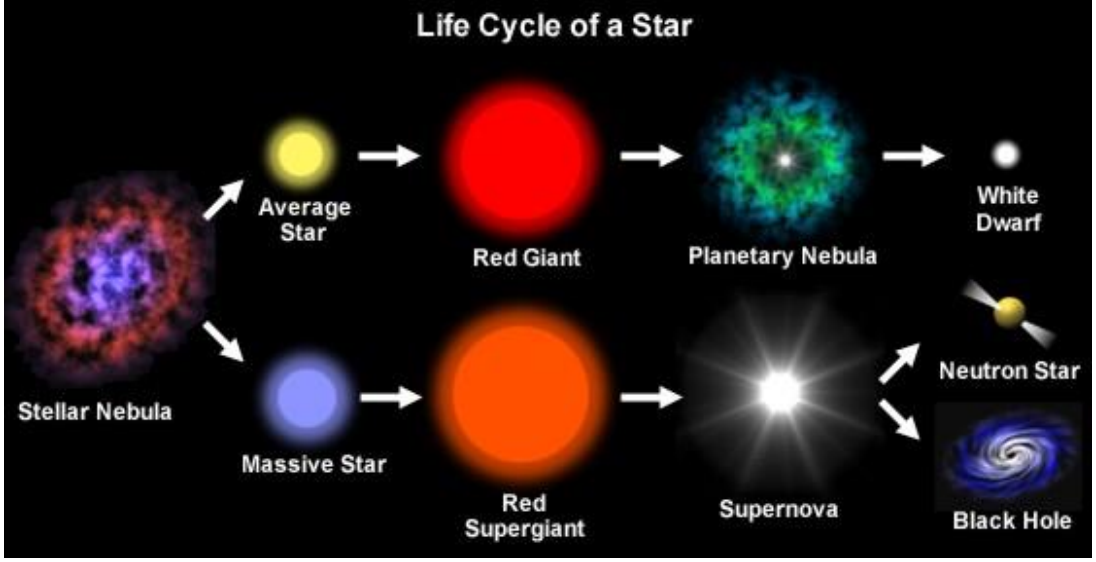
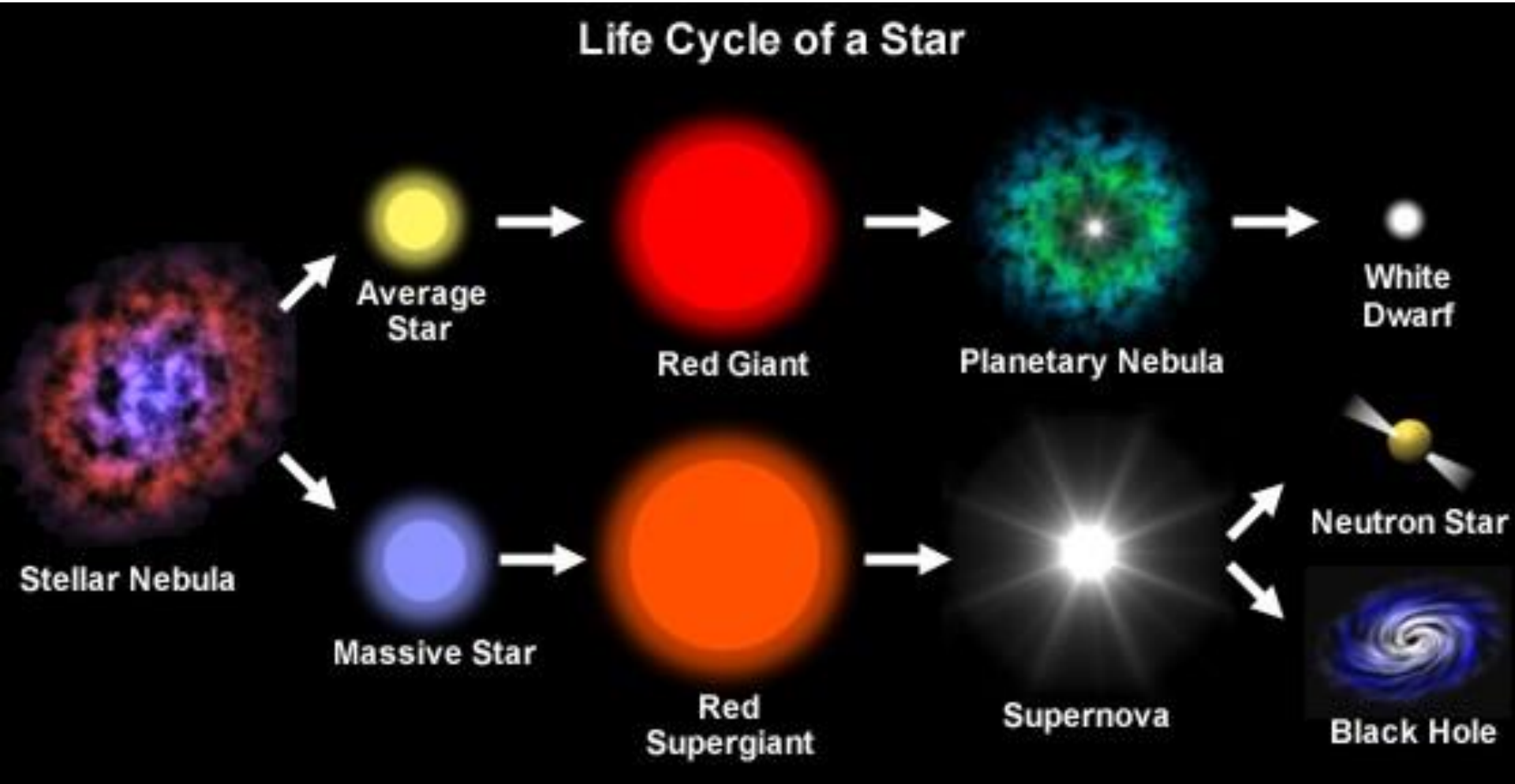


Life cycle of stars

Ch. 25.2:

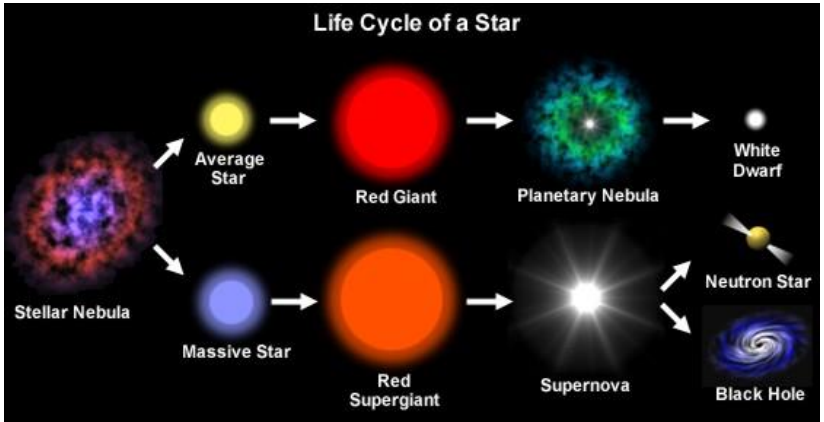
- *Identify and define the stages of a star's life.*
- *Identify the conditions needed for fusion to occur.*
- *Relate the color of a star to its temperature.*

Life Cycle of a Small to Average Star



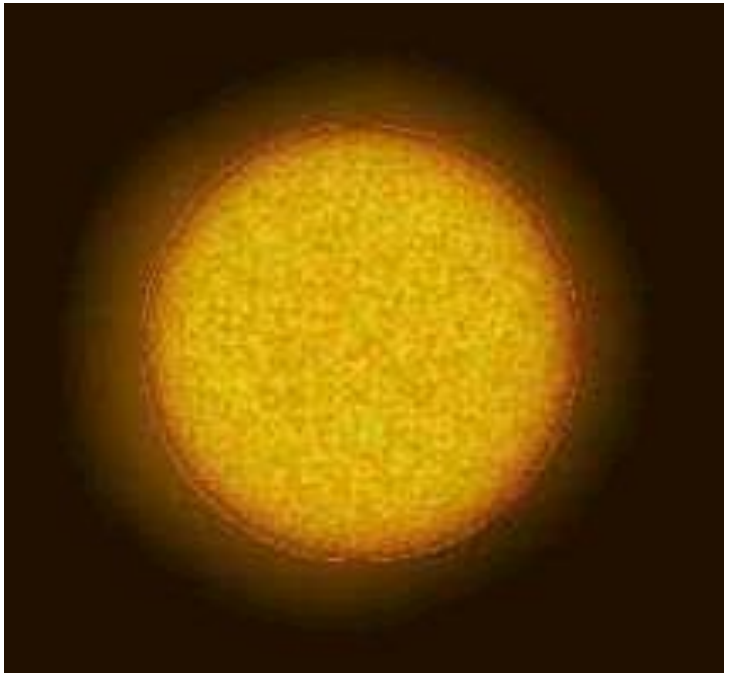
Nebula

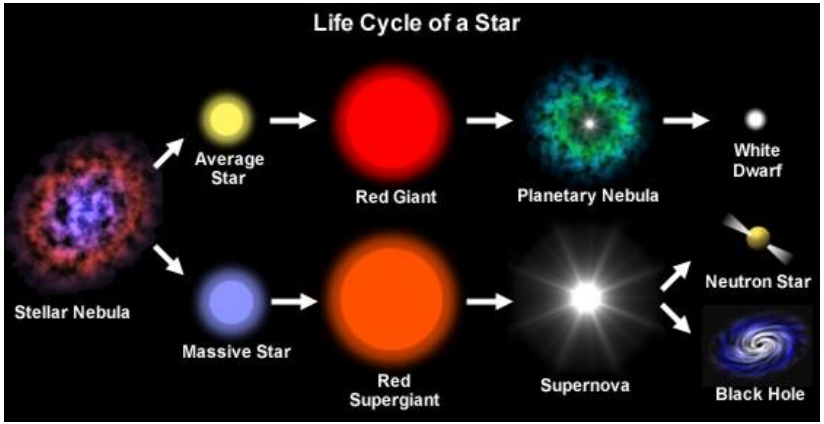
- Stars begin as a huge cloud of gas and dust called a **nebula**.
- **Protostar** is the earliest stage in the life cycle.
- *A star is born when temperature and pressure become great enough to start nuclear fusion.*



Average Star

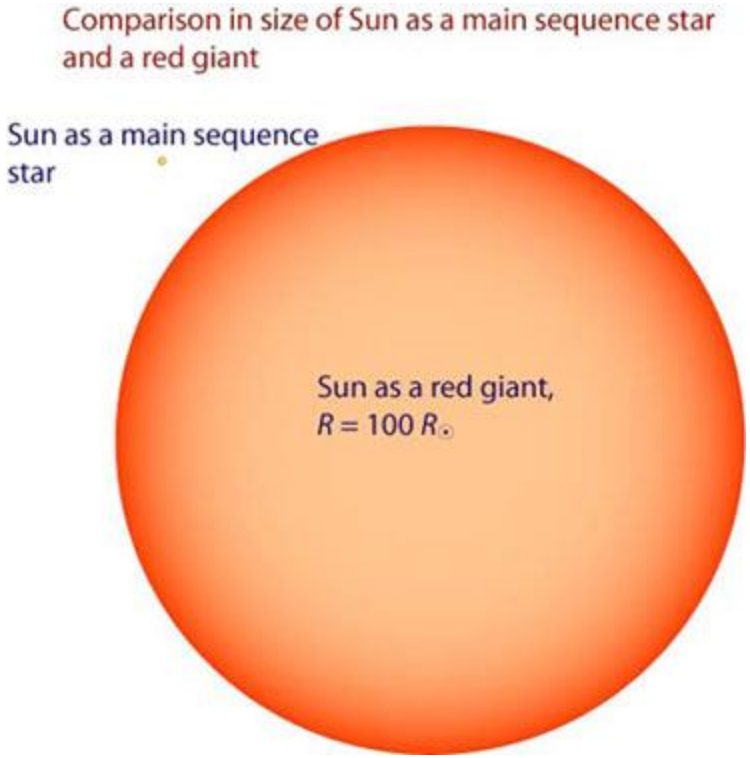
- Also called the main sequence star.
- Longest and most stable part of a star's life.
- *Stars with large masses use up their hydrogen fuel more quickly than stars with small masses, so they have much shorter life spans.*

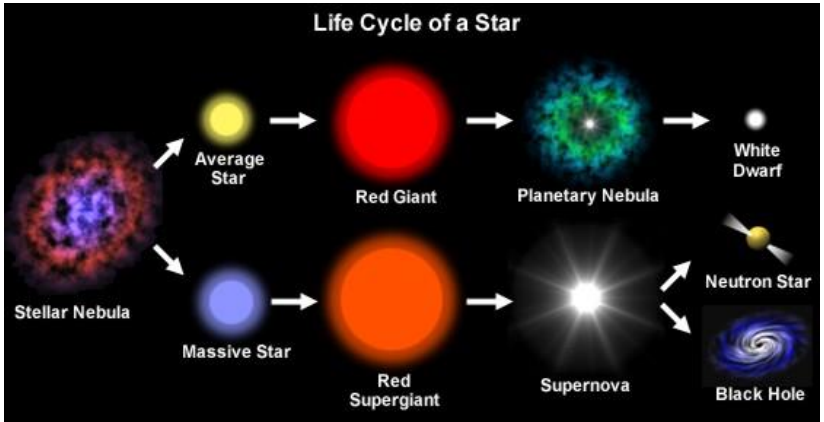




Red Giant

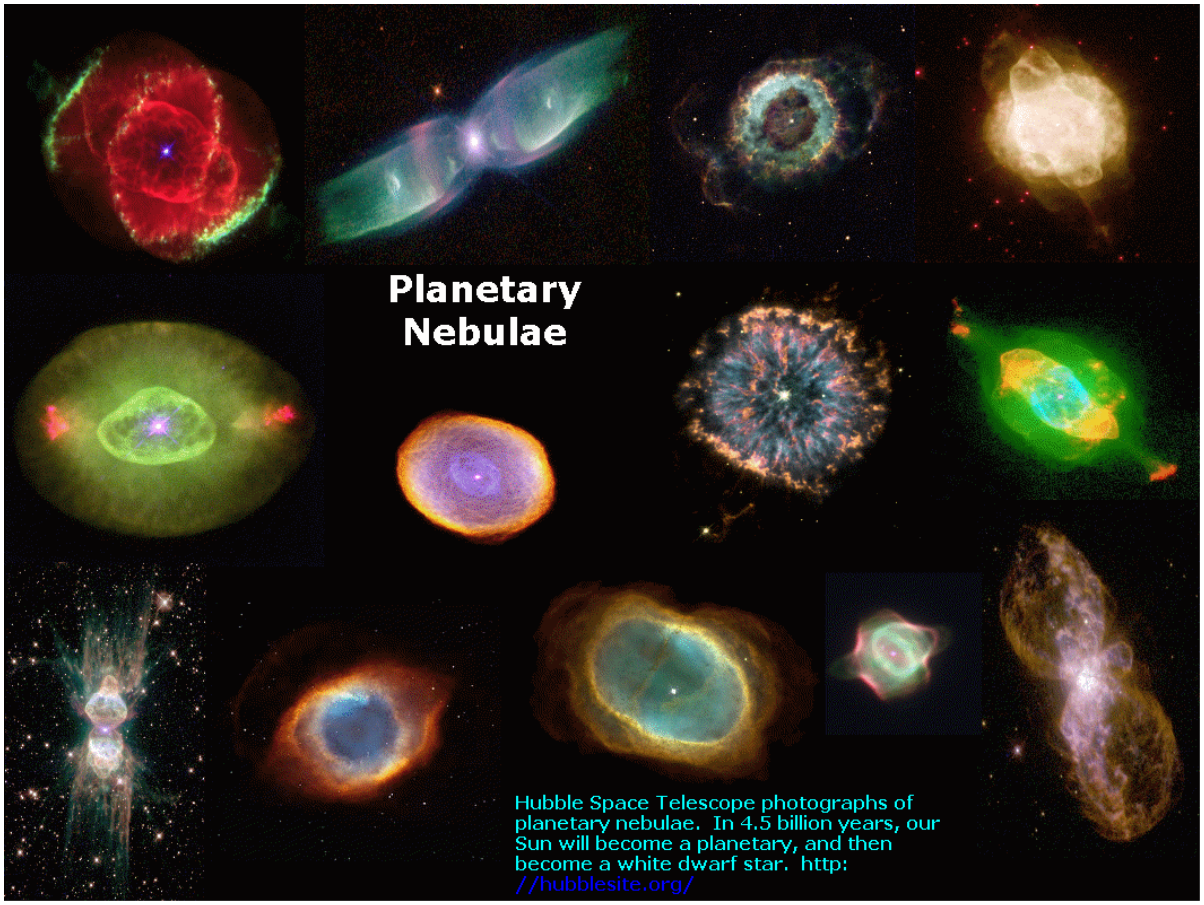
- Star runs out of hydrogen fuel.
- Gravity causes the core to contract, which forces the outer gases to expand outward.





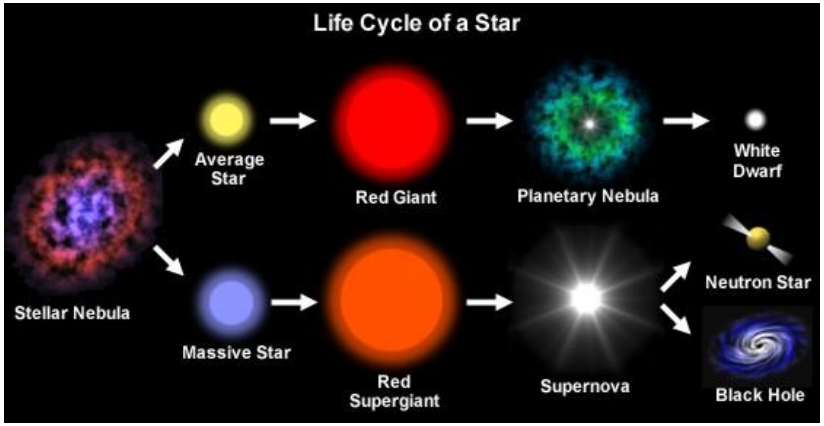
Planetary Nebula

- The outer layer of the star expands out called a **planetary nebula.**



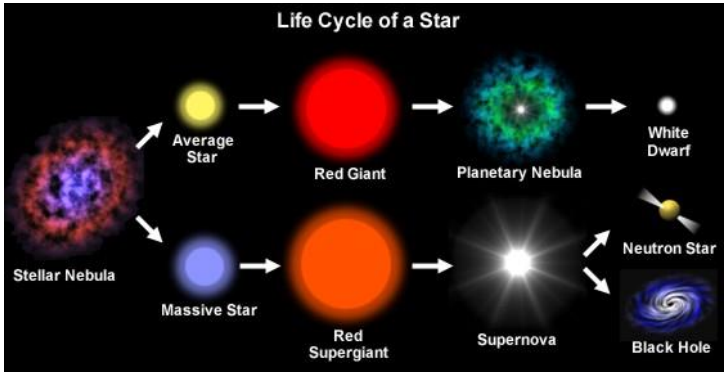
White Dwarf

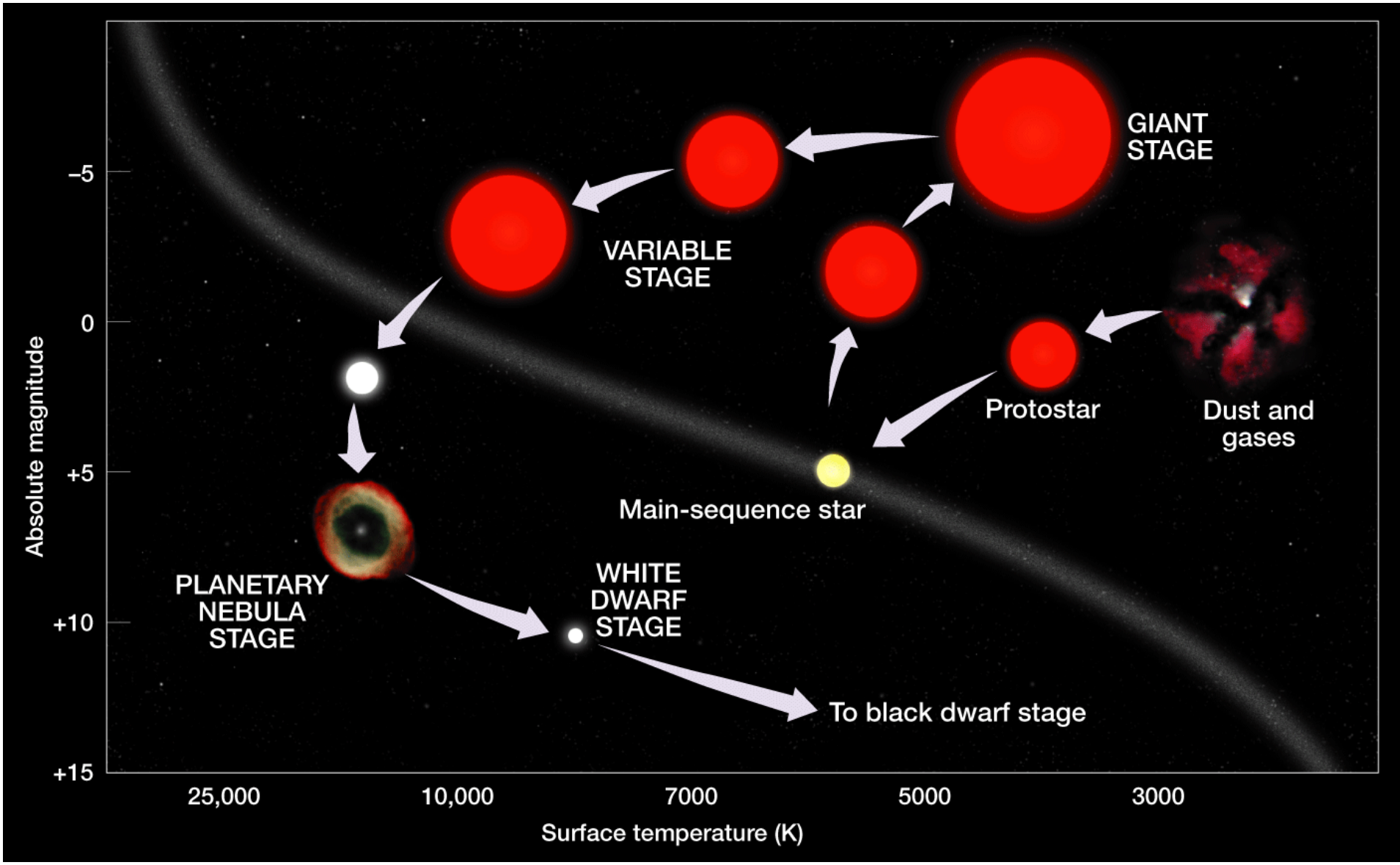
- Size of Earth
- Same mass as the Sun.



Black Dwarf

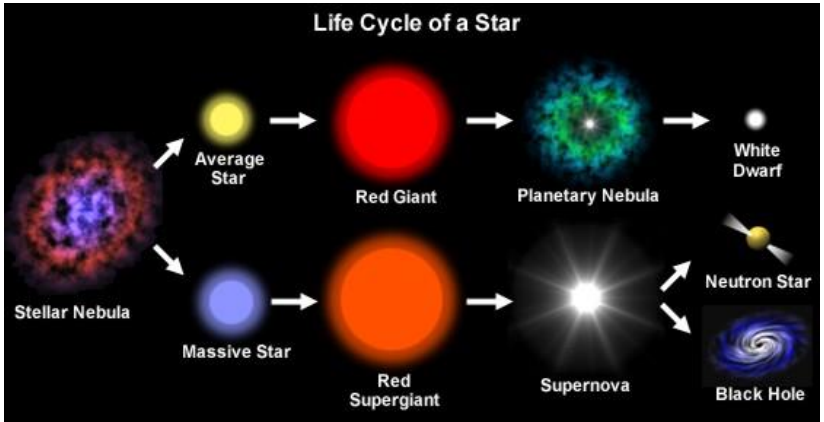
- When a white dwarf stops glowing.




GIANT STAGE
VARIABLE STAGE
Protostar
Dust and gases
Main-sequence star
PLANETARY NEBULA STAGE
WHITE DWARF STAGE
To black dwarf stage
Absolute magnitude
−5
0
+5
+10
+15
25,000
10,000
7000
5000
3000
Surface temperature (K)

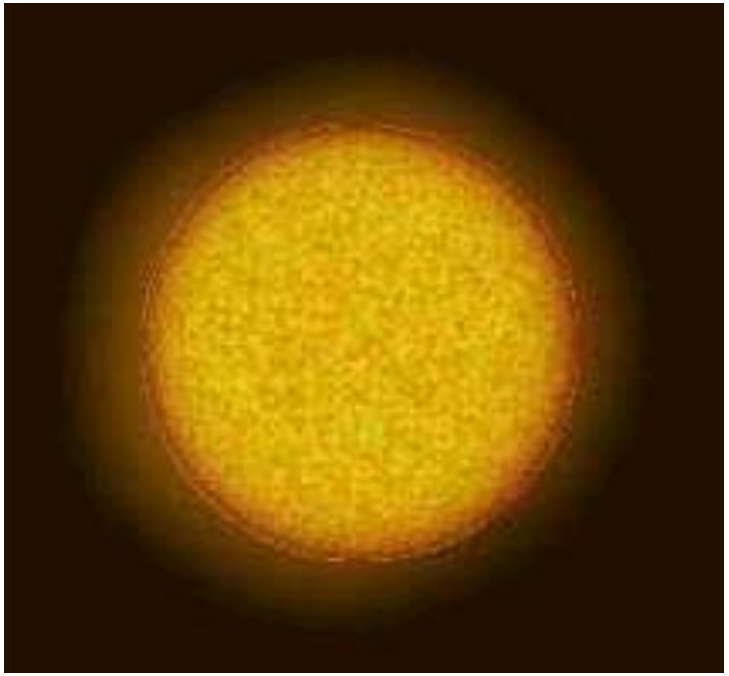
Life Cycle of a Giant Star

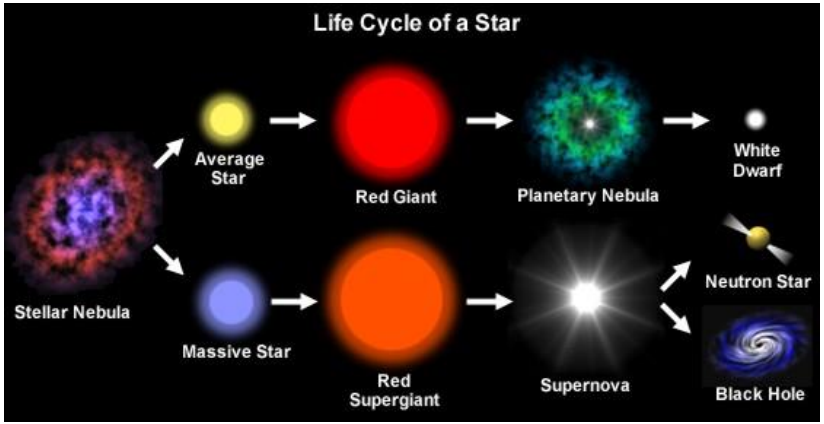
- Stars begin as a huge cloud of gas and dust called a **nebula**.
- **Protostar** is the earliest stage in the life cycle.
- A star is born when temperature and pressure become great enough to start nuclear fusion.



Massive Star

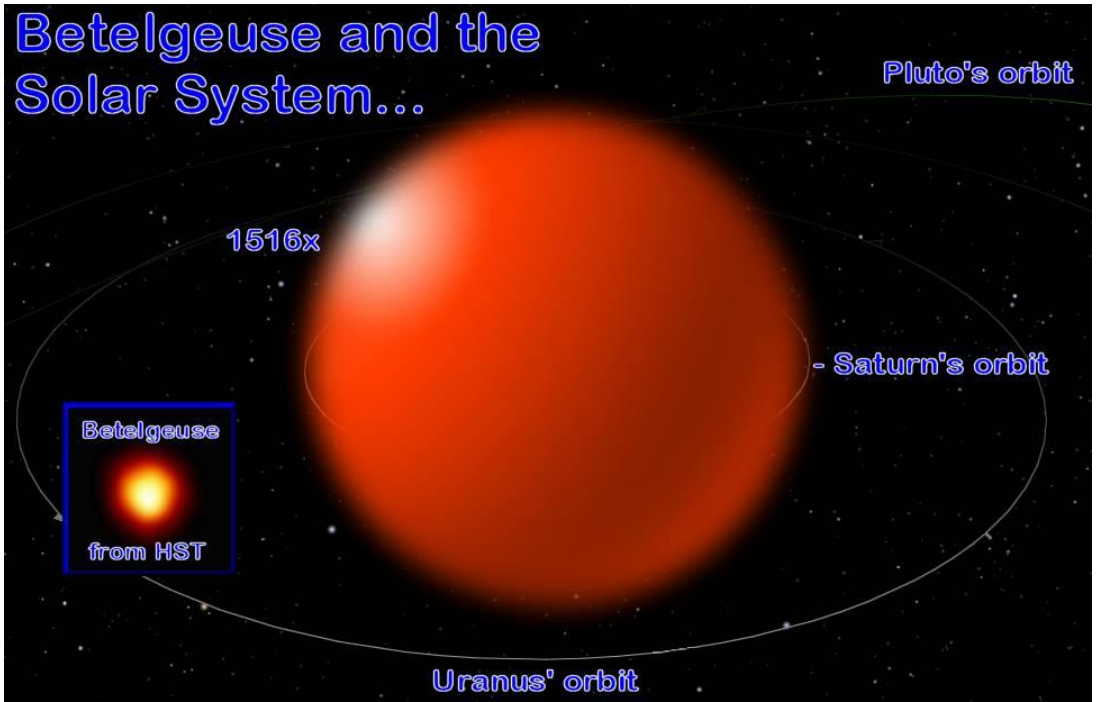
- Also called the main sequence star.
- Longest and most stable part of a star's life.
- *Over 5 times the mass of the sun.*
- *Stars with large masses use up their hydrogen fuel more quickly than stars with small masses, so they have much shorter life spans.*

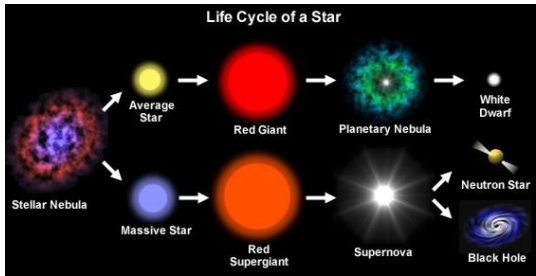




Red Supergiant

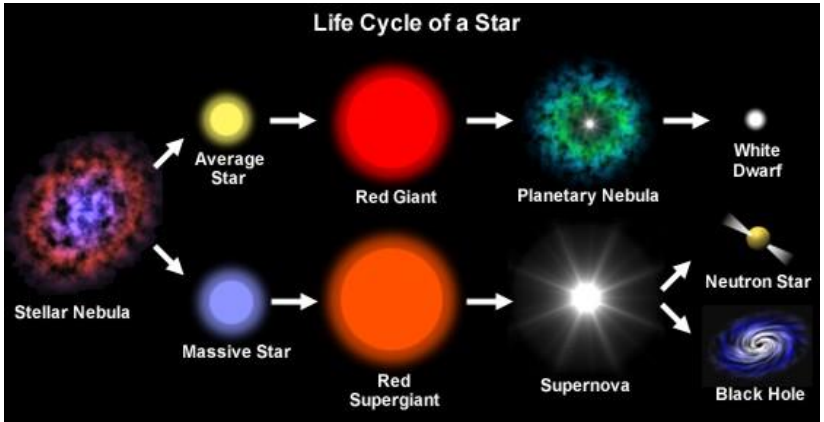
- Star runs out of hydrogen fuel.
- Gravity causes the core to contract, which forces the outer gases to expand outward.
- A Supergiant is bigger than a giant.





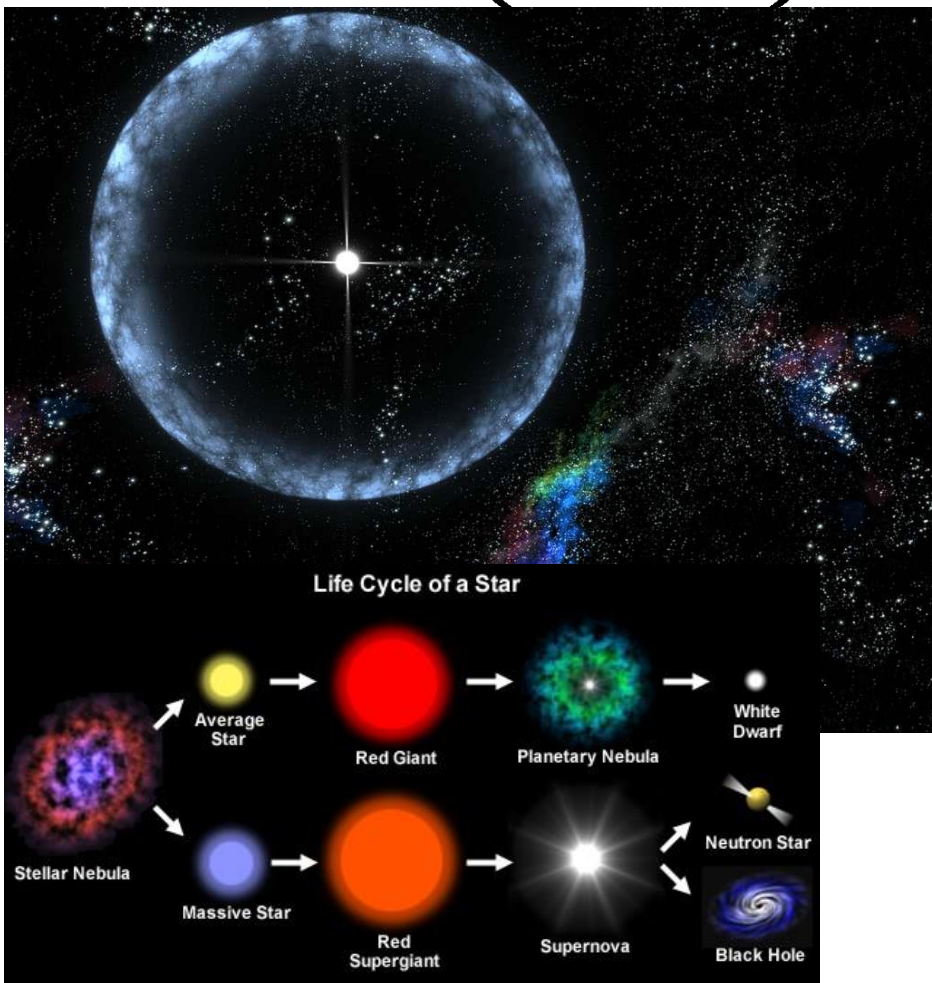
Supernovas

- Because giant stars have so much mass, that when the core contracts and heats up it explodes.



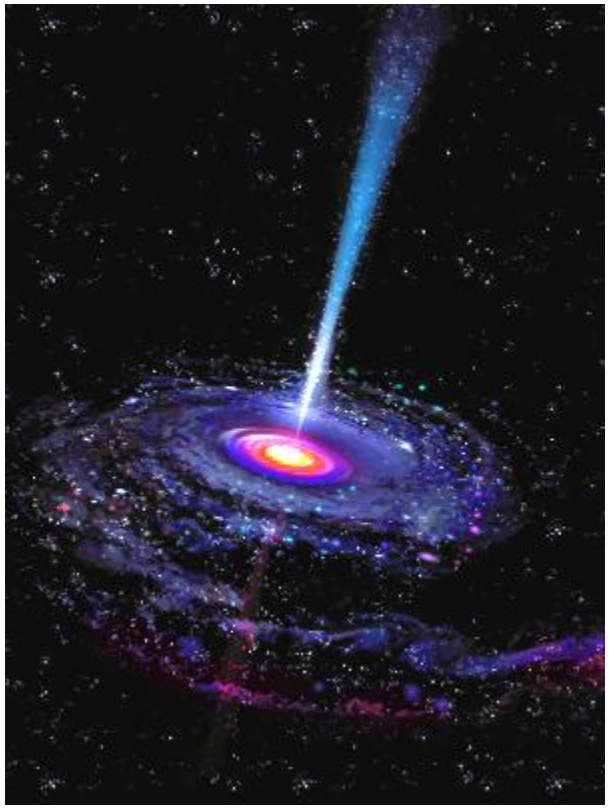
Neutron star

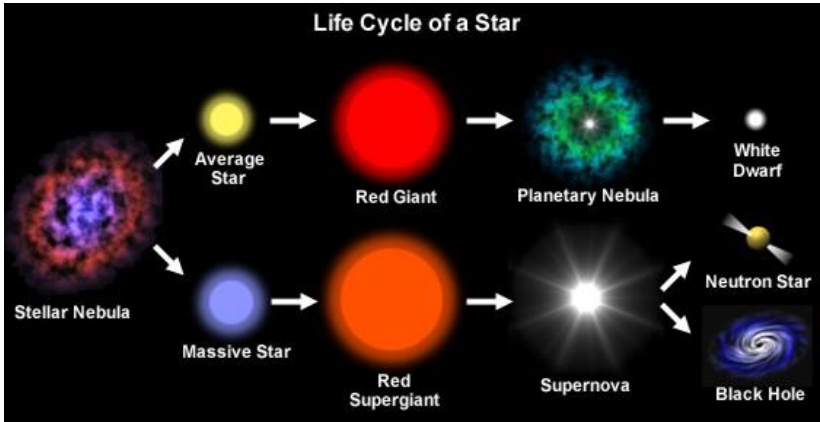
- After the supernova fades away, the remains of the star is called a neutron star.
  - It's only few kilometers in diameter.
  - Has more mass than our sun.
- If the star radiates short bursts of radio energy it is called a **pulsar**.

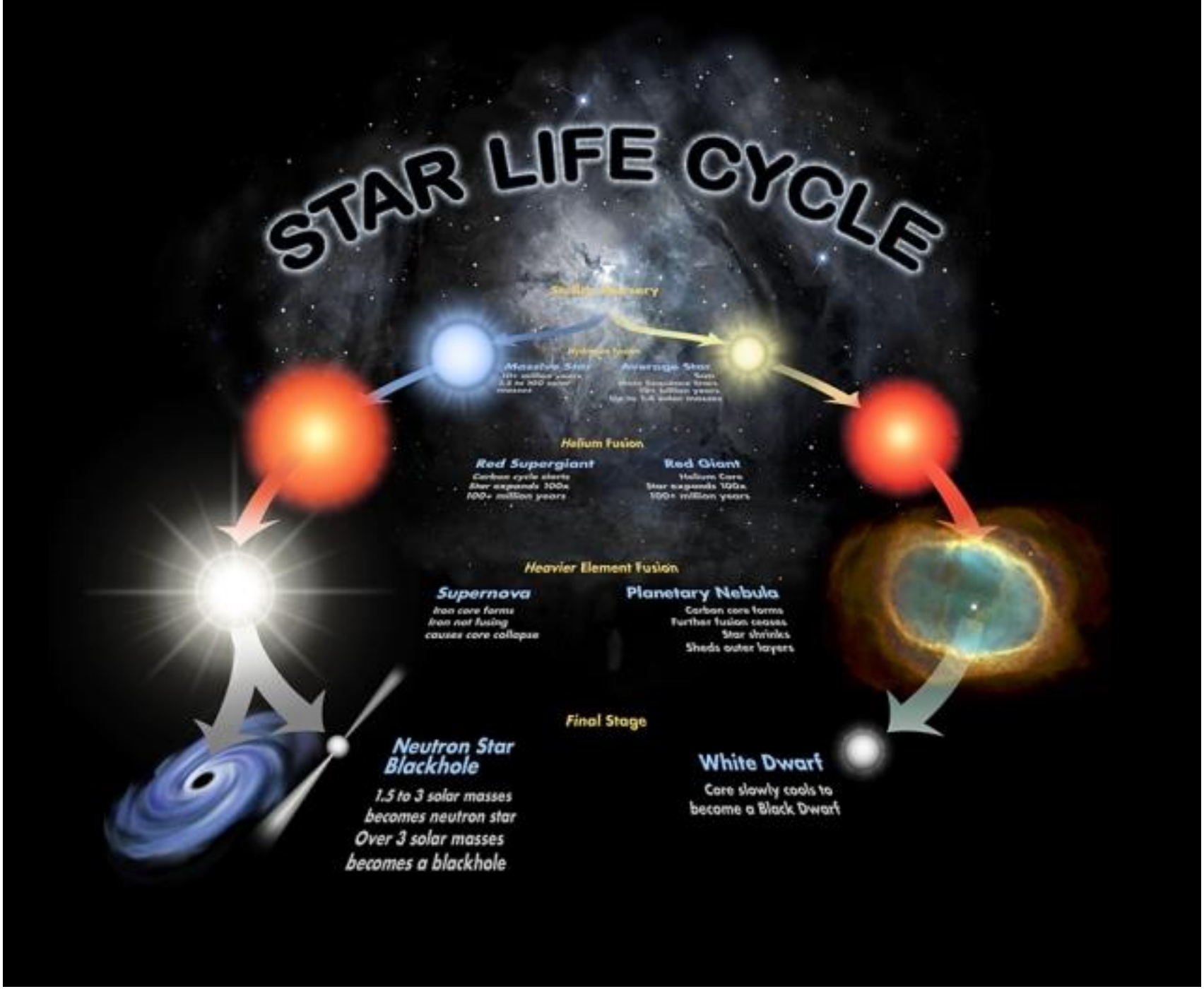


Black Hole

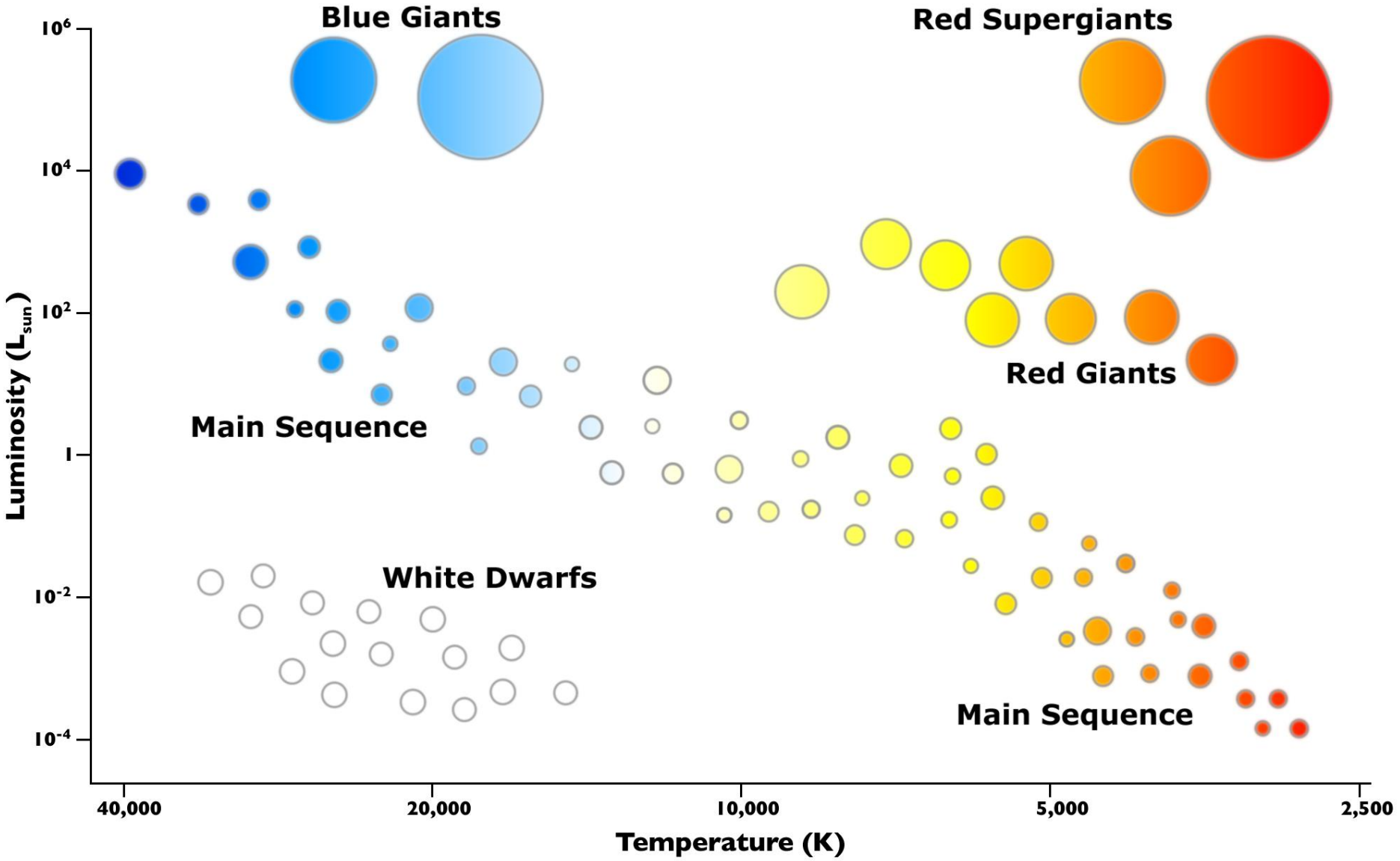
- A black hole is a massive star that has collapsed to such a small volume that its gravity prevents the escape of everything, including light.
- No light can escape from a black hole.
- Scientists think that as matter is pulled into a black hole, it should become very hot and emit a flood of X-rays before being pulled in.

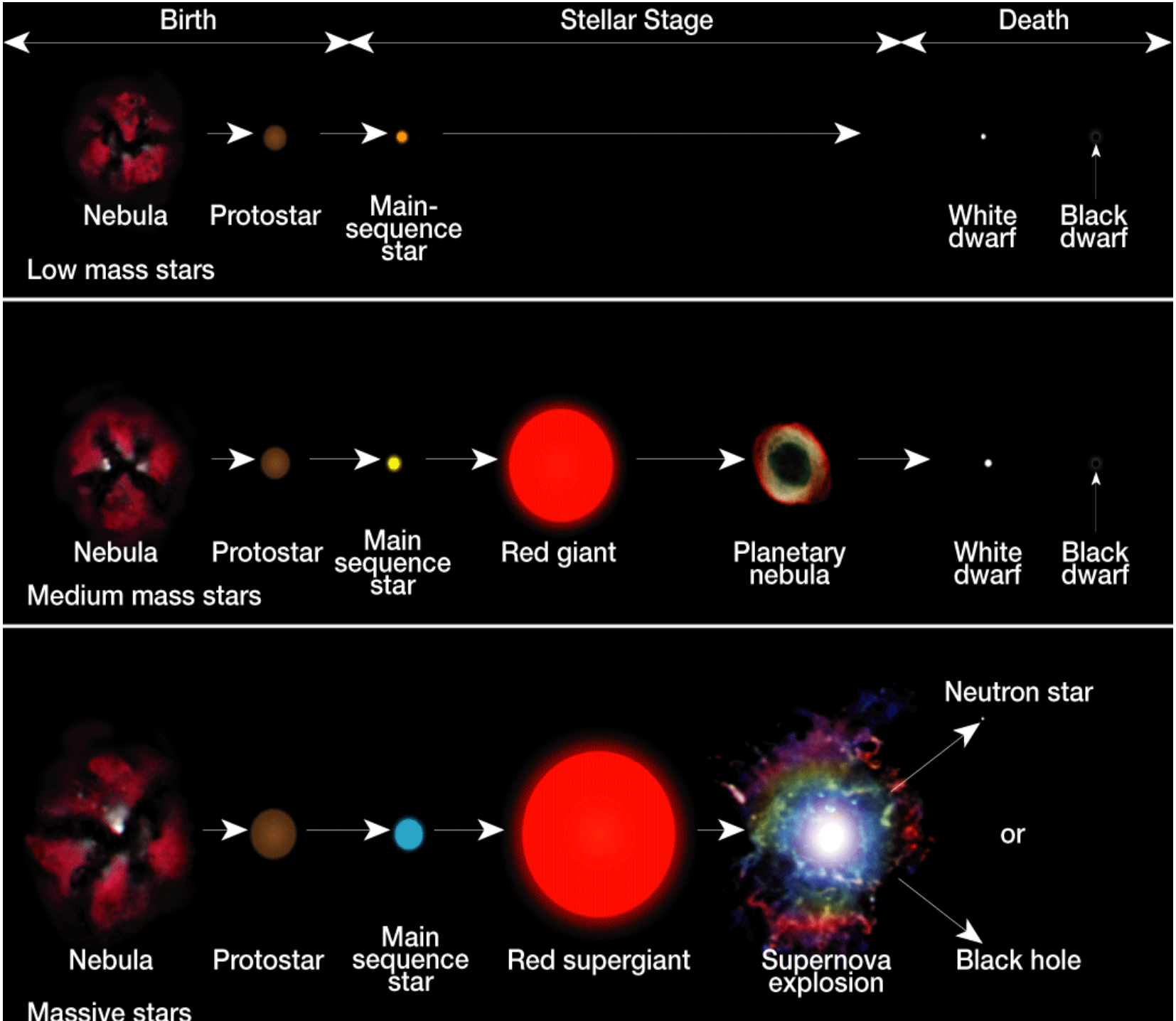


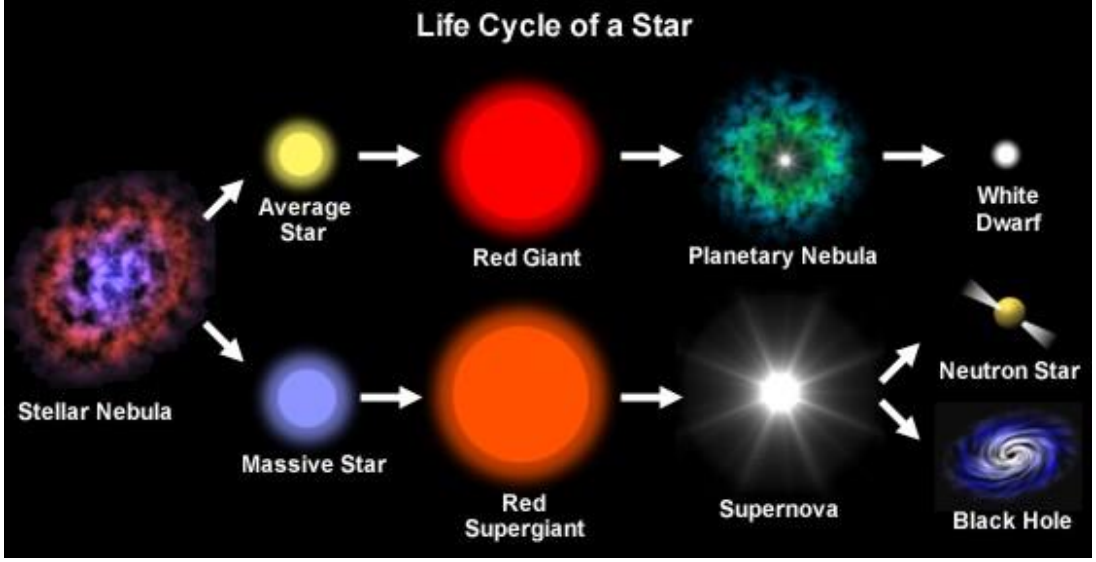



STAR LIFE CYCLE
Massive Star
Average Star
Helium Fusion
Red Supergiant
Carbon cycle starts
Star expands 100x
100+ million years
Red Giant
Helium Core
Star expands 100x
100+ million years
Heavier Element Fusion
Supernova
Iron core forms
Iron not fusing
causes core collapse
Planetary Nebula
Carbon core forms
Further fusion ceases
Star shrinks
Sheds outer layers
Final Stage
Neutron Star
Blackhole
1.5 to 3 solar masses
becomes neutron star
Over 3 solar masses
becomes a blackhole
White Dwarf
Core slowly cools to
become a Black Dwarf

H-R Diagram


Blue Giants
Red Supergiants
Red Giants
Main Sequence
White Dwarfs
Main Sequence
Luminosity (L_{sun})
10^6
10^4
10^2
1
10^{-2}
10^{-4}
40,000
20,000
10,000
5,000
2,500
Temperature (K)


Birth
Stellar Stage
Death
Nebula
Protostar
Main-sequence star
White dwarf
Black dwarf
Low mass stars
Nebula
Protostar
Main sequence star
Red giant
Planetary nebula
White dwarf
Black dwarf
Medium mass stars
Neutron star
or
Black hole
Nebula
Protostar
Main sequence star
Red supergiant
Supernova explosion
Massive stars



Life cycle of stars

Ch. 25.2:

- *Identify and define the stages of a star's life.*
- *Identify the conditions needed for fusion to occur.*
- *Relate the color of a star to its temperature.*