









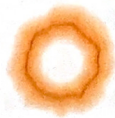
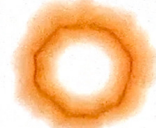





Summarizing the Life Cycles of Stars

Figure 4.38 summarizes the life cycle of stars, based on mass.

Figure 4.38 Life cycle pathways for stars based on their mass. (The drawings are not to scale.)

Star	Low-Mass (<5 solar masses)	Intermediate-Mass ($10\text{--}20$ solar masses)	High-Mass (>20 solar masses)
Birth and early life	 <p>Forms from a small- or medium-sized portion of a nebula; gradually turns into a hot, dense clump that begins producing energy.</p>	 <p>Forms from a large portion of a nebula, and in a fairly short time turns into a hot, dense clump that produces large amounts of energy.</p>	 <p>Forms from an extremely large portion of a nebula, very quickly turning into a hot, dense clump that produces very large amounts of energy.</p>
Main sequence phase	 <p>Uses nuclear fusion to produce energy for about 10 billion years if the mass is the same as the Sun's, or 100 billion years or more if the mass is less than the Sun's.</p>	 <p>Uses nuclear fusion to produce energy for only a few million years. It is thousands of times brighter than the Sun.</p>	 <p>Uses nuclear fusion to produce energy for only a few million years. It is extremely bright.</p>
Old age	 <p>Uses up fuels and swells to become a large, cool red giant.</p>	 <p>Uses up fuels and swells to become a red supergiant.</p>	 <p>Uses up fuels and swells to become a red supergiant.</p>
Death	 <p>Outer layers of gas drift away, and the core shrinks to become a small, hot, dense white dwarf star.</p>	 <p>Core collapses; outer layers explode as supernova.</p>	 <p>Core collapses; outer layers explode as huge supernova.</p>
Remains	 <p>White dwarf star eventually cools and fades.</p>	 <p>Core material packs together as a neutron star. Gases drift off as a nebula to be recycled.</p>	 <p>Core material packs together as a black hole. Gases drift off as a nebula to be recycled.</p>