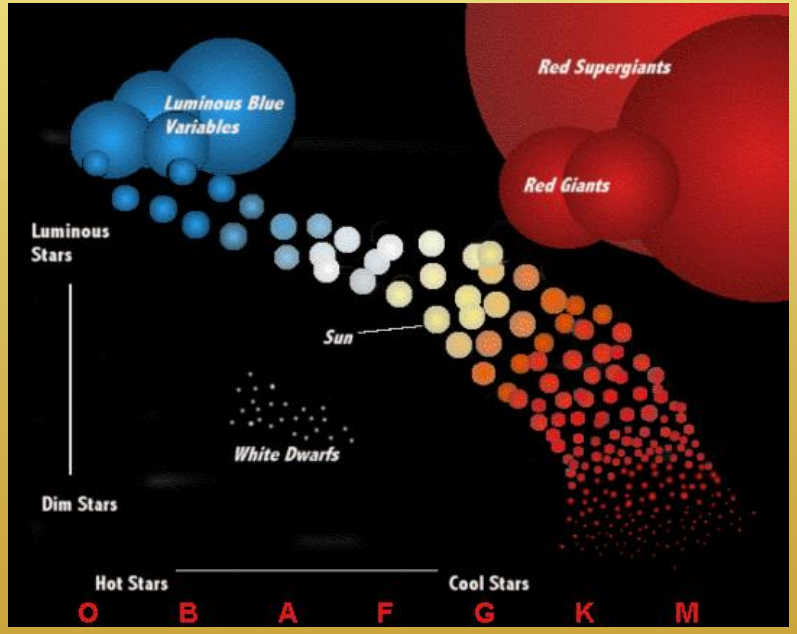
Stars

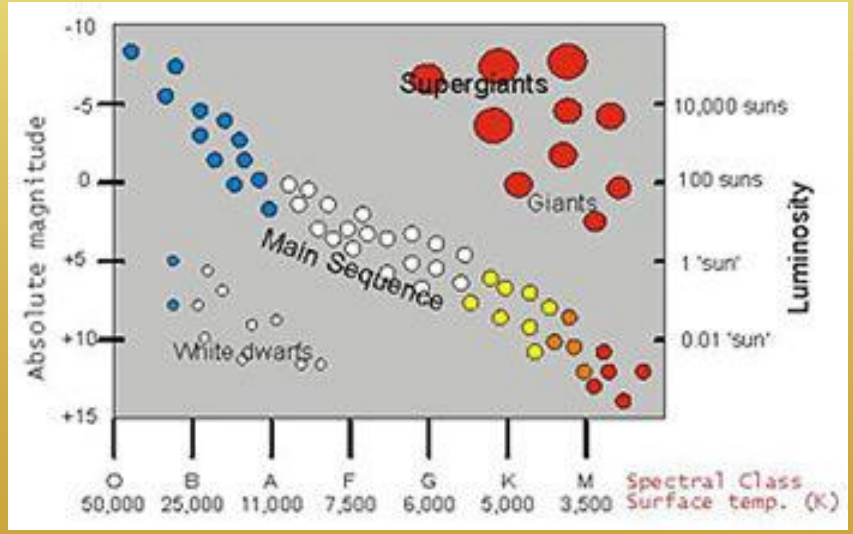
What is a Star?

- A star is a ball of hot gas, which produces heat and light from nuclear reactions (fusion) within its core.
- Stars are classified by color, temperature, size, composition, and brightness.

Color and Temperature

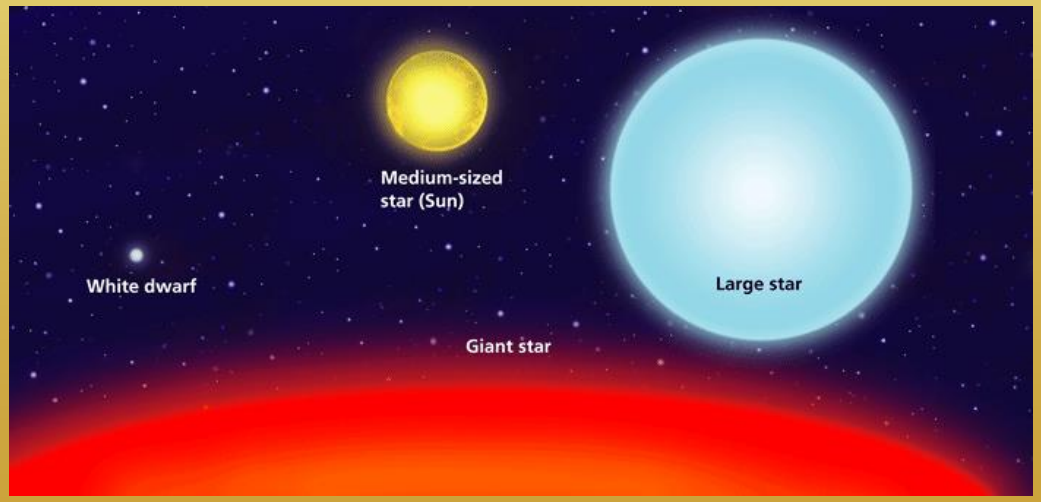
•Stars vary in color and temperature. The color of a star is relative to its temperature.





Size

- Stars all appear to be points of light of the same size. However, many stars are the same size as the sun, which is medium-sized.

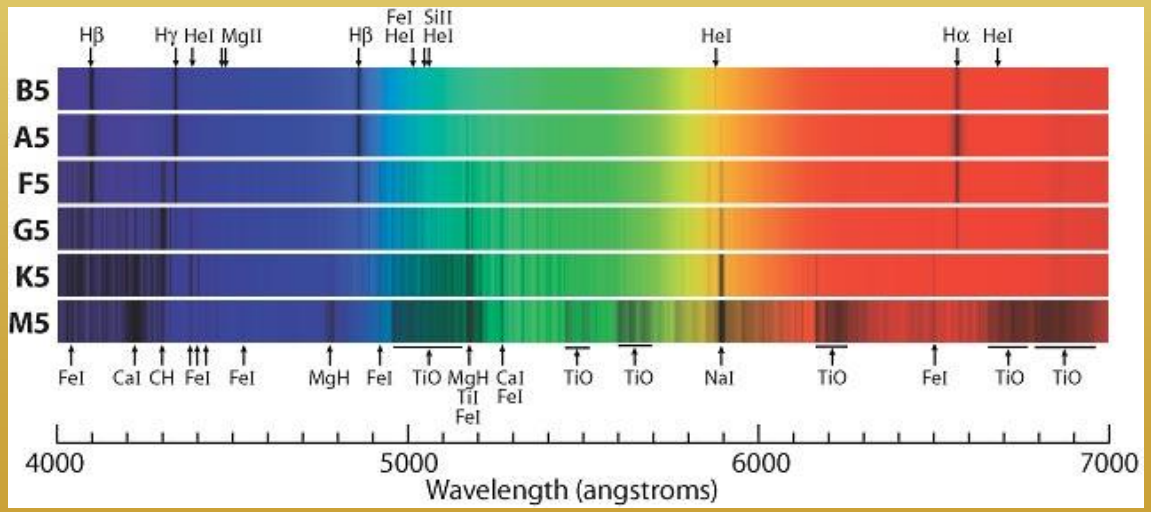


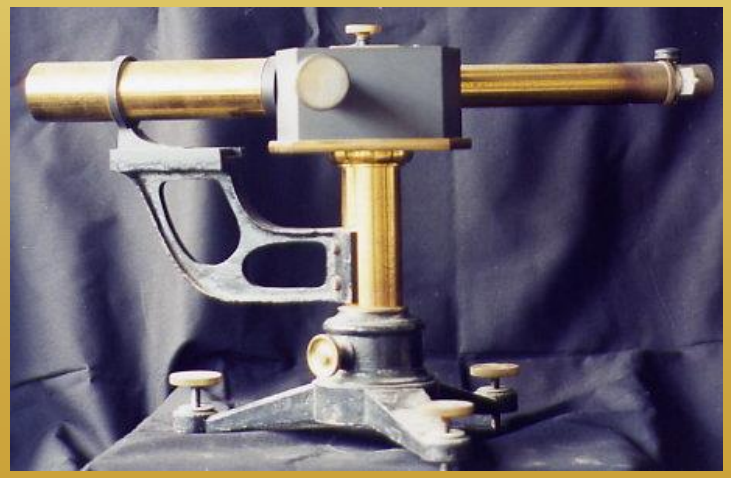
Chemical Composition

- The chemical composition of most stars is
  - 73% Hydrogen
  - 25% Helium
  - 2% other elements by mass

Chemical Composition

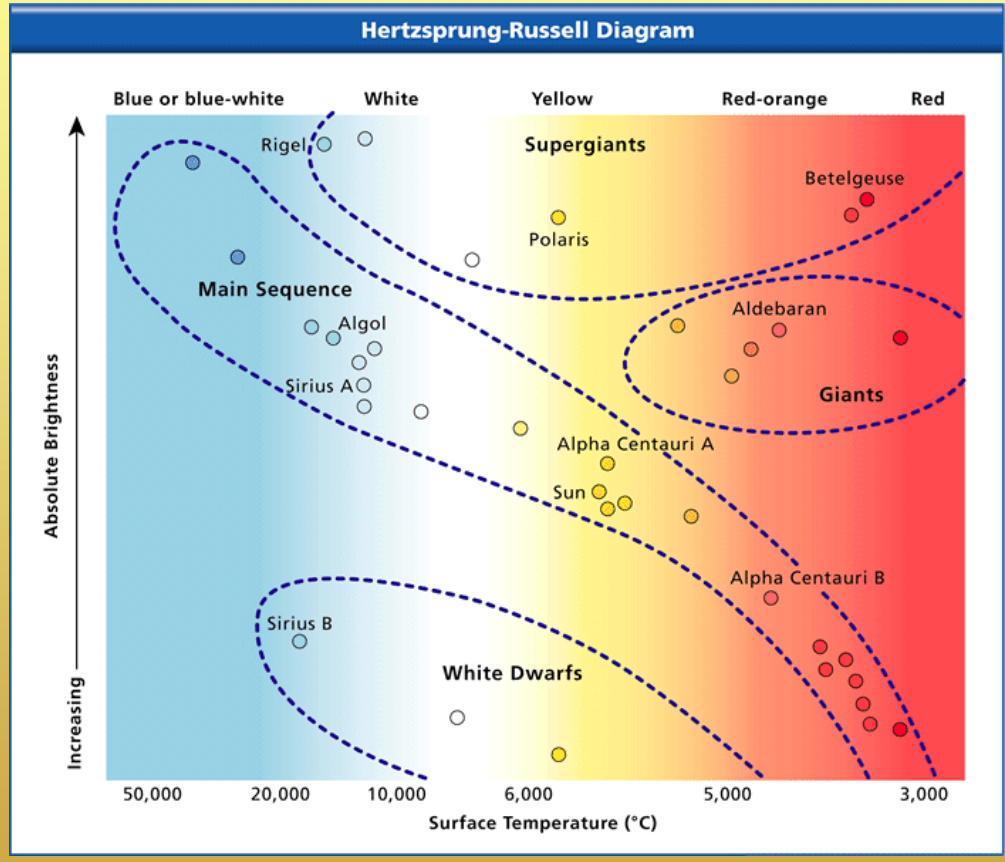
•Astronomers use a spectrograph to determine the other elements in stars. A spectrograph is a device that breaks light into colors and produces an image of the resulting spectrum.





Brightness

- The brightness of a star depends upon both its size and temperature.
- Astronomers use Hertzsprung-Russell diagrams to classify stars and to understand how stars change over time.



Beginning of a Star

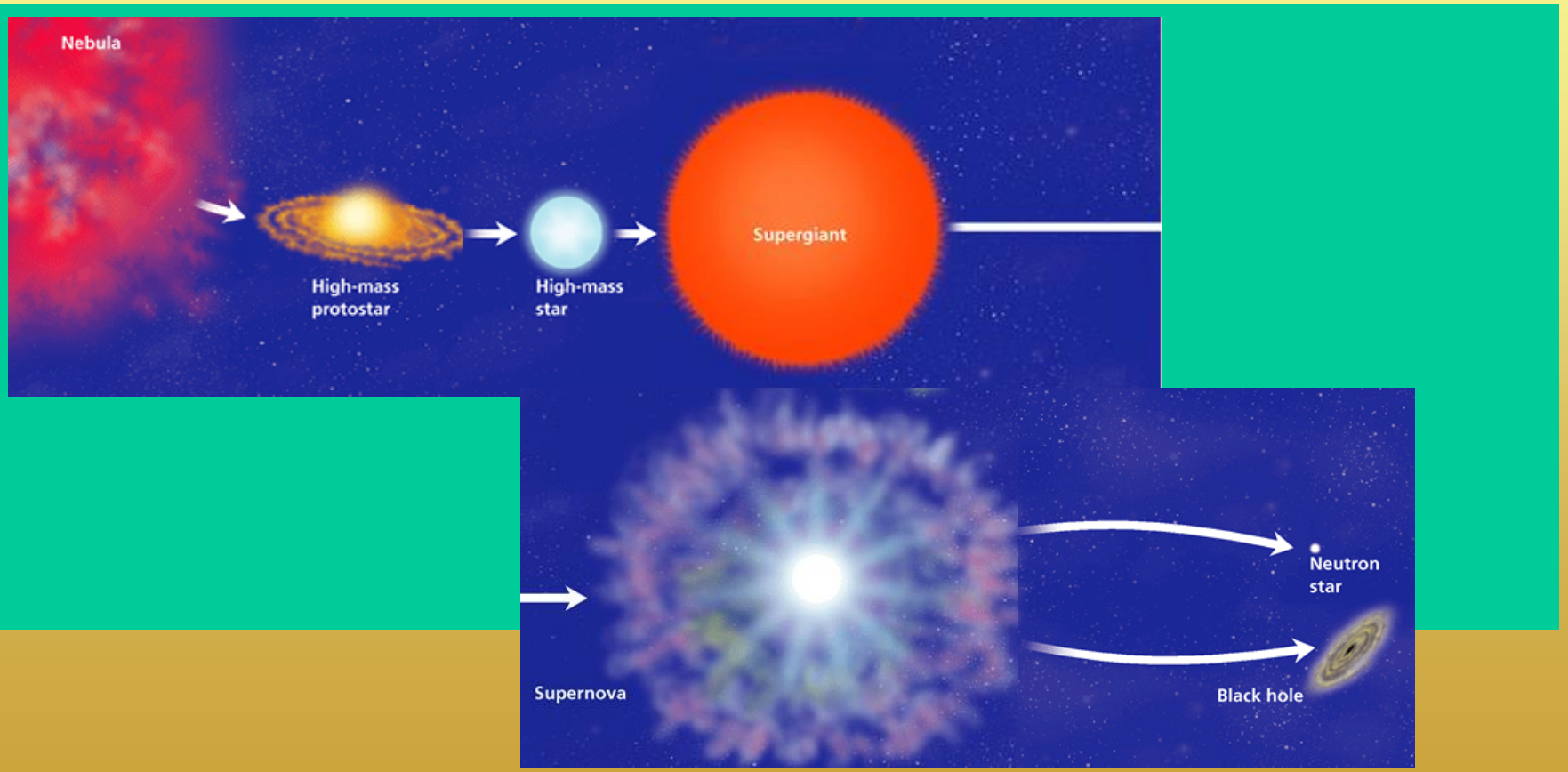
- Stars begin as a large cloud of gas and dust called a *nebula*.
- Gravity pulls the particles of gas and dust causing the nebula to shrink.
- A contracting cloud of gas and dust with enough mass to form a star is called a *protostar*. (*Proto* means “earliest” in Greek).
- A star is born when the gas and dust become so dense and hot that nuclear fusion begins.

The Lives of Stars

- A star's life history depends on its mass. After a star runs out of fuel, it becomes a black dwarf, a neutron star, or a black hole.
- Watch the Video Field Trip about Stars.
- Visit PHSchool.com to view the "active art" about the lives of stars!
- WEB code: cfp-5043

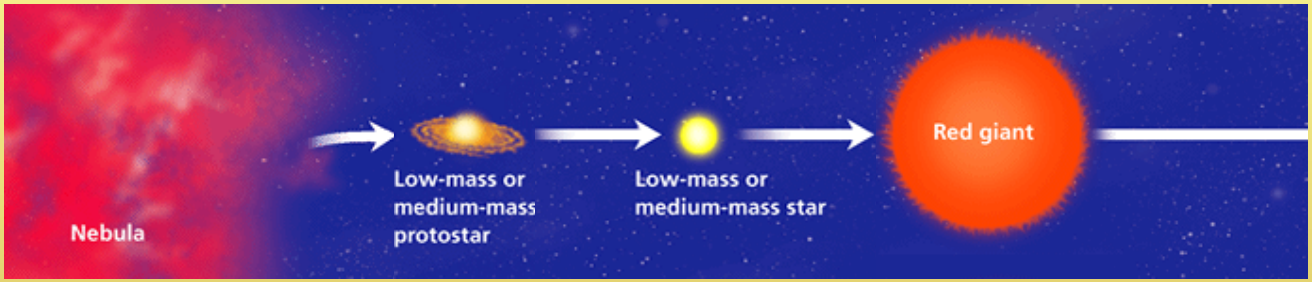
The Lives of Stars

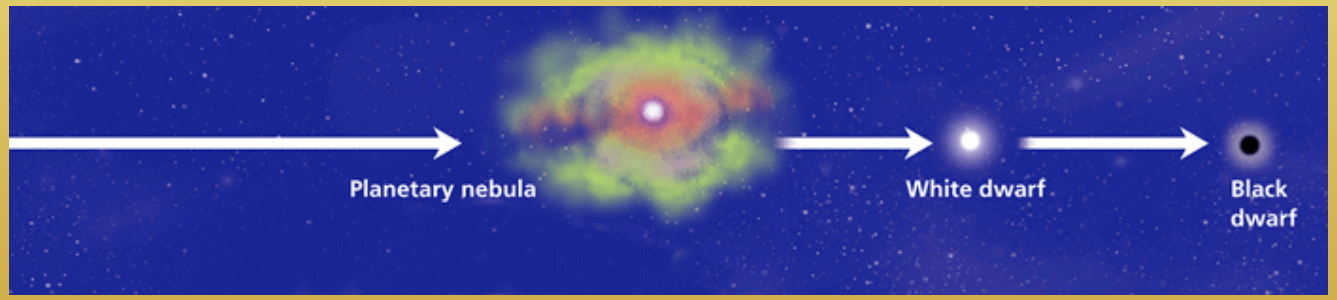
- High-mass Stars



The Lives of Stars

- Low-mass or Medium-mass Stars





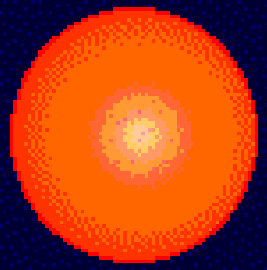
The Lifecycle of Stars

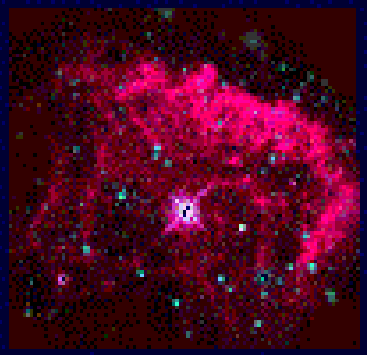
Stellar Nursery

Stars form in a nebula, from collapsing clouds of interstellar gas and dust.

Sun-Like Stars (up to 1.5 times the mass of the Sun)

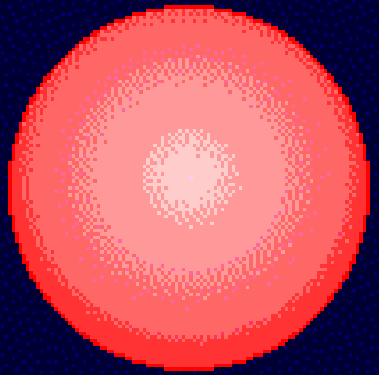
Sun-Like Stars → Red Giant → Planetary Nebula → White Dwarf → Black Dwarf

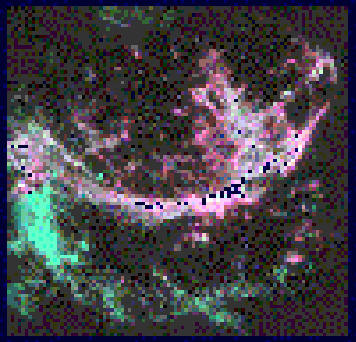




Huge Stars (from 1.5 to 3 times the mass of the Sun)

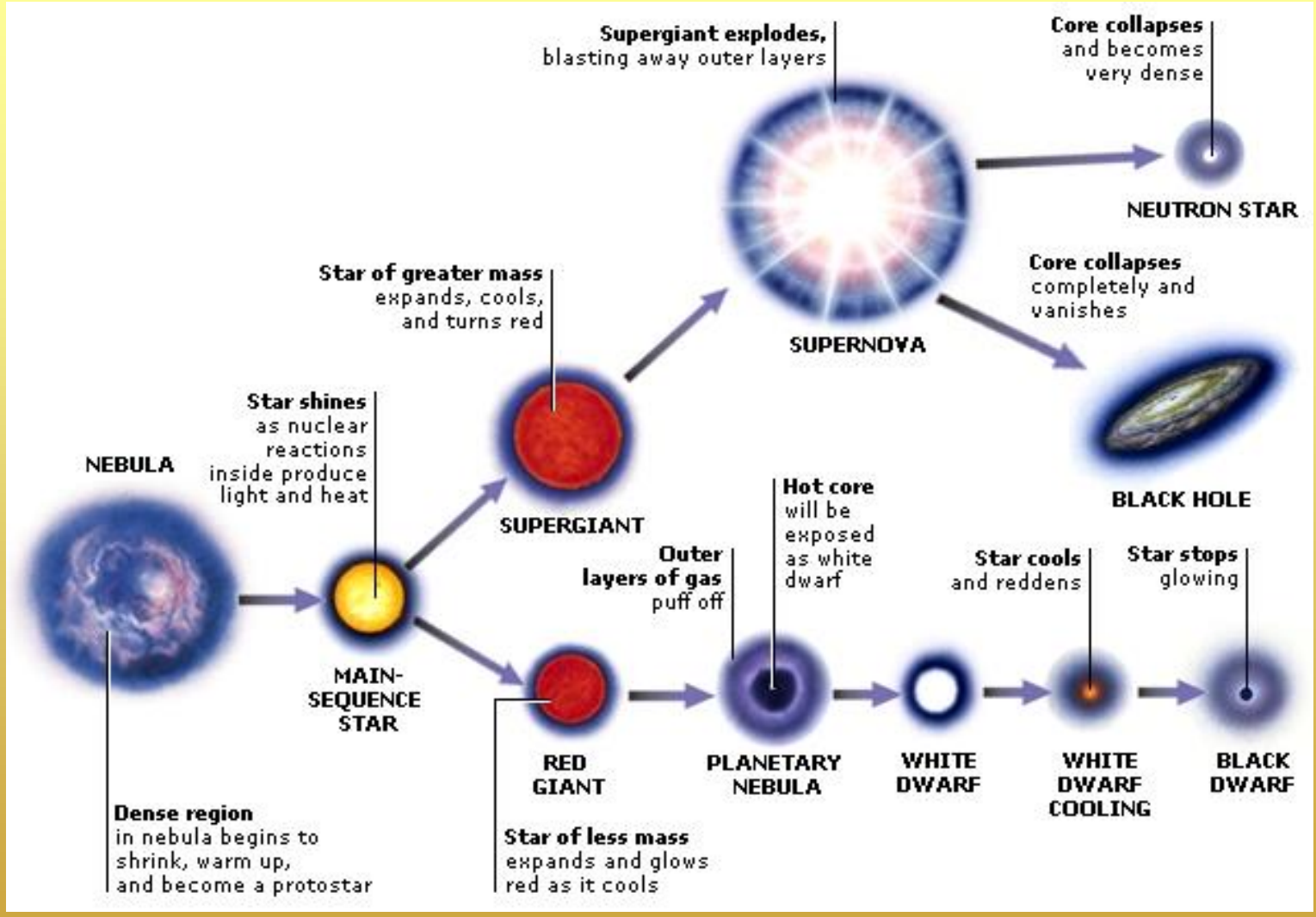
Huge Stars → Red Supergiant → Supernova → Neutron Star

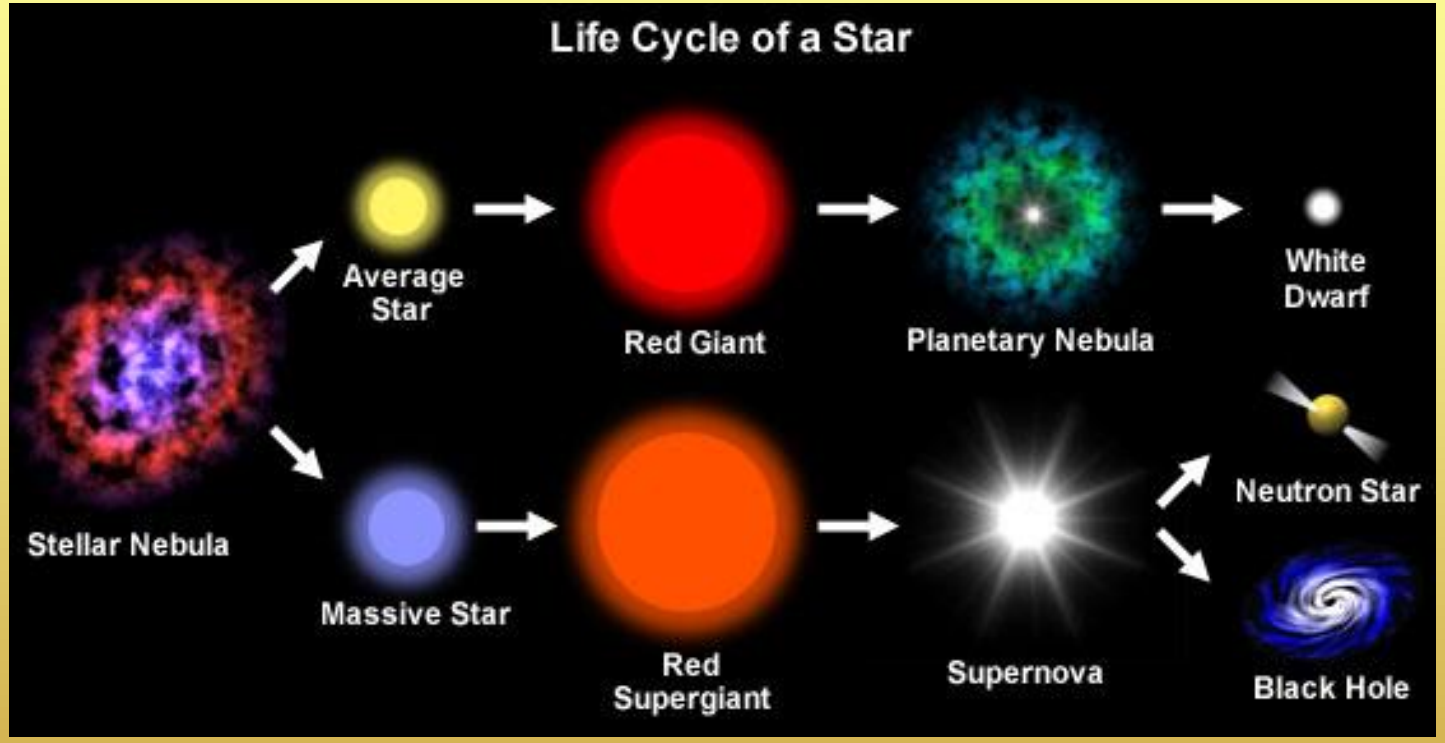




Giant Stars (over 3 times the mass of the Sun)

Giant Stars → Red Supergiant → Supernova → Black Hole


Supergiant explodes, blasting away outer layers
Core collapses and becomes very dense
NEUTRON STAR
Star of greater mass expands, cools, and turns red
Core collapses completely and vanishes
SUPERNOVA
BLACK HOLE
Star shines as nuclear reactions inside produce light and heat
NEBULA
SUPERGIANT
Hot core will be exposed as white dwarf
Outer layers of gas puff off
Star cools and reddens
Star stops glowing
MAIN-SEQUENCE STAR
RED GIANT
PLANETARY NEBULA
WHITE DWARF
WHITE DWARF COOLING
BLACK DWARF
Dense region in nebula begins to shrink, warm up, and become a protostar
Star of less mass expands and glows red as it cools


Life Cycle of a Star
Average Star
Red Giant
Planetary Nebula
White Dwarf
Stellar Nebula
Massive Star
Red Supergiant
Supernova
Neutron Star
Black Hole

The Sun

- A massive ball of exploding gas.
- 1.4 million km across
- Can hold more than a million planets the size of the Earth.
- Closest star to the Earth
- ONLY star in our solar system!
- The Sun is the center of our solar system (heliocentric)

Constellations

Let's Get Some Background Information

- Read the short paragraph "Constellation" and answer the 4 questions.
- Then, see if you can match the constellation names to their pictures in "Pictures in the Night Sky".
- Be ready to share out!

Now let's look a little deeper…

- Click here to watch "All of the Constellations in HD"!
- Take notes on the back of your "Stars" note sheet.
  - You can bullet new information OR
  - You can make a T-chart of what you already knew and what you learned OR
  - You can make a chart of what you knew, what you were wrong about, and new questions you have….

CONSTELLATIONS

Constellations

- What do we already know about constellations?
- Which ones can we name?

Constellations

- Ancient Greeks, Romans, and other people who lived long ago found patterns, or shapes, made by stars in the night sky.

- These star patterns are called constellations.

- There are 88 official constellations.

SHORT FORM:

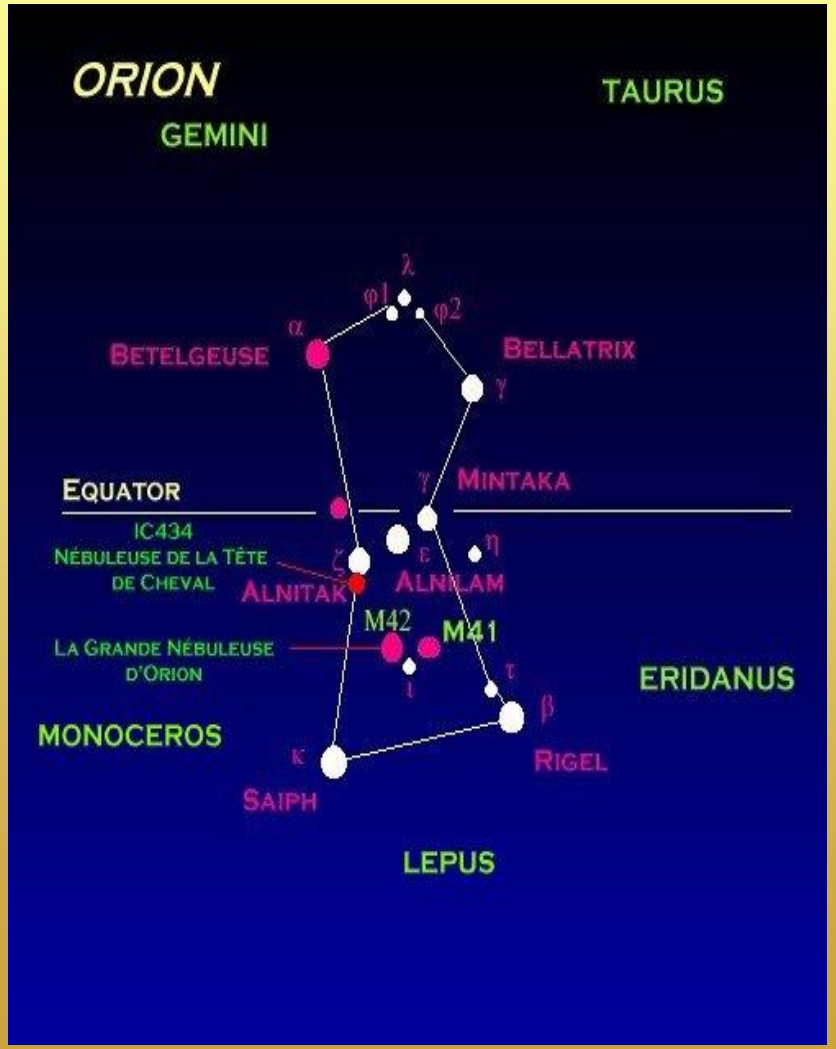
- **Ancient people found patterns made by stars-called constellations-88 official ones**

Orion

- *A great hunter*

Orion

- In the Southern sky in autumn, WINTER, and spring
- His head points to Polaris
- Look for his belt – 3 bright stars in a straight line

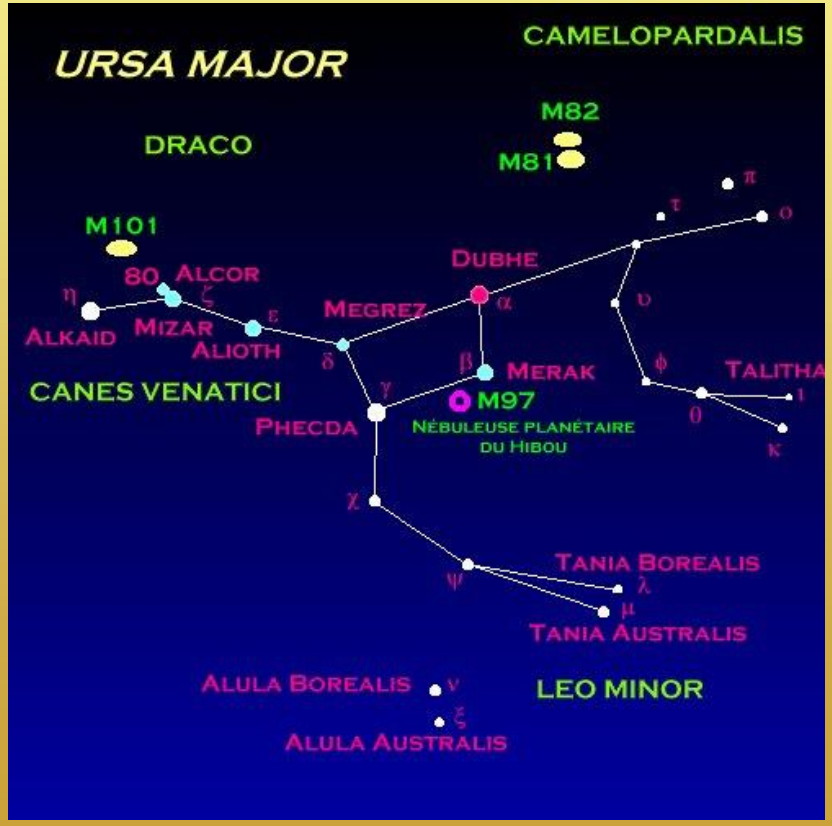


Ursa Major

- The great Bear

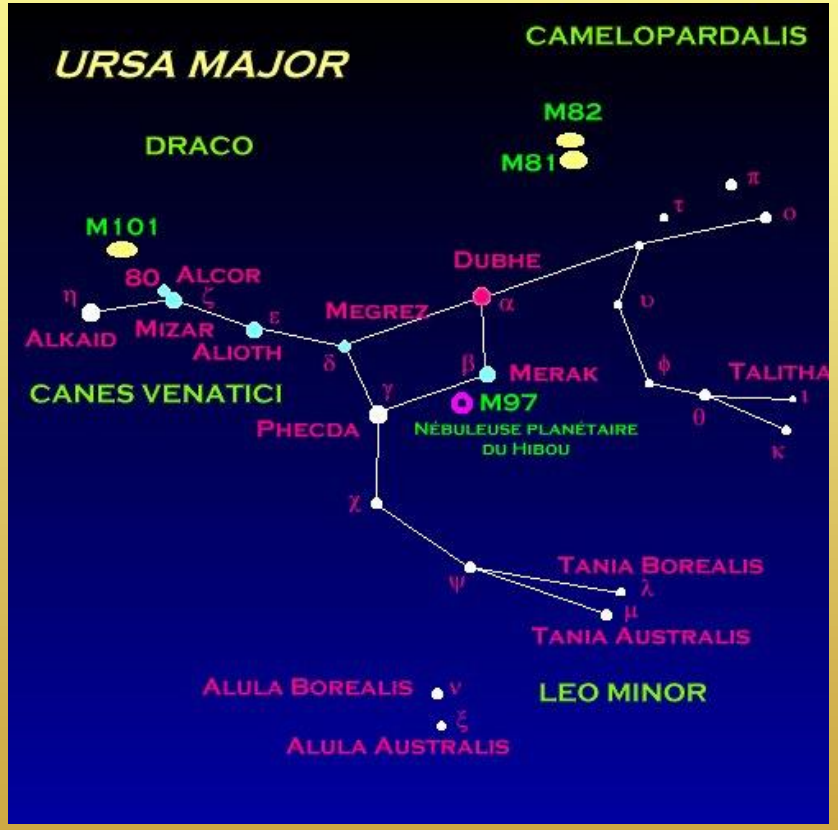
Ursa Major

- Do you see a common "constellation" in Ursa Major?



Ursa Major

- Seen all year round (circumpolar)
- Best seen in SPRING
- The big dipper is part of Ursa Major



Cygnus

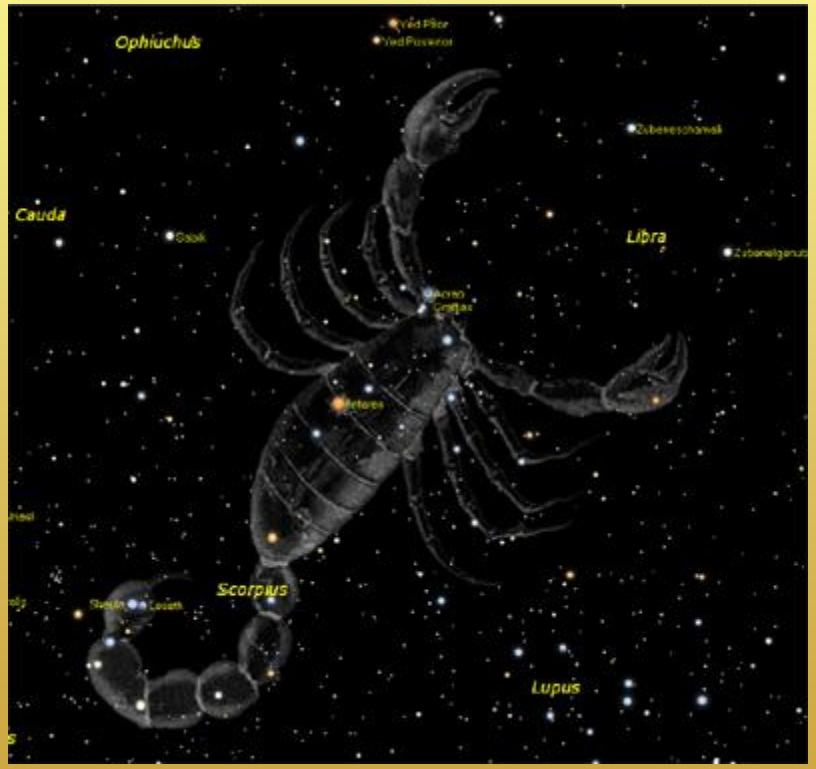
- The swan

Cygnus

- Located in the Milky Way
- Best seen in SUMMER and FALL
- Follow inner cup of Big Dipper to tail of Cygnus
- Daneb, the brightest star in Cygnus, is the tail!

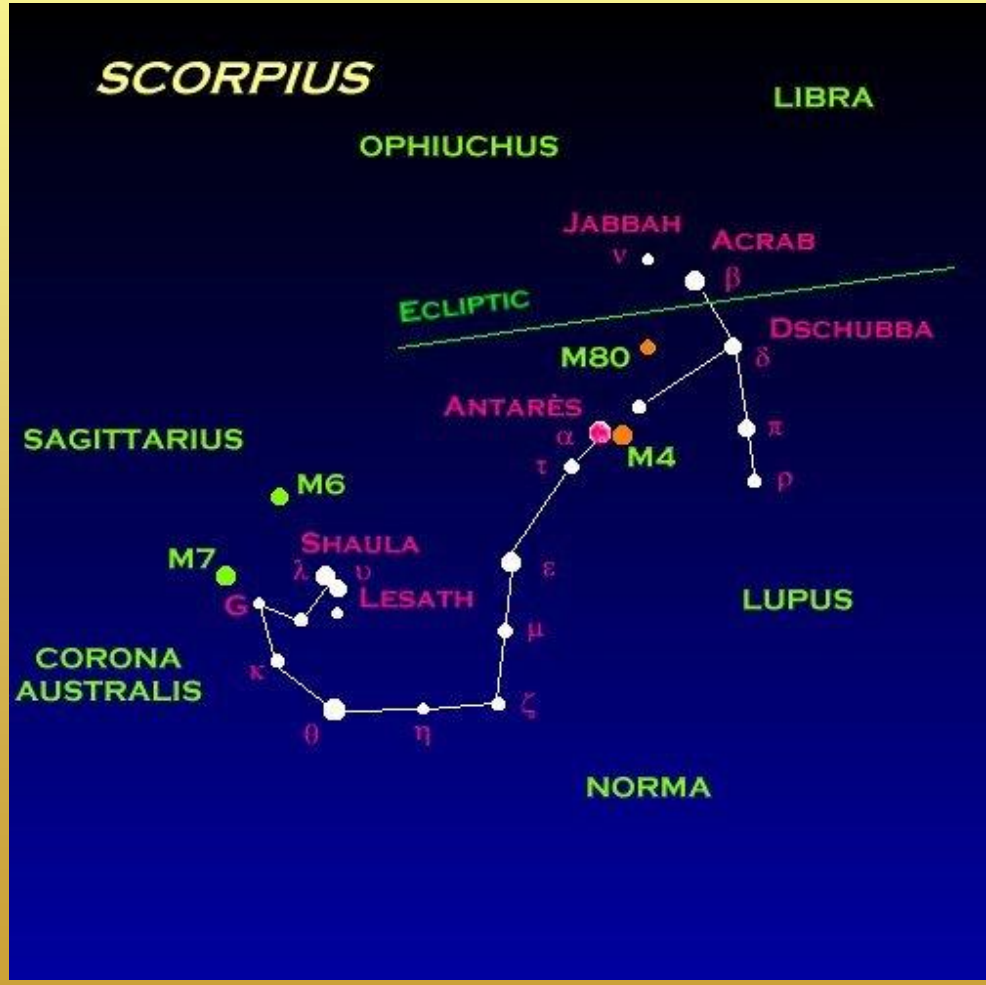
Scorpius

- The scorpion



Scorpius

- Sits low along the southern horizon
- Best seen in SUMMER
- Tail NOT visible to most northern latitudes



Cassiopeia

- Female figure- possibly a queen

Cassiopeia

- Seen all year round (circumpolar)
- Found in Milky Way
- ½ year looks like an “M”; the other ½ year looks like a “W”

Constellations

- Why do you think people created Constellations?
- Talk with your group!