Galaxies and the Universe

A \_**Light\_ \_Year**\_\_\_ is a unit of distance that light can travel in one year (9,500,000,000,000 kilometers).

Light moves at a velocity of about 300,000 km each second in a vacuum.

**\_Nebula**\_\_\_\_\_: Large cloud of gas and dust which can form stars and galaxies.

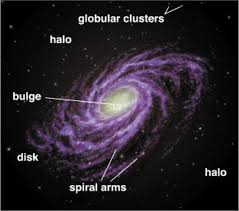
\_**Solar Nebula Theory**: Stars and planets formed through condensing of the solar nebula.

**Galaxy**\_: Large group of stars, gas, and dust that constitute the universe. By a large group, we mean hundreds of billions.

Most galaxies have a \_**black hole** at their center.

Three components:

1. Halo – contains the oldest stars in the galaxy
   1. **Dark matter** – A hypothetical form of matter that is believed to make up 90% of the universe; it is invisible (does not absorb or emit light).
2. Nuclear bulge
3. The disk – contains the majority of the stars, including the sun, and virtually all of the gas and dust



The \_**Milky Way**\_\_ is our galaxy. It is a great disk made of stars orbiting a central point in the disk.

Scientists have used **radio waves**\_\_\_\_ and **infrared radiation**\_ to determine the shape of the Milky Way.

The Milky Way has a galactic center (called the nucleus) that is surrounded by a \_**nuclear bulge**\_\_ which sticks out of the galactic disk. Surrounding this disk is a set of \_**spiral arms**\_\_.

Three types of galaxies (based on their shape)

1. **\_spiral** \_\_\_\_ : Flattened into a disk with spiral arms.
2. \_**elliptical**\_\_\_: Three dimensional and look more like a football
3. \_**irregular\_**\_: Does not have a distinct shape.

Three types of spectrums:

1. \_**continuous\_**\_\_\_\_\_ : Has no breaks in it - produced by a hot solid, liquid, or dense gas.
2. \_**emission\_**\_\_\_\_\_\_\_: bright lines at certain wavelengths. The wavelengths depend on the element being observed, because each element has its own characteristic emission spectrum.
3. \_**absorbtion\_\_\_\_\_\_\_** : dark spectral lines from light observed from the sun (in same location as elements from emission lines.

Star populations: Three generations differ in their content of chemical elements heavier than \_**helium**\_\_\_.

1. Population I - have the lowest percentage of these elements (our sun).
2. Population II - have a higher percentage.
3. Population III - have the highest percentage of elements heavier than helium.

The percentages differ in this way because **first- and second-generation stars that "died" passed along their heavier elements**. Many of these stars produced successively heavier elements **by means of fusion** in and near their cores. The heaviest elements were created when the most massive stars exploded as supernovae.