



# The Life Cycle of the Stars

Workbook  
Pages 136-137

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**Q1** A star in its **stable phase** neither expands nor contracts, despite strong forces acting on it. Explain what these forces are, and how the star remains stable.

The fusion reaction within the star produces outward pressure making the star expand.

The pull of gravity between the particles of mass in the star produces an inward force making the star contract.

In the stable phase the magnitude (size) of these two forces is equal. This means that the star is in equilibrium.

**Q2** Explain the difference between a **first generation** solar system and a **second generation** solar system.

When a first generation star and its planetary system comes to the end of its life cycle it explodes in a supernova and flings dust particles out into space. Gravity pulls the particles together and a new star system is formed from the debris. This is the secondary system. A second generation system contains more heavier elements than a first generation one.

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**Q3** The Sun is a main sequence star, but in about 5 billion years time it will become a red giant.

a) What causes a main sequence star to become a red giant?

It becomes a red giant when the hydrogen in the core begins to run out. The helium formed in the fusion of hydrogen then starts to fuse to produce heavier elements

b) Why is a red giant red?

The surface temperature is lower - therefore it looks red

c) What happens to small stars like our Sun after they become red giants?

A small star expands to become a red giant and then when it runs out of particles that it can fuse together (light elements) fusion stops and it collapses to form a dense small star. As it collapses it heats up and turns from red to yellow and then white. It is called a white dwarf. It then fades as it cools and finally 'goes out' and becomes a black dwarf.

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**Q4** Some red giants start to undergo more fusion reactions, glow very brightly and then explode.

Give the name of this explosion, and describe what happens after it.

The explosion is called a **supernova**, the outer layers are thrown out into the universe as dust. This dust will then later amalgamate under gravity to form new stars.

The dense core of the exploding star remains as a neutron star. If the star is big enough this can become a black hole.

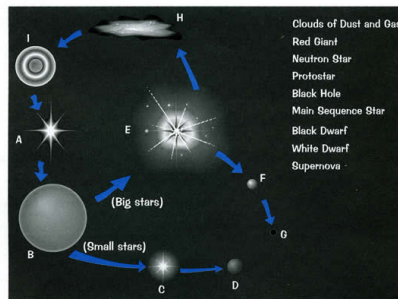


Hint— these bodies have all undergone periods of intense **contraction**.

**Q5** Neutron stars, white dwarfs and black dwarfs are made of matter that is very different from the matter of which planet Earth is made. What is the cause of this difference?

The matter in these stars is not composed of atoms with electrons orbiting them. It is composed of only neutrons compressed together and very dense - like the density of an atomic nucleus. This was formed because of the force of gravity pulling the matter together so strongly - squashing the matter in the centre of the star.

**Q6** Below is a diagram showing the life cycles of stars.



Match the letters to the words on the right of the diagram.

- |   |                           |   |                              |
|---|---------------------------|---|------------------------------|
| A | <u>Main sequence star</u> | B | <u>Red Giant</u>             |
| C | <u>White dwarf</u>        | D | <u>Black dwarf</u>           |
| E | <u>Supernova</u>          | F | <u>Neutron star</u>          |
| G | <u>Black hole</u>         | H | <u>Cloud of dust and gas</u> |
| I | <u>Protostar</u>          |   |                              |