

# Ch 30.3: Stellar Evolution Notes – Honors

Name Key 2022

**Low Mass – Long Life**

**0-8 Solar mass**

**High Mass - Short life**

**8-20+ solar mass**

1 NEBULA

Cloud of dust & gas collapses on itself due to its gravity  
Eg → E<sub>heat</sub>

2 PROTOSTAR

"Developing ⚡"  
Not hot enough for nuclear fusion, yet Temps rise

3 MAIN SEQUENCE

H fuses to He in core & a star is born!  
90% of life is spent here.  
Hydrostatic Equilibrium  
"Stable"

4 RED SUPER GIANT / RED GIANT



F<sub>gravity</sub> = Thermonuclear outward Press.

He core contracts → H → He in shell  
E from shell burning causes outer layers to expand & cool giving ↑ size & Red color

\* Red Supergiant goes thru more reaction phases

5b SUPERNOVA

5a PLANETARY NEBULA

5b Fe core collapses, rebounds, explodes  
Source of heavy elements

All fuel is gone & nothing can burn in core or shell.  
Burning ends w/ pulse that ejects outer layers into space

6b NEUTRON STAR

6b2 BLACK HOLE

6a WHITE DWARF

**8-20 solar mass**

**20+ solar mass**

6b1  
e<sup>-</sup> + p<sup>+</sup> = n<sup>0</sup>  
held up against gravity by neutron degeneracy  
Extremely small & dense  
"Cosmic Pebble"  
1 Tsp = 1 bill Tons

6b2  
gravity's victory over mass!  
core collapses forever, compacting matter into smaller & smaller volume. Nothing can escape, not even light.  
Found via X-Rays

Potential to be involved in Type IA Supernova w/ RE binary \*

"Retired ⚡"  
6a What is left after planetary nebula - stable as e<sup>-</sup> degeneracy holds up against gravity. Comp. depends on # rxn phases (mass) small, dense, cooling

7a BLACK DWARF

7a Hypothetical - \* cools to temp of CMB