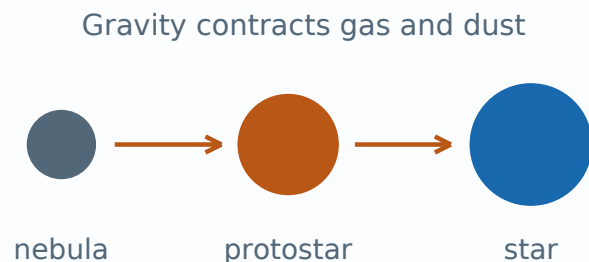


P8 Stars, fusion and elements

Separate Physics extras | AQA 8463 | CORE

Complete Physics-only topic. Foundation + Higher content.

A star is born



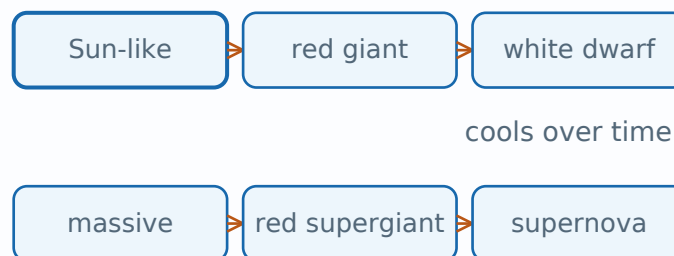
Core heats until fusion starts

Gravity pulls gas and dust in a nebula together. As the protostar contracts, its core temperature rises until fusion starts.

Fusion releases energy. A stable main-sequence star has a balance between inward gravitational collapse and the outward effect of energy released by fusion.

The Sun is one star in the Milky Way galaxy. Our solar system contains eight planets, dwarf planets and natural satellites.

Mass determines the life cycle



cools over time

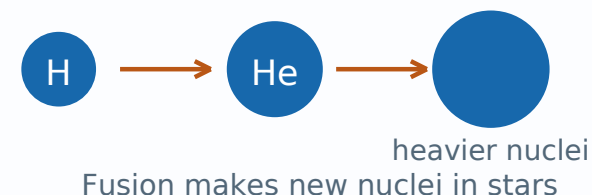
Supernova remnant: neutron star or black hole

A Sun-like star becomes a red giant, then leaves a white dwarf after losing its outer layers. The white dwarf gradually cools.

A much more massive star becomes a red supergiant and explodes as a supernova. The remnant is a neutron star or, if sufficiently massive, a black hole.

A black hole is not the final stage of every star.

Where elements come from



Fusion makes new nuclei in stars

AQA model: beyond iron in supernovae

Fusion joins light nuclei into heavier nuclei, forming new elements. Stars build up heavier nuclei through fusion.

In the AQA model, elements heavier than iron are formed in a supernova. The explosion spreads elements through space.

This material can later become part of new stars, planets and living organisms. The Sun did not create all the elements in Earth by itself.

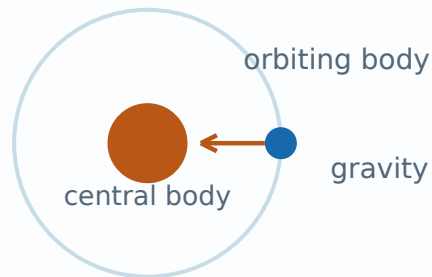
The diagrams simplify stages and are not to scale.

P8 Orbits, red-shift and the universe

Separate Physics extras | AQA 8463 | CORE

Complete Physics-only topic. Foundation + Higher content.

Planets and satellites



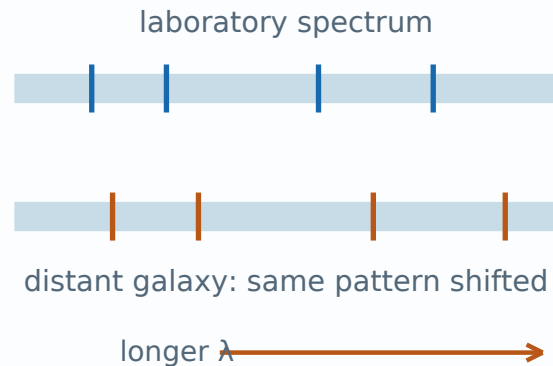
Gravity acts towards the centre

Planets orbit stars. Moons are natural satellites orbiting planets. Artificial satellites are human-made objects placed in orbit.

Gravity provides the force that maintains the circular orbits used in this model. It acts towards the central body.

Objects in orbit still experience gravity. Being in orbit does not mean that the gravitational force has disappeared.

Read the red-shift evidence

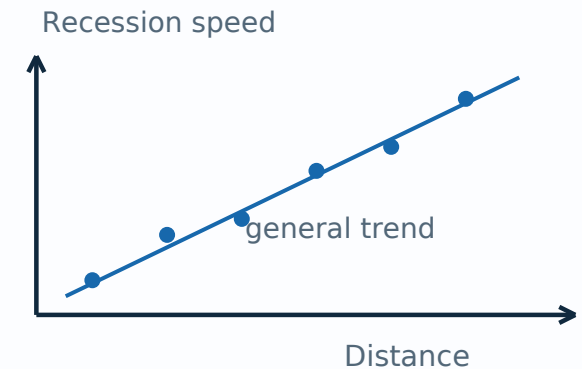


Light from most distant galaxies has a longer observed wavelength than the corresponding laboratory spectrum: it is red-shifted.

The farther away a galaxy is, the greater its red-shift and, in the observed trend, the faster it is receding.

Identify a shifted pattern of spectral lines, not just a galaxy that looks red. Some nearby galaxies do not follow the general recession pattern.

An evolving scientific model



Red-shift evidence supports an expanding universe and the Big Bang model: the universe began in a very small, extremely hot, dense region.

Supernova observations since 1998 suggest the expansion is accelerating. Scientists test models against observations and revise explanations.

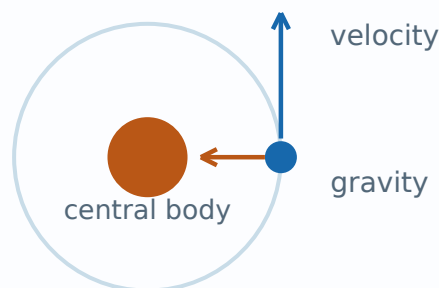
Much remains unexplained, including dark matter and dark energy. These names describe gaps in our understanding, not a complete account of their nature.

P8 Speed, velocity and stable orbits

Separate Physics extras | AQA 8463 | HIGHER ONLY

Complete Physics-only topic. Higher-tier material is kept on this separate page.

Velocity changes in a circle



Gravity acts towards the centre

Velocity includes direction. In uniform circular motion the speed stays constant, but the direction of motion changes continuously.

Gravity acts towards the centre and continually changes the velocity. The object accelerates even though its speed stays constant.

The velocity arrow is tangential to the orbit. The force arrow points inward; these arrows show different physical quantities.

A stable orbit has a condition



Comparing stable circular orbits of one body

For stable circular orbits around the same central body, orbital speed and radius are linked. A smaller radius corresponds to a higher orbital speed.

If the speed changes, the radius must change for another stable circular orbit. The original stable circular orbit cannot simply persist at the new speed.

Do not assume a sudden speed change instantly produces a new circular orbit; the path may become non-circular.

Build a complete explanation

Prompt: a satellite moves at constant speed around a planet. Explain why it is accelerating.

Answer chain: gravity produces a resultant inward force → its direction of motion changes → its velocity changes → it accelerates.

Prompt: compare two stable circular orbits around the same planet.

Answer chain: a smaller orbital radius needs a greater stable orbital speed; a larger radius has a lower stable orbital speed.

The required treatment is qualitative. These sheets do not introduce a circular-orbit equation beyond the GCSE specification.

Core orbital descriptions and red-shift are on the preceding core page; only these specified orbital explanations are Higher only.