**Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Period\_\_\_\_\_Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Chapter 25 Guided Notes: Beyond our Solar System**

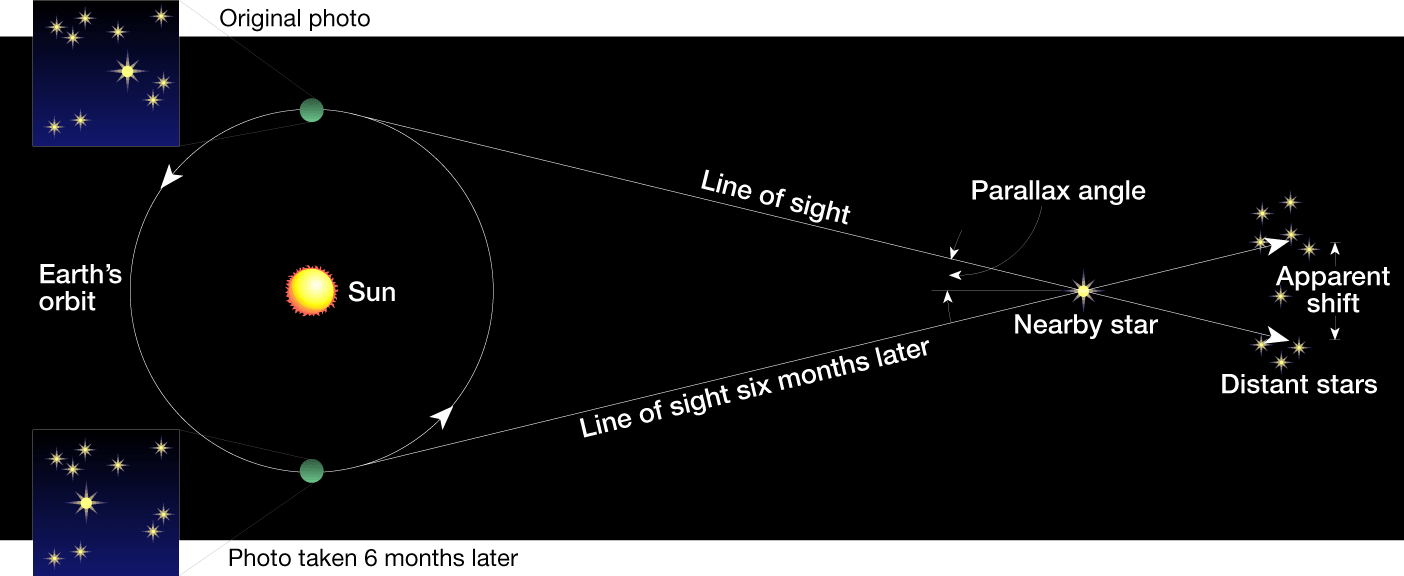
**25.1: Properties of Stars**

**What is a star?**

* **Huge \_\_\_\_\_\_\_\_\_of very hot \_\_\_\_\_\_that emit \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **The sun is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_to earth**
* **The next closest star is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, which is \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ times farther away from Earth than the \_\_\_\_\_\_\_\_\_\_**
* **On a clear night you can see about \_\_\_\_\_\_\_\_\_\_\_\_ stars**
* **Stars are driven by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_reactions**
* **A star is made of mostly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **A star is held together by \_\_\_\_\_\_\_\_\_\_\_\_\_forces from its own \_\_\_\_\_\_\_\_\_**
* **Nuclear fusion takes place in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a star**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_is released as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: an apparent \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ originally named from mythical creatures. The sky contains \_\_\_\_\_\_\_\_ constellations**

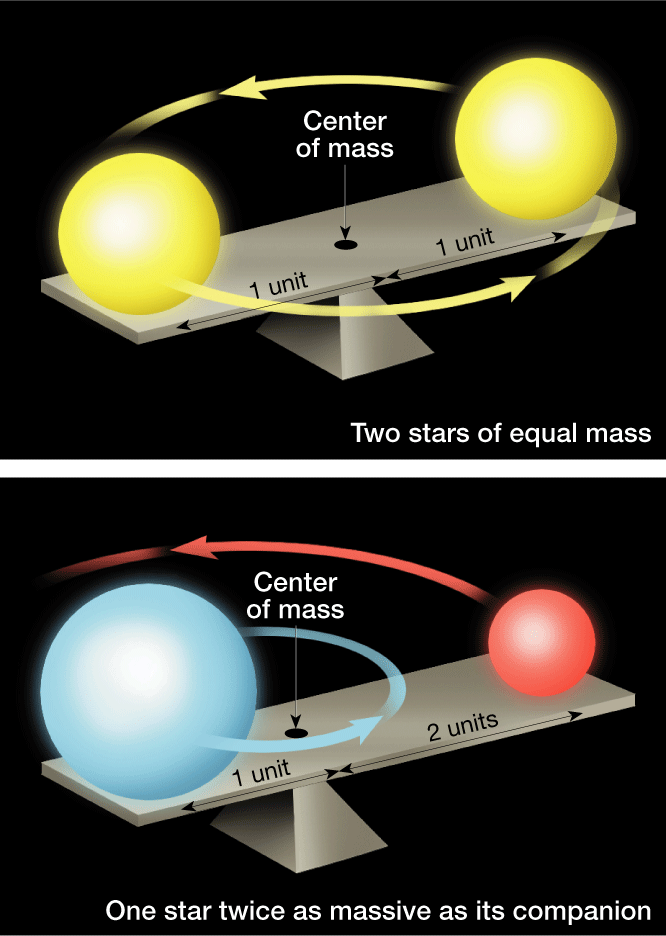
**Measuring Distance to Stars**

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_: the slight \_\_\_\_\_\_\_of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a star due to the \_\_\_\_\_\_\_\_\_\_\_motion of Earth**
  + **The \_\_\_\_\_\_\_\_\_\_\_\_\_\_way to measure distance**
  + **The \_\_\_\_\_\_\_\_\_\_\_\_\_\_stars have the \_\_\_\_\_\_\_\_\_\_\_\_\_parallax angles, while those of \_\_\_\_\_\_\_\_\_\_\_\_\_stars are too \_\_\_\_\_\_\_\_\_\_ to measure**
  + **\_\_\_\_\_\_\_\_\_parallax angles are still \_\_\_\_\_\_\_\_\_\_\_\_\_ or smaller than \_\_\_\_\_\_\_\_\_\_\_\_\_of an arc**

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* **\_\_\_\_\_\_\_\_\_\_\_\_\_: the \_\_\_\_\_\_\_\_\_\_\_\_\_which a ray of light would travel in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **1 light year = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **Proxima Centauri is about \_\_\_\_\_\_\_\_\_ly away from the sun**

**Binary Stars and Stellar Mass**

* **A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is one of \_\_\_\_stars revolving around a common \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ under their mutual \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **More than \_\_\_\_\_\_\_\_\_\_of the stars in the universe \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in pairs or multiples**
* **Binary stars are used to determine the star property most difficult to calculate: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **For stars of \_\_\_\_\_\_\_\_\_\_\_\_mass, the center of mass lies \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_between them**
* **If one star is more mass than its partner, their common center will be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. If the size of their \_\_\_\_\_\_\_\_\_\_\_are known, the mass can be determined.**

**Brightness (luminosity)**

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(brightness)**
  + **A measure of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of celestial objects**
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_values represent \_\_\_\_\_\_\_\_\_\_\_\_\_ objects, \_\_\_\_\_\_\_\_\_\_\_ values represent \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_objects**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **How bright a star \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **Brightness depends on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Star Color and Temperature**

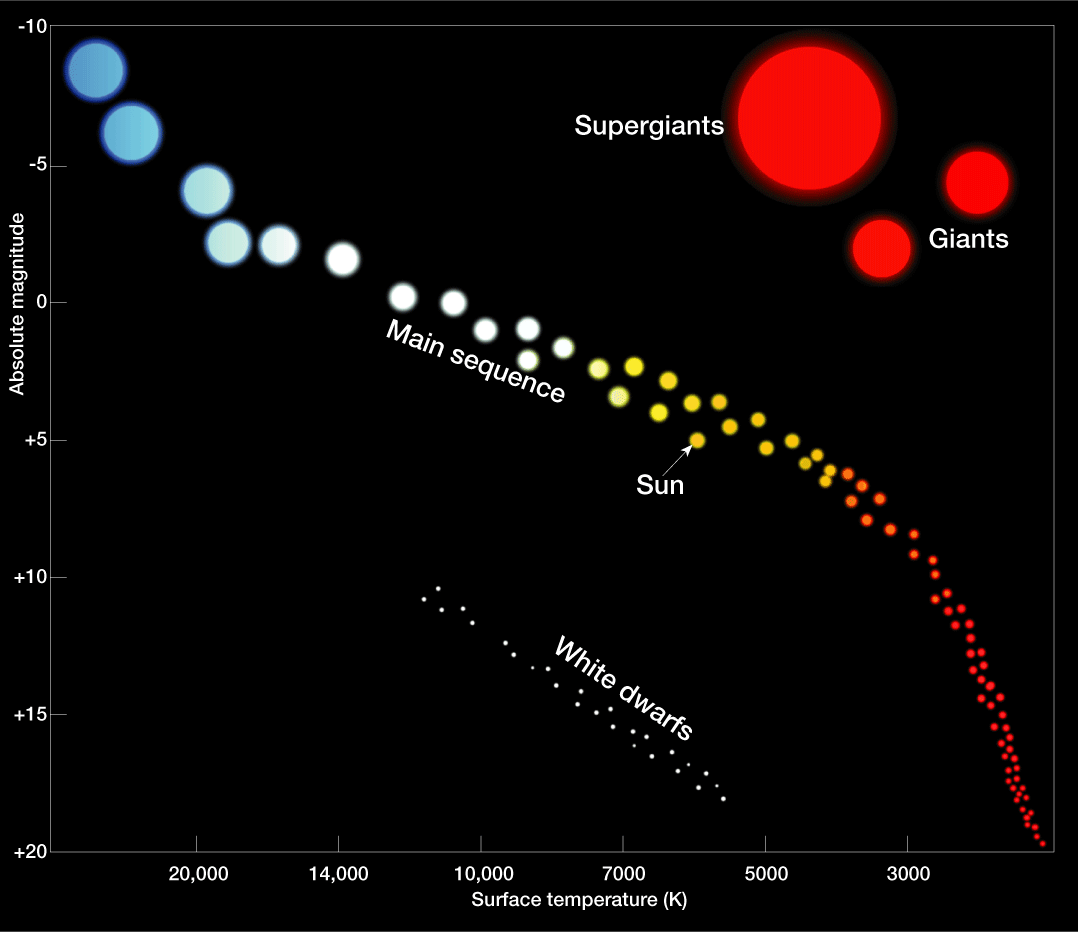
* **Color is a clue to a star’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **Very \_\_\_\_\_\_\_\_ stars emit light in \_\_\_\_\_\_\_\_\_\_wavelengths, so they appear more \_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_stars are much \_\_\_\_\_\_\_\_\_\_\_, and their wavelengths are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **Stars are classified by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **Remember: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_objects glow with light that is \_\_\_\_\_\_intense, and has \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ wavelengths**
* **The hottest type of star is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **The coldest type of star is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **The sun is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**H-R Diagram**

* **Stands for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Diagram**
* **A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to study the stars**
* **Shows the relationship between the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **Y axis:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ X axis:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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* **A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_star is a star that falls on the main sequence category on the H-R diagram. This category contains \_\_\_\_\_\_\_of the stars and runs \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_from the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_stars are about \_\_\_\_\_\_times more massive than the \_\_\_\_\_\_\_\_\_\_, while the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_stars are only about \_\_\_\_\_\_ the size of the sun**
* **The graph shows stars from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_stars to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ stars**
* **A \_\_\_\_\_\_\_\_\_\_\_\_is a \_\_\_\_\_\_\_\_\_\_\_\_\_star of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, it occupies the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_portion of the H-R Diagram**
* **A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_red giant star**
* **The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(though not all white in \_\_\_\_\_\_\_\_\_\_) are much \_\_\_\_\_\_\_\_\_\_\_\_ than main sequence stars of the same \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Some are probably no bigger than \_\_\_\_\_\_\_\_\_\_\_\_. They occur in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_part of the H-R Diagram**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **A \_\_\_\_\_\_\_\_\_\_\_\_\_\_variable star is a star whose \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_periodically because it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_; it is a pusating type of star**
  + **A \_\_\_\_\_\_\_\_\_\_\_\_\_\_is a star that explosively \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
    - **Scientists think that novas occur in \_\_\_\_\_\_\_\_\_\_\_\_\_systems consisting of a expanding \_\_\_\_\_\_\_\_\_\_\_\_\_and a nearby \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **A \_\_\_\_\_\_\_\_\_\_\_ is a cloud of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in space**
  + **There are \_\_\_\_\_major types of nebulae**
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_-if close to a \_\_\_\_\_\_\_star**
    - **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ nebula-mostly \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
    - **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_nebula-reflects light of nearby stars**
  + **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_-if \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_to a bright star to be lit up**

**Section 2: Stellar Evolution**

**Star Birth**

* **Stars \_\_\_\_\_\_\_\_\_\_their lives as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **In the Milky Way Galaxy, nebulae consist of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_may cause the nebula to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the gas cloud will begin to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_into a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_region called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **A protostar is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ star \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to engage in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **When the \_\_\_\_\_\_\_ of a protostar has reached about 10 million K, \_\_\_\_\_\_\_\_\_\_\_\_ is so great that nuclear fusion begins, and a star is \_\_\_\_\_**

**Main sequence stage**

* **Once nuclear fusion \_\_\_\_\_\_\_\_, the star is now it is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ stage where it spends about \_\_\_\_\_\_\_\_\_\_\_\_\_ of its life**
* **Life span depends on \_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **Very \_\_\_\_\_\_\_\_\_\_\_\_\_stars burn their fuel much \_\_\_\_\_\_\_\_\_\_, and only last a few \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **\_\_\_\_\_\_\_\_\_\_\_\_stars will live on for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_of years because they burn their fuel much \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **Eventually, the star’s fuel will begin to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **As nuclear fusion slows, the \_\_\_\_\_\_\_\_\_\_\_\_\_fuel source is depleted, and a star \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **With the exception of \_\_\_\_\_\_-mass \_\_\_\_\_stars, a star can \_\_\_\_\_\_\_ its death by fusing \_\_\_\_\_\_\_\_\_\_\_\_elements and become a giant**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_mass stars become \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_stars become \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Red Giant/Supergiant Stage**

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_burning migrates \_\_\_\_\_\_\_\_\_\_\_. The star’s \_\_\_\_\_\_ envelope \_\_\_\_\_\_\_\_\_\_\_\_\_(and becomes a giant)**
* **Its surface \_\_\_\_\_\_\_\_\_\_ and becomes \_\_\_\_\_\_\_\_\_\_\_**
* **The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as \_\_\_\_\_\_\_\_\_\_\_\_\_ is converted to \_\_\_\_\_\_\_\_. Eventually, all nuclear fuel is used and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ squeezes the star**
  + **Average star=\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **Massive star=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Burnout and Death of Stars**

* **\_\_\_\_\_\_stars, regardless of \_\_\_\_\_\_\_\_, eventually run out of fuel and collapse due to \_\_\_\_\_\_\_\_\_\_\_\_\_**

**Death of Low Mass Stars**

* **Stars \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_mass of the sun \_\_\_\_\_\_\_\_\_evolve to the \_\_\_\_\_\_\_\_\_\_\_\_\_ stage, but remain in the stable \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ stage until they consume \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_fuel and collapse into a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **Low mass stars don’t get \_\_\_\_\_\_\_\_\_\_\_\_ to fuse \_\_\_\_\_\_\_\_\_ so only fuel source is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Death of Average/Medium Mass Stars**

* **Stars with masses \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ evolve essentially the same way as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **During their collapse from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, medium mass stars are thought to cast off their bloated \_\_\_\_\_\_\_\_layers, creating an \_\_\_\_\_\_\_\_\_\_\_round cloud of \_\_\_\_\_\_\_ called a \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_**

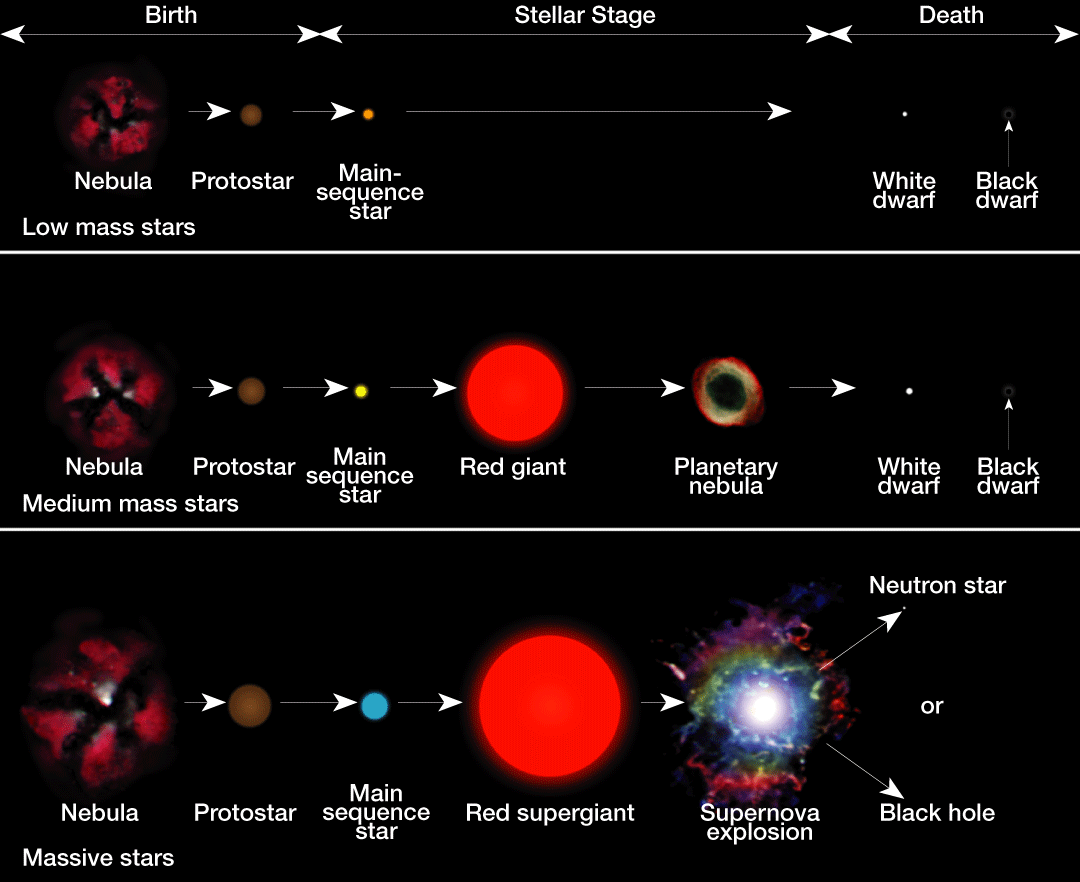
**Death of Massive Stars**

* **Stars that are over \_\_\_\_\_\_\_\_the mass of the sun have relatively \_\_\_\_\_\_\_ life space, which end in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ explosion event**
* **A \_\_\_\_\_\_\_\_\_\_\_\_ is an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ many thousands of times**
  + **Supernova are \_\_\_\_\_\_\_\_\_\_\_\_, none have been observed in the galaxy**
* **The massive star’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_ condenses and may produce a \_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_object that is either a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Burnout and Death**

* **H-R Diagrams and Stellar evolution**
  + **H-R Diagrams have been helpful in formulating and testing models of stellar evolution**
  + **They are also useful for illustrating \_\_\_\_\_\_\_\_\_that take place in an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_during its life spac**

**Stellar Remnants**

* **White Dwarf: a \_\_\_\_\_\_\_\_that has exhausted \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of its nuclear fuel and has \_\_\_\_\_\_\_\_\_\_\_\_ to a very \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, believed to be near its \_\_\_\_\_\_\_\_\_\_ stage of evolution**
* **The sun begins as a \_\_\_\_\_\_\_\_\_\_\_\_ spends much of its life as \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_star, and then becomes a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, a \_\_\_\_\_\_\_\_\_\_\_\_\_, and finally a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_: a \_\_\_\_\_\_\_\_\_extremely \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ composed entirely of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **Neutron stars are thought to be the remnants of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ events**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: A \_\_\_\_\_\_\_\_\_\_\_ star that has collapsed to such a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the escape of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **Scientists think that as matter is pulled into a black hole, it should become very \_\_\_\_\_ and emit a flood of \_\_\_\_\_\_\_\_ before being pulled in**

**Section 3: The Universe**

**Types of Galaxies**

* **A \_\_\_\_\_\_\_\_\_\_\_\_is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **There are \_\_\_\_\_types: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **Classified based on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**\_\_\_\_\_\_\_\_\_\_Galaxies**

* **About \_\_\_\_\_\_ of all galaxies are spiral galaxies**
* **They have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **Usually disked \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, with a somewhat \_\_\_\_\_\_\_\_ concentration of stars near their \_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **A \_\_\_\_\_\_\_\_\_\_ spiral galaxy has its stars arranged in the shape of a bar which rotates as a rigid system and attached to the bar are \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **The Milky Way may be a Barred Spiral Galaxy**
* **Have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in between stars**
* **Clouds of interstellar matter provide the materials to allow \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**The Milky Way Galaxy**

* **Size of the Milky Way Galaxy**
  + **Hard to study because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ blocks are vision**
  + **A \_\_\_\_\_\_\_\_ spiral galaxy whose disk is about \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ thick at the nucleus.**
* **Structure of the Milky Way**
  + **Scientists have used \_\_\_\_\_\_\_\_\_\_ telescopes to determine the structure of our galaxy**
  + **Has at least \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **The sun is in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ about \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ away from the \_\_\_\_\_\_\_\_\_\_\_\_ of the galaxy**
  + **Our solar system orbits the galactic nucleus once every \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**\_\_\_\_\_\_\_\_\_\_\_\_\_Galaxies**

* **\_\_\_\_\_ of all galaxies are elliptical**
* **Range in shape from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **Most are \_\_\_\_\_\_\_\_\_, though the largest galaxies are \_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Galaxies**

* **Only \_\_\_\_\_\_\_of the known galaxies have irregular shape**
* **Irregular galaxies contain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Galaxy Clusters**

* **A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **We are in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ which contains at least \_\_\_\_ galaxies (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)**

**Superclusters**

* **Galaxy clusters make groups called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **These may be the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_structures in the universe**

**Origin of the Universe**

* **Remember, a light year is the distance light travels in \_\_\_\_\_\_\_\_\_\_**
* **When we say the sun’s light is 8 minutes away, we are saying we see it as it was 8 minutes ago, and never as it really is**
* **The same is true for stars, planets, galaxies or clusters of galaxies**
* **Most of the universe is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**The Expanding Universe**

* **\_\_\_\_\_\_\_\_\_\_\_shifts**
  + **Red shift, or a Doppler shift toward the red end of the spectrum, occurs because wavelengths are \_\_\_\_\_\_\_\_\_\_\_\_\_, which shows that Earth and the source are moving \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Law**
  + **A law that states that the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the Milky Way at a speed that is proportional to its \_\_\_\_\_\_\_\_\_\_\_\_**
  + **The red shift of distant galaxies indicate that the universe is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Big Bang Theory**

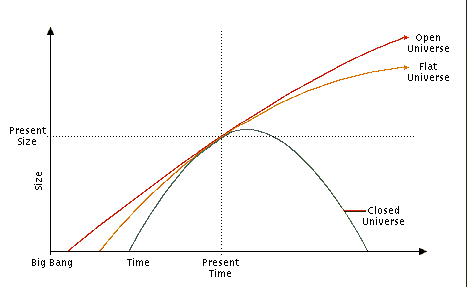
* **States that at one time, the entire universe was confined to a dense, hot, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Then about \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, a violent explosion occurred, hurling this material in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ were created at that \_\_\_\_\_\_\_\_\_\_\_\_\_\_. After several hundred thousand years, the universe became \_\_\_\_\_\_ enough for atoms to form. Gases in the universe continued to cool and condense. They eventually formed the stars that make up the galaxies we now observe moving away from us**

**Supporting Evidence for Big Bang**

* **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **Scientists have discovered a type of energy called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Scientists think that this radiation was produced during the big bang.**

**Predicting the Future of the Universe**

* **The future is uncertain, but there are 3 possible outcomes**
  + **The universe will keep \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **The expansion of the universe will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and the universe will approach a \_\_\_\_\_\_\_\_\_\_ in size**
  + **The universe will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and start to fall back in on itself \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Fate of Universe Depends on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

* **If \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_mass, the gravitation force will be too \_\_\_\_\_\_ to stop the expansion and the universe will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
* **If there is just the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of mass, the expansion will continually \_\_\_\_\_\_\_\_\_\_\_, but will never \_\_\_\_\_\_\_\_\_\_\_\_**
* **If there is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_mass, gravity will eventually overcome the expansion and the universe will start to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
  + **Could be known as the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**