Name: Class: Date:

LIFE CYCLES OF STARS

Although stars last for very long periods of time, they do not last forever. Like living organisms, stars go through cycles of birth, maturity and eventually, death.

The life cycle of a star varies, depending on the mass of the star when it is first made. **Higher-mass stars** develop more quickly than **lower-mass stars**. Towards the end of their life cycles, higher-mass stars also behave differently than lower-mass stars.

"Birth"

Stars form inside a **nebula**, which is a large cloud of dust and gas spread out in an immense volume. Gravity can pull the gas and dust together in some regions of the nebula. As the matter contracts, it forms a hot and dense sphere. A star is born when the contracting gas and dust become so dense that nuclear fusion starts.

"Maturity"

The stage in which stars produce energy through the fusion of hydrogen into helium is called the main sequence. How long a star stays in the main sequence depends on its initial mass. **Lower-mass stars** use their fuels more slowly than higher-mass stars, and stay in the main-sequence stage for **billions** of years. The Sun has been a main-sequence star for 4.6 billion years, and will remain for about another 5 billion years. **Higher-mass stars** spend much less time in the main sequence stage because they use their hydrogen fuel rapidly. Higher-mass stars stay in the main sequence for only a few **million** years.

"Death"

When a star finally runs out of hydrogen fuel, it can become a white dwarf, a neutron star, or a black hole.

When **lower-mass star**s use up their fuel, their outer layers expand greatly. At this stage, they are called **red giants**. Eventually, the loose outer layers drift into space, forming a cloud of gas called a planetary nebula. New stars and planets can form in this nebula. The blue-white hot core of the star that is left behind cools and becomes a **white dwarf**.

As **higher-mass stars** use up their fuel, they expand tremendously to become **supergiant** stars. In the core of a supergiant, fusion begins to produce heavier and heavier elements other than helium. When an iron core forms, gravity causes the core to collapse. This causes the star to erupt in a tremendous explosion called a **supernova**. The outer layers of the star shoot into space. Eventually, this matter may become part of new stars or planets.

After a supergiant star explodes, the collapsed core may form an extremely dense body called a **neutron star**. Neutron stars are small, but extremely dense. Thy can measure only 20 kilometres in diameter, but can have a mass one to three times greater than the Sun.

Sometimes a supernova leaves behind a core with a mass more than three times that of the Sun. In this case, the core does not end up as a neutron star. Instead, it collapses even further, forming an invisible object called a **black hole**. The gravity of a black hole is so strong that nothing can escape it, not even light.

REVIEW QUESTIONS - LIFE CYCLES OF STARS

1. What do astronomers call a large cloud of gas and dust over an immense volume?

2. Describe how a star is born inside a nebula.

3. Circle the letter of the factor that ultimately determines how long a star lives.

   a. its brightness c. its volume

   b. its mass d. its temperature

4. True or false? Stars with greater mass last longer than stars with less mass. _____

Match each stage of a star with its definition.

_____ 5. white dwarf	a. The small, dense remains of a higher-mass star
_____ 6. planetary nebula	b. Explosion of a higher-mass star once an iron core forms and collapses on itself.
_____ 7. supernova	c. An object whose gravity is strong that not even light can escape it.
_____ 8. neutron star	d. A glowing cloud of gas formed from the expanding outer layers of a red giant.
_____ 9. black hole	e. The cooled core of a lower-mass star that has run out of fuel.

10. Describe the relationship between mass and the three types of end stages of stars.

11. What stage of its life cycle is the Sun in? What will it likely form when it runs out of fuel?