Student worksheet answers

6.3 Stars have a life cycle

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Stellar evolution

1 Use the wordlist below to correctly identify each of the stages (A to F) in a star's life cycle if it initially has a mass greater than eight solar masses and a core mass greater than three solar masses. Write your answers in the table provided.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Supernova | Red super giant | Gas and dust | Main sequence | Neutron star |
| White dwarf | Protostar | Planetary nebula | Black hole | Super giant |



|  |  |
| --- | --- |
| A Gas and dust | D Red super giant |
| B Protostar | E Supernova |
| C Main sequence | F Black hole |

2 How is a neutron star formed?

Neutron stars are formed when the core from a supernova (exploding star) collapses and the force of gravity causes the remaining protons and electrons to fuse together to form neutrons.

3 Describe the process that is occurring now in our Sun to produce its energy and maintain its stability.

The energy released by the Sun comes from the fusion of hydrogen atoms into helium atoms. This energy forces the gas particles outwards, but the force of gravity pulls them back in. When these two forces are balanced, the star is relatively stable, like our Sun is currently, and it is said to be in hydrostatic equilibrium.

4 Explain what will happen inside, and what will happen to, the Sun when it reaches the end of the main sequence part of its life cycle.

When our Sun runs out of hydrogen for nuclear fusion, it will fuse its helium into heavier elements. This process releases more energy than the nuclear fusion of hydrogen atoms, so there will be a greater outward pressure on the gas particles than the gravitational force pulling them back in. Hence, the Sun will expand and become a red giant star.

Extend your understanding

Astronomers have determined that the centre of our Milky Way galaxy is located in the constellation of Sagittarius, and have also hypothesised that there is a super massive black hole located there – dubbed Sagittarius A\*.

5 What evidence have astronomers been able to gather in support of the hypothesis that Sagittarius A\* is a super massive black hole? Use the internet to research the answer.

The evidence that astronomers have been able to gather in support of the hypothesis that Sagittarius A\* is a super massive black hole is: applying Kepler’s laws and Newton’s law of gravity on the stars orbiting Sagittarius A\* give it a mass of 4.31 million times the mass of our Sun, which is much bigger than any known star. There is no light being emitted from the region of space that these stars are orbiting around.