galaxies will call the Local group. It has three large galaxies in it: Milky Way, Andromeda, and _________________. There are also several dozen smaller or dwarf elliptical galaxies.

Andromeda is about _______ Mpc away from the Milky Way.

It is estimated that there are about as many galaxies in the visible universe as there stars in the Milky Way. That means there are more stars in the visible universe than there are ________________________ on the earth.

Because distances are so fast, even though light travels very fast (faster than anything else), it still takes a long time to see things. For example, if a star is 13 ly away, the light we see from the star is _______ years old.

**Your Address**

Name: ___________________________  Galaxy Neighborhood: _______________________

Street: ___________________________  Galaxy: ________________________________

City / Country: _____________________  Group or Cluster: _______________________

Planet: ___________________________  Supercluster: ___________________________

Solar System: _____________________  Universe: The Universe