The Life Cycle of a Star

By Cindy Grigg

[1] Stars are born in nebulae, vast clouds of dust and gas in space. Some of the gas in a nebula is hydrogen gas. Over millions of years, gravity causes the hydrogen gas to collect in a cloud. As more and more gas is pulled into the cloud, it begins to spin. As the cloud spins, atoms of hydrogen gas bump into one another. The faster the gas spins, the more the atoms bump together. The temperature of the spinning cloud rises.

[2] When the temperature reaches ten million degrees Celsius, a chemical change called nuclear fusion begins to take place. In this change, two atoms of hydrogen gas combine to form an atom of helium gas. The gas in the nebula begins to glow. This is the first step in the life cycle of a star. It is called a protostar. This chemical change gives off a large amount of energy in the form of heat. This causes the nebula to break up into a cluster of many baby stars. The new stars give off heat and light from the nuclear fusion of hydrogen atoms.

[3] After a star forms, it is in its main life period called the main sequence period. A main sequence star lives and shines fairly steadily for millions of years or more. Stars with greater mass have hotter temperatures and usually shorter lives. When the star's supply of hydrogen is used up, it begins to convert helium into oxygen and carbon. If the star is massive enough, it will continue until it converts carbon and oxygen into neon, sodium, magnesium, sulfur, and silicon. Eventually, these elements are transformed into calcium, iron, nickel, chromium, copper, and others until iron is formed.

[4] When the core becomes mostly iron, the star's nuclear reactions can no longer continue. It runs out of fuel and starts cooling down. This is because the temperature required to fuse iron is much too great. The inward pressure of gravity becomes stronger than the outward pressure of the nuclear reaction. The star collapses in on itself. This causes the temperature inside to rise. The intense heat causes the gases to explode. The star swells up into a glowing red giant that may be a hundred times larger than the original star. What happens next depends on the star's mass.

[5] From the red giant stage, a dwarf or medium-sized star (like our sun) slowly cools off. The core collapses, and the star shrinks. It becomes a faint, small star called a white dwarf. Eventually it will fade out completely and become a black dwarf.

[6] From the red giant stage, a giant or supergiant star will blow up in a huge explosion called a supernova. A supernova may leave behind a tiny, dense, fast-spinning star called a neutron star. Such a star may give out radio waves in pulses as it rotates. These bursts of radiation are called pulsars.

[7] A neutron star that was very large can shrink into a body so dense that the star disappears inside itself. This is known as a black hole. The gravitational pull is so strong that everything nearby is pulled inside. Even light cannot escape.

Name _____ Science Pd _____

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1. In the first step in the life cycle of a star, it is called a:
   - (A) Protostar
   - (B) Main sequence period
   - (C) White dwarf
   - (D) Red giant

2. A star spends most of its life in this stage:
   - (A) White dwarf
   - (B) Red giant
   - (C) Protostar
   - (D) Main sequence period

3. When a star runs out of fuel, it collapses on itself and becomes a:
   - (A) Red giant
   - (B) Protostar
   - (C) White dwarf
   - (D) Main sequence period

4. After the red giant stage, a smaller star will become a:
   - (A) Red giant
   - (B) Main sequence period
   - (C) Protostar
   - (D) White dwarf

5. At the end of its life cycle, a very large star may become a:
   - (A) Planet or asteroid
   - (B) Neutron star, pulsar, or a black hole
   - (C) White or black dwarf
   - (D) Giant or supergiant

6. What process causes stars to give off heat and light?
   - (A) A chemical reaction called fusion
   - (B) A physical reaction
   - (C) Gravity
   - (D) Fire

7. At what temperature does nuclear fusion begin?
   - (A) 10,000,000 degrees Celsius
   - (B) 10,000 degrees Celsius
   - (C) 1,000 degrees Celsius
   - (D) 10,000,000,000 degrees Celsius

8. Our sun is a medium-sized star. What will its final stage be?
   - (A) Giant or supergiant
   - (B) Neutron star
   - (C) Black hole
   - (D) White or black dwarf