Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pd: \_\_\_\_\_ Ast: \_\_\_\_\_

**Stars & Galaxies Study Guide**

1. ***Vocabulary: Know the definitions of the following words.***
   1. ASTRONOMICAL UNIT (A.U.): *average distance between the Sun and Earth (used within the solar system)*
   2. LIGHT YEAR: *a unit of measure for distance equal to the distance that light travels through space in one year*
   3. STAR: *a massive ball of gas held together by gravity with a core so hot that nuclear fusion occurs*
   4. NUCLEAR FUSION: *the nuclei of multiple atoms fuse into one releasing massive amounts of energy*
   5. NEBULA: *an immense cloud of dust & gas where stars are born*
   6. APPARENT MAGNITUDE: *a scale measure of how bright a star or other object appears from Earth*
   7. MAIN SEQUENCE STAR: *stars at the beginning of their life cycle that fuse hydrogen atoms into helium atoms*
   8. SUNSPOTS: *areas of high magnetic activity on the surface of the Sun, observed as dark spots on the Sun*
   9. GALAXY: *a huge collection of hundreds of billions of stars held together by gravity*
2. Proxima Centauri (the nearest star to our Sun) is about 4.3 light years away from Earth. Explain what this means.

*It takes light from Proxima Centauri 4.3 years to reach us.*

1. Why are nebulae (plural for “nebula”) important celestial (space) regions?

*Nebulae are where stars are “born”. The dust and gas in a nebula is drawn together by gravity to form a star.*

1. What is the cause of nuclear fusion? Where does it occur in stars such as our Sun?

*Nuclear fusion occurs under intense heat and pressure. This takes place in the core of a star, where the heat and pressure are greatest.*

1. What occurs during nuclear fusion?

*Intense heat and pressure causes the nuclei of multiple atoms to fuse into one new atom.*

1. What is the result of nuclear fusion?

*Nuclear fusion results in the release of massive amounts of energy.*

1. How are stars classified? How does this relate to the color of a star?

*Stars are classified by their temperatures. Temperatures determine the color of a star. Blue stars are the hottest, while red stars are the coolest.*

1. How do scientists measure the brightness of objects in the sky?

*Scientists use a scale called “Apparent Magnitude” to compare the brightness of objects in the sky. The brightest objects have a negative value on the scale.*

1. What characterizes a main-sequence star? (*What makes them different from Red Giants or Supergiants?*)

*Stars on the main-sequence are at the beginning of their life-cycle. They are fusing hydrogen atoms into helium atoms. Once they run out of hydrogen to fuse, they move off of the main-sequence to become different types of stars depending on their mass.*

1. What determines how long a star remains a main-sequence star?

*More massive stars move off of the main-sequence faster than low-mass stars. They do this when they run out of hydrogen to fuse.*

1. Describe the life cycle of a low-mass star.

*Low mass stars begin their life on the main sequence before becoming red giants. When they have burned through their available fuel, they become white dwarfs as they slowly cool into black dwarfs.*

1. Describe the life cycle of a high mass star.

*High mass stars begin on the main sequence and become red giants and then red supergiants as they fuse heavier and more complex nuclei. When they have burned through their available fuel, they explode in a supernova, ending up as either a neutron star or a black hole if they have enough mass.*

1. About how long do scientists expect that our Sun will remain on the main sequence? How far through its lifespan do they think it is?

*Our Sun is about half-way (4.6 billion years) through its estimated 10-billion year life-cycle.*

1. How did Galileo discover that our Sun rotates?

*Galileo observed sunspots moving across the surface of the Sun.*

1. Describe the Sun’s location and motion in relation to the Milky Way.

*The Sun is located in one of the spiral arms (the Orion arm) of the Milky Way. It rotates on its axis as it revolves around the center of the Milky Way galaxy (possibly a supermassive black hole).*

1. What type of galaxy do we most likely live in?

*The Milky Way is a spiral galaxy, consisting of a rotating band of stars that orbit the center like a hurricane.*

1. What are some other “types” of galaxies?

*Other main types of galaxies include elliptical galaxies where stars orbit in the shape of a football and irregular galaxies where stars appear to be grouped with no organizational pattern.*

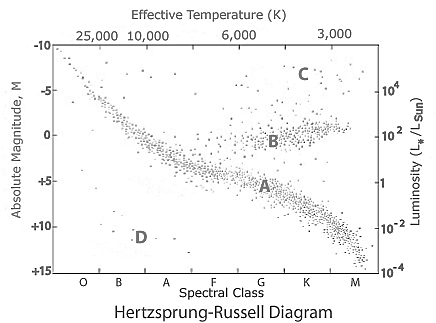
1. Relate the following concepts: Galaxy, Galaxy Cluster, Nebula, Solar System, Star, Star Cluster, Universe

*STARS are born inside a NEBULA. Often, SOLAR SYSTEMS form around a STAR, which is part of a STAR CLUSTER of relatively close-together stars within a GALAXY. Each GALAXY contains hundreds of billions of STARS. GALAXIES are often grouped together within GALAXY CLUSTERS. There are hundreds of billions of GALAXIES in our UNIVERSE.*

1. Scientists observe that all galaxies are moving away from one another. What does this lead them to conclude?

*This leads scientists to conclude that the universe is expanding.*

***For the following questions, refer to the H-R diagram shown to the right.***

1. What information is shown on an H-R diagram?

*It shows the relationship between the temperature of a star and its brightness*

1. Where is our Sun in comparison to other stars on the H-R diagram?

*Our Sun is a relatively average main sequence star, found near the middle of the diagram*

1. Which letters on the HR diagram to the right correspond to the following types of stars?

* *C*  Supergiants (*fuse heavier elements than carbon*)
* *B*  Red Giants (*fuse helium to carbon*)
* *A*  Main Sequence (*fuse hydrogen to helium*)
* *D*  White Dwarf (*fuse heavier elements than carbon*)

***The “spectral class” categories are listed as letters along the bottom of the graph.***

1. Which spectral class identifies the hottest stars? What color are they?

*The hottest stars are blue. They are spectral class – O.*

1. Which spectral class identifies the coolest stars? What color are they?

*The coolest stars are red. They are spectral class – M.*

1. Which spectral class is our Sun? What color is it?

*Our Sun is a spectral class – G main sequence star. It is sometimes referred to as a “yellow dwarf”.*

1. Main-sequence stars are represented as a diagonal line on an H-R diagram. What does this indicate about the relationship between the temperature and brightness of main-sequence stars?

*Main sequence stars tend to increase in brightness as their temperatures increase.*

1. Based on the H-R Diagram shown, compare a Class-B main-sequence star to a Class-K main-sequence star.

*A class-B main-sequence star will be among the hottest and brightest stars, while a class-K main-sequence star will be among the coolest and dimmest main sequence stars.*