AQA GCSE Space Physics

Life Cycle of Stars Notes and Questions

A star goes through a life cycle. The life cycle depends on the mass of the star. Stars about the same size as the Sun have a different ending from stars that are much more massive than the Sun.

All stars begin in the same way. They start as a cloud of gas and dust called a nebula. Gravity pulls the gas and dust together.

As the gas and dust are pulled together, the material becomes hotter and denser. This forms a protostar. A protostar is an early stage of a star before fusion has fully started.

When the temperature becomes high enough, hydrogen nuclei begin to fuse together. This releases a large amount of energy. The star has now become a main sequence star.

A main sequence star is stable. Gravity pulls the star inwards, while energy from fusion pushes outwards. These two forces balance each other.

Our Sun is currently a main sequence star. It is fusing hydrogen into helium and releasing energy. It will stay in this stage for billions of years.

When a star about the same size as the Sun runs out of hydrogen fuel, it expands and becomes a red giant. The outer layers of the star swell outwards.

After the red giant stage, the star loses its outer layers. The hot core left behind becomes a white dwarf. A white dwarf is small, hot and dense.

Over a very long time, the white dwarf cools down. It eventually becomes a black dwarf. A black dwarf would be a cold, dark star remnant.

Stars much more massive than the Sun have a different life cycle. After the main sequence stage, they expand into red super giants. These are much larger than red giants.

A red super giant can then explode in a supernova. A supernova is a huge explosion at the end of a massive star's life.

After a supernova, the core left behind may become a neutron star. This happens if the core is very dense but not massive enough to form a black hole.

If the core left behind is extremely massive, it can collapse into a black hole. A black hole has such strong gravity that not even light can escape.

Fusion reactions inside stars make new elements. In the main sequence stage, hydrogen fuses to form helium. In later stages, heavier elements can be made.

Fusion in stars produces many of the naturally occurring elements. However, elements heavier than iron are produced in a supernova.

A supernova also spreads these elements out into space. This means the material from exploded stars can become part of new stars, planets and living things.

This is why stars are important. They do not just give out light and heat. They also help form the elements that make up the universe.

Questions

1. What is the name of the cloud of gas and dust where all stars begin?
2. What force pulls the gas and dust in a nebula together to start forming a star?
3. As gravity pulls the gas and dust together, what happens to the temperature and density of the material?
4. What is a protostar?
5. What must start happening inside a protostar for it to become a main sequence star?
6. During the main sequence stage, what element is fused to form helium?
7. Explain why a main sequence star stays stable for millions or billions of years.

8. A star about the same size as the Sun leaves the main sequence. Describe the stages it goes through after this.
9. A star much more massive than the Sun leaves the main sequence. Describe the stages it goes through after this.
10. Explain how fusion and supernovae help to make and spread new elements across the universe.