

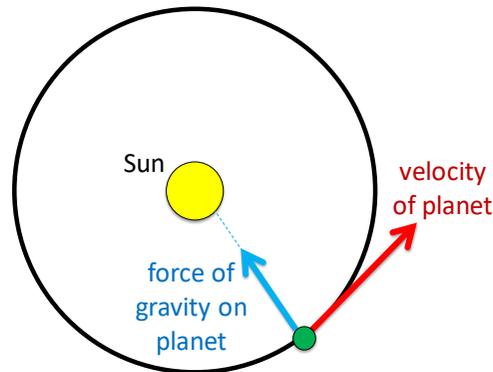
Space – PHYSICS ONLY

Formation of the Solar System

1. The Solar System formed from gas and dust clouds that gradually became more and more concentrated because of **gravitational attraction**.
2. A **protostar** is a concentration of gas and dust that becomes hot enough to cause **nuclear fusion**.
3. Energy is released inside a star because of hydrogen nuclei fusing together to form helium nuclei.
4. The Sun is stable because gravitational forces acting inwards balance the forces of nuclear fusion energy in the core acting outwards.

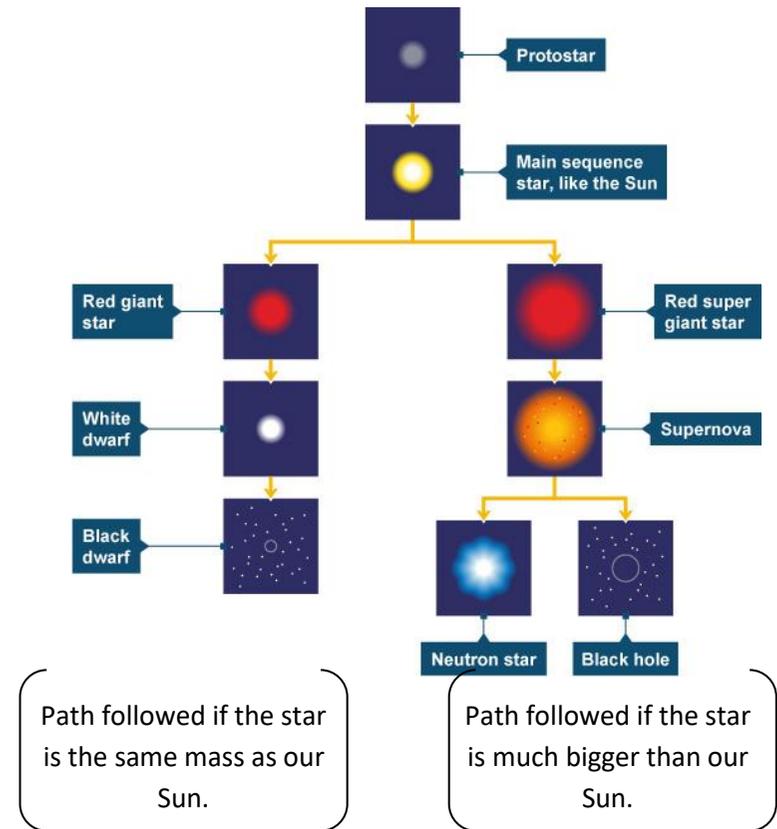
Planets, satellites and orbits

10. The force of gravity on a planet from the Sun acts towards the centre of the Sun, this is an example of **centripetal force**.
11. The force of gravity between a planet and the Sun, or a satellite and the Earth, keeps the planet/satellite moving along its **orbit**.
12. The force of gravity on an orbiting body in a circular orbit is towards the centre of the circle.
[see picture]
13. As a body in a circular orbit moves around the orbit:
 - a. The magnitude of its velocity does not change.
 - b. The direction of its velocity continually changes and is always at right angles to the direction of the force.
 - c. Due to this it experiences an acceleration towards the centre of the circle.
14. To stay in orbit at a particular distance, a small body must move at a particular speed around a large body.



The life history of a star

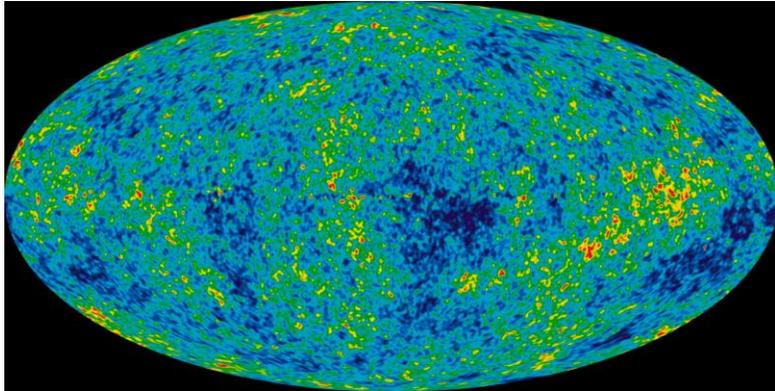
5. Stars become unstable when they have no more hydrogen nuclei that they can fuse together.
6. Stars with about the same mass as the Sun: protostar → main-sequence star → red giant → white dwarf → black dwarf.
7. The Sun will eventually become a black dwarf.
8. Stars much more massive than the Sun: protostar → main-sequence star → red supergiant → supernova → neutron star (or black hole if enough mass).
9. A supernova is the explosion of a red supergiant after it collapses.



Space – PHYSICS ONLY

The beginning of the universe

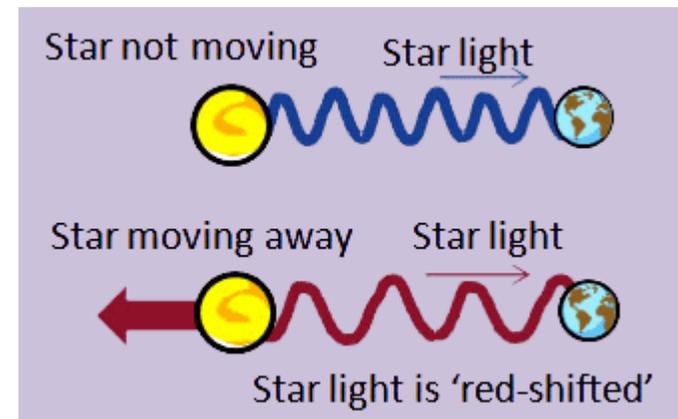
15. The universe started with the **Big Bang**, which was a massive explosion from a very small point. The universe has been expanding ever since the Big Bang.
16. **Cosmic microwave background radiation (CMBR)** is electromagnetic radiation that was created just after the Big Bang.
17. The red shifts of the distant galaxies provide evidence that the universe is expanding.
18. CMBR can be explained only by the Big Bang theory.



[picture shows a microwave image of the universe from the Cosmic Background Explorer satellite]

The expanding universe

19. The **red-shift** of a distant galaxy is the shift to longer wavelengths (lower frequencies) of the light from the galaxy because it is moving away from you.



20. The faster a distant galaxy is moving away from you, the greater its red-shift is.
21. All the distant galaxies show a red-shift.
22. The distant galaxies are all moving away from you because the universe is expanding.