Stars

The View From Earth

You have probably noticed, when looking at the sky at night, that some stars look as though they are grouped together into a distinct pattern. Perhaps the best known star pattern in the northern hemisphere is the big dipper.

The big dipper is actually just part of a larger star pattern known as ursa major, which is itself a constellation.

A constellation is a group of stars that, from Earth, have a recognizable form. Some other constellations are: Orion, Cancer, Pisces, Ursa Minor

Though you may think that the Big Dipper is a constellation, it is actually an asterism, a smaller star pattern within a constellation.

Though star patters we see at night appear to be the same distance from Earth, they are actually not. When viewed from elsewhere these star patterns would not be visible.

How a Star Is Born

All stars form inside a collapsing nebula, a cloud of dust and gases. This collapse can be triggered by the gravitational attraction of a nearby star or the shockwave from an exploding star.

Inside a collapsing nebula, the region with the greatest amount of matter will start to draw material towards it through gravity.

The material falling inward to the core has excess energy that causes the central ball of material to begin to spin. Extremely high pressures build up inside the ball, which in turn causes tightly packed atoms to heat up. As the temperature climbs, the core begins to glow. This is called a protostar, a star in its first stage of formation.

Eventually, the temperature of the spinning protostar rises to millions of degrees Celsius. This is hot enough for nuclear reactions to start. Over tens of thousands of years, the __energy__ from the core gradually reaches the star's outside and the star "switches on" and begins to __shine__.

The Life Cycle of Stars

The way in which a star evolves in its lifetime depends on the __mass__ it had when it originally formed. Stars fall into __3__ general mass categories: low, medium and high.

Low Mass Stars

- Use their __fuel__ much more __slowly__ than more massive stars
- Can last for __100__ __billion__ years
- With __less__ gravity and __more__ pressures than other stars, the __nuclear__ reactions in the core happen at a relatively __slow__ rate
- Shine __weakly__ as small red stars called __red__ __dwarfs__
- The light of a __red__ __dwarf__ stars dim and gradually grows __dimmer__
- As they burn out they __collapse__ under their own __gravity__
- __red__ __dwarfs__ eventually cool into smaller __white__ __dwarfs__

Medium Mass Stars

- Burn their fuel __faster__ than low mass stars
- Use their __hydrogen__ up in about __10__ __billion__ years
- Eventually, the star will __collapse__ under its own gravity
- This process of __collapsing__ raises the __temperature__ and __pressure__ inside the star, and the star actually __reignites__!
- As the star reheats, it expands rapidly into a __red__ __giant__
- Eventually, even the __helium__ fuel burns out and the star collapses again and slowly burns out

High Mass Stars

- More than __10__ times the mass of the Sun
- As __gravity__ pulls matter into the center of the star, the __nuclear__ reactions accelerate making high mass stars __hotter__, __brighter__, and __bluer__ than other stars
- Always come to a __violent__ end in less than __7__ __billion__ years
- As the star collapses, it __expands__ into a __supergiant__

- When the helium fuel runs out the core collapses again and continues to go through many cycles of collapse and expansions as new elements including iron are formed in its core

Supernovas: The Violent End of High Mass Stars

When iron fuses, it does not release energy. If too much of the core of a high mass star is made up of iron, the star will "turn off" over a period of minutes

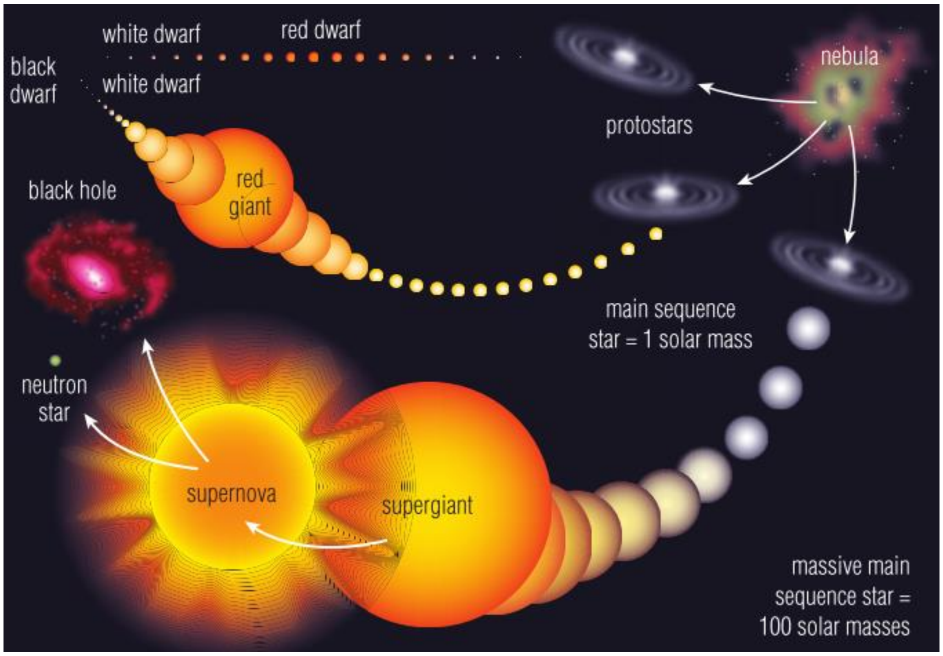
With no fuel left to produce heat energy, the star collapses one final time, so fast and intensely that the core of the star heats up to many hundreds of millions of degrees and explodes into a supernova.

The explosion releases enough energy to cause the iron and other elements to fuse in various combinations. It is in this way that all of the elements of the periodic table have been formed.

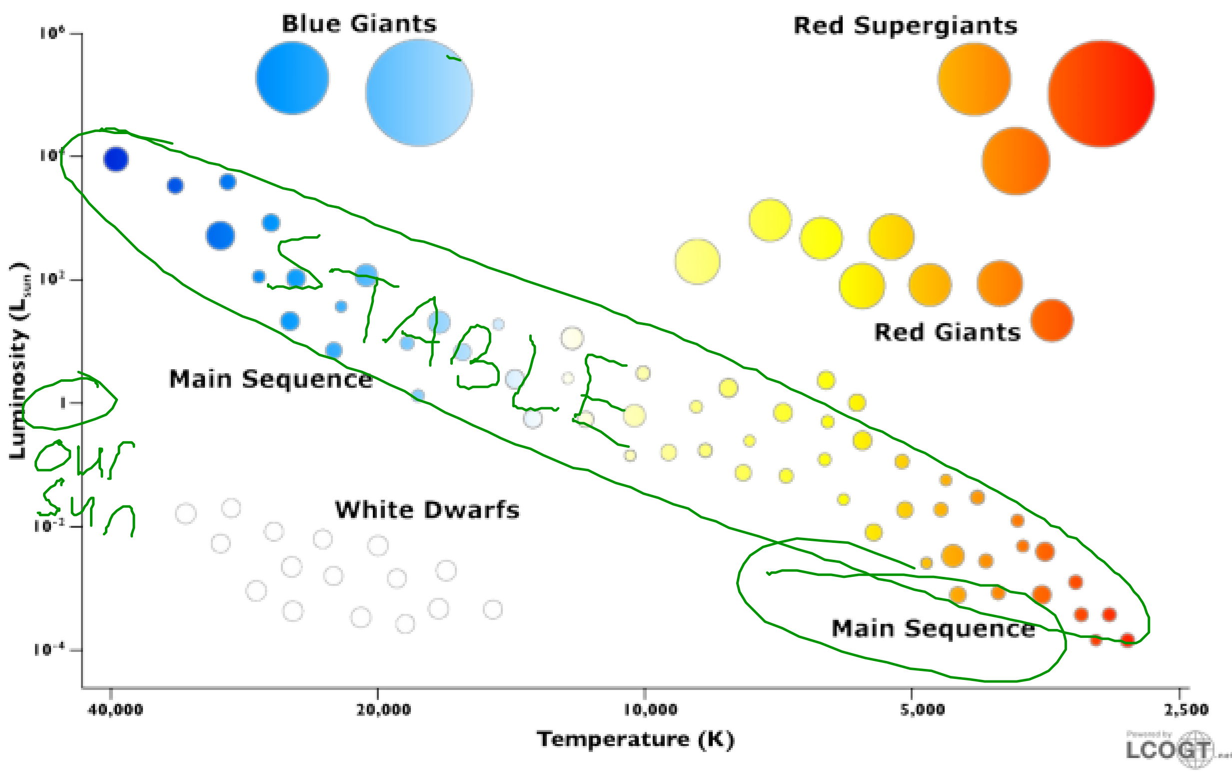
As the elements are sent out into space, some of the debris and elements from the old star create new nebulae out of which new star and planet systems may form.

The star's remaining core after a supernova explosion will turn into either a neutron star or a black hole depending on the mass of the original star.

Neutron Star	Black Hole
- Form if star was between 10 and 40 times the mass of the Sun - When an atom collapses it forms neutrons - When the core of a star becomes a ball of neutrons about 15 km across, it is called a neutron star - Neutron stars are made of the densest material known	- Form if star was more than 40 times the mass of the Sun - After exploding, the star's core is under so much gravitational force that nothing can stop its collapse - Results in gravity so great that space, time, light and other matter fall into a single point



The Hertzsprung-Russell Diagram



Read pages 300 and 301 and describe the Hertzsprung-Russell Diagram in the space below.