Name: _____ Date: _____ Period: _____

Stellar Evolution Lab- The Life-cycle of a Star

INSTRUCTIONS: 1) Read about the life-cycles of average-sized and massive stars below.
2) Cut out the photos of the different objects and assemble them into a diagram of the life-cycle of the star.
3) Include temperature and brightness from the chart in your diagram
4) Answer the questions at the end

Average Stars- The Life of a Star of about one Solar Mass.

Stage 1- Stars are born in clouds of gas and dust called ***Nebulas***.

Stage 2- The gas and dust spiral together and contract under their own gravity. The gas and dust will begin to heat up and start to glow forming ***Protostars***.

Stage 3- If a protostar contains enough matter, the central temperature will reach 15 million degrees Celsius and nuclear reactions in which hydrogen fuses to form helium can start. This is the birth of the star! The star begins to release energy, stopping it from contracting even more and causing it to shine. It is now a ***Main Sequence Star***. A star of one solar mass remains in main sequence for about 10 billion years. until all of the hydrogen has fused to form helium.

Stage 4- Eventually the hydrogen begins to run out and the helium core starts to contract further and reactions begin to occur in a shell around the core. The core is now hot enough for the helium to fuse and form carbon. The outer layers begin to expand, cool and shine less brightly. The expanding star is now called a ***Red Giant***.

Stage 5- The helium core runs out, and the outer layers drift away from the core. This gas that surrounds the core is called a ***Planetary Nebula***.

Stage 6- The remaining core (80% of the original star) is known as a ***White Dwarf***

Stage 7- When it stops shining, the now dead star is called a ***Black Dwarf***.

Massive Stars - The Life of a Star of about 10 Solar Masses

The first 3 stages of the lives of massive stars are the same as those of average-sized stars

Stage 4- The hydrogen begins to run out and the helium core contracts and reactions begin to occur. The helium fuses and forms carbon and expands again. The star expands and contracts several times forming heavier elements like Magnesium and Oxygen. This massive star is called a ***Red Supergiant***.

Stage 5- The core collapses in less than a second, causing an explosion called a ***Supernova***, in which a shock wave blows off the outer layers of the star. (The actual supernova shines brighter than the entire galaxy for a short time).

Stage 6- Sometimes the core survives the explosion. If the surviving core is between 1.5 - 3 solar masses it contracts to become a a tiny, very dense ***Neutron Star***. If the core is much greater than 3 solar masses, the core contracts to become a ***Black Hole***.

Star type	Temperature (°C)	Brightness (compared to the sun)
Dwarf (Black)	**2,500**	**0.0001 x**
Dwarf (White)	**8,000 - 15,000**	**0.01 - 0.5 x**
Giant (Red)	**3,000 - 6,000**	**100 - 4,000 x**
Main Sequence	**5,000 - 15,000**	**1 - 1,000 x**
Supergiant (red)	**4,000**	**100,000 - 1,000,000 x**

Questions

Use the information in this lab to answer the questions below

1) Do all protostars become stars? Why or why not? _____

_____

_____

2) Which type of star is the brightest? _____

3) How is a massive star's stage 4 different than an average star's stage 4? _____

_____

_____

_____

4) Why do some massive stars become neutron stars and others black holes? _____

_____

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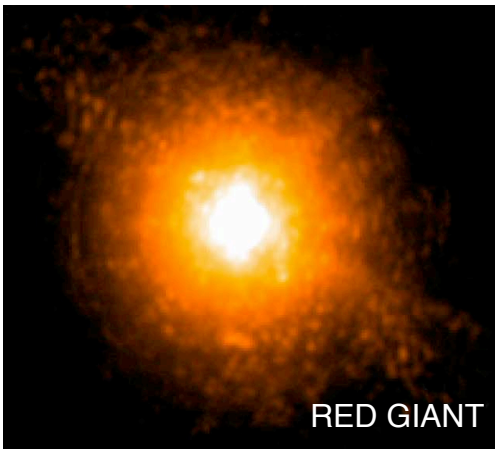
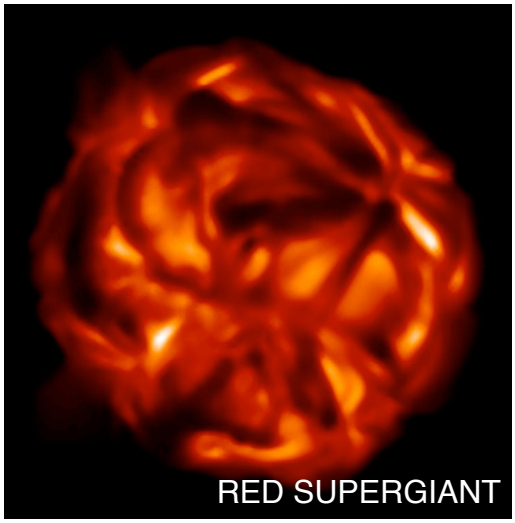
_____

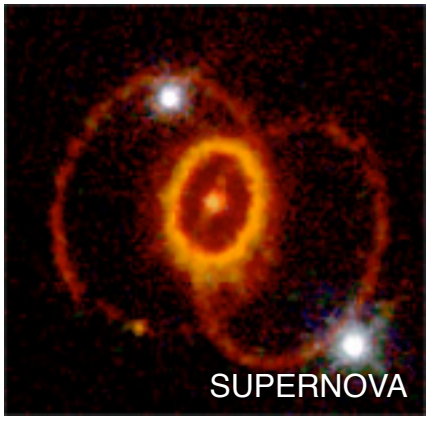

RED GIANT


RED SUPERGIANT

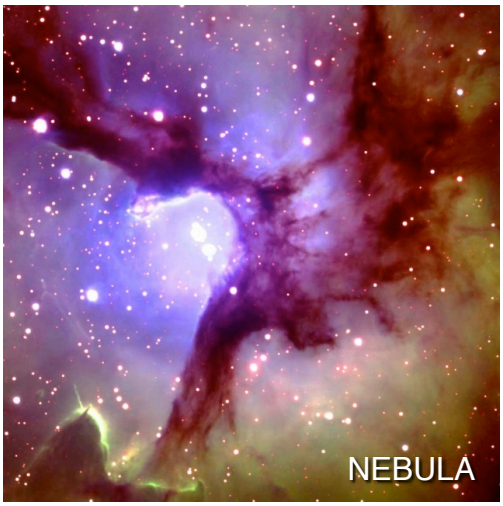

PLANETARY NEBULA


WHITE DWARF


PROTOSTAR


SUPERNOVA


BLACK DWARF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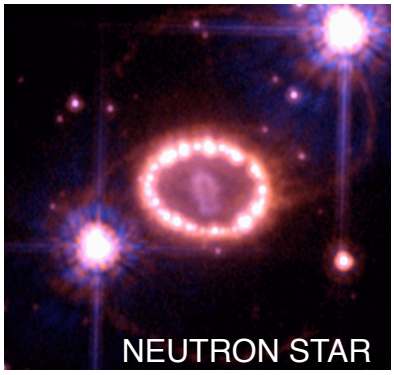
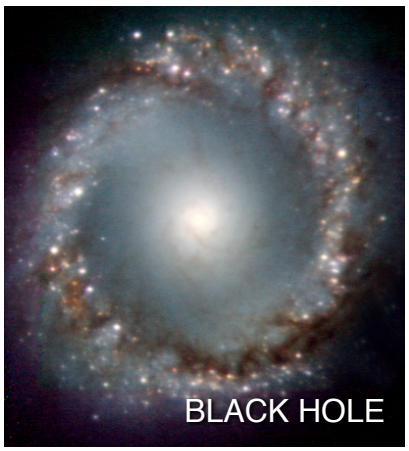
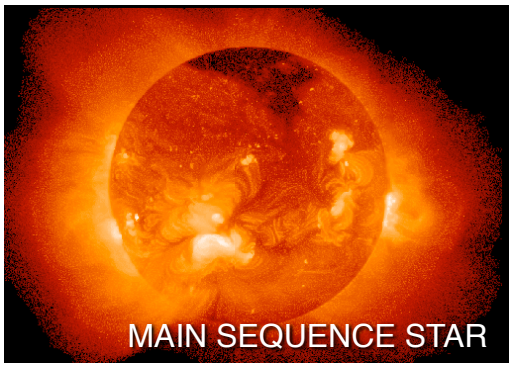

NEUTRON STAR


BLACK HOLE


MAIN SEQUENCE STAR