

Astronomy Notes

Death Process for Middle Main Sequence Stars

(9) Star will spend most of its time on the main sequence

For a star like our sun that is about 10 billion years

During this time there is hydrogen fusion occurring in the core at a stable rate

Energy output is constant- Temperature and luminosity do not change

The outward force of fusion is balanced by the inward force of gravity

(10) The star runs out of hydrogen in the core for hydrogen fusion

Hydrogen in the core is substantially depleted

Hydrogen fusion stops in the core of the star

Inward force of gravity is no longer balanced by the fusion force outward

(11) The star starts to collapse

As it collapses the temperature increases in the core and the area just outside the core

Temperatures reach 10 million Kelvin in the areas around the core

(12) Hydrogen fusion starts in the areas around the core

The core of the star continues to shrink

Density of the core increases

The temperature in the core increases

The radius of the star expands to about the size of Mercury's orbit (100 solar radii)

The luminosity of the star increases

Surface temperature decreases

(13) Star becomes a Red Giant

(14) The core reaches 100 million Kelvin

Helium fusion starts in the core

Helium is fused to produce Carbon

(15) A few hours after helium fusion starts and unbalanced forces in the core cause a sudden large burst of energy called the helium flash

The Helium flash causes the core to expand, density decrease, temperature decrease and stability is restored to the core

Helium fusion occurs at a much faster rate than hydrogen fusion occurred while the sun was on the main sequence.

(16) The star runs out of Helium in the core to fuse to carbon in about 50,000 years

The star starts to collapse

Temperature increases in the core and outer core

Temperatures reach 100 million Kelvin in the areas just outside the core

(17) Helium fusion starts in the areas around the core

The core shrinks, density and temperature increase

The radius of the star expands to about earth's orbit

Surface temperature decreases, luminosity increases

(18) Star becomes a Red SuperGiant

(19) Fusion stops in the areas around the core

The gases outside the core continue to expand, the core continues to shrink

The outer gasses separate from the core

The outer gasses become a ring around the core called a planetary nebula

(20) The core is very hot (100 million K)

There is no nuclear fusion in the core but the core does emit light because of its high temperature

The core is composed of extremely dense carbon atoms

The core is now a white dwarf star

(21) The core cools, no longer emits light and is classified as a black dwarf star

