

Exercise walk-through

8.1

Star life cycles and orbits

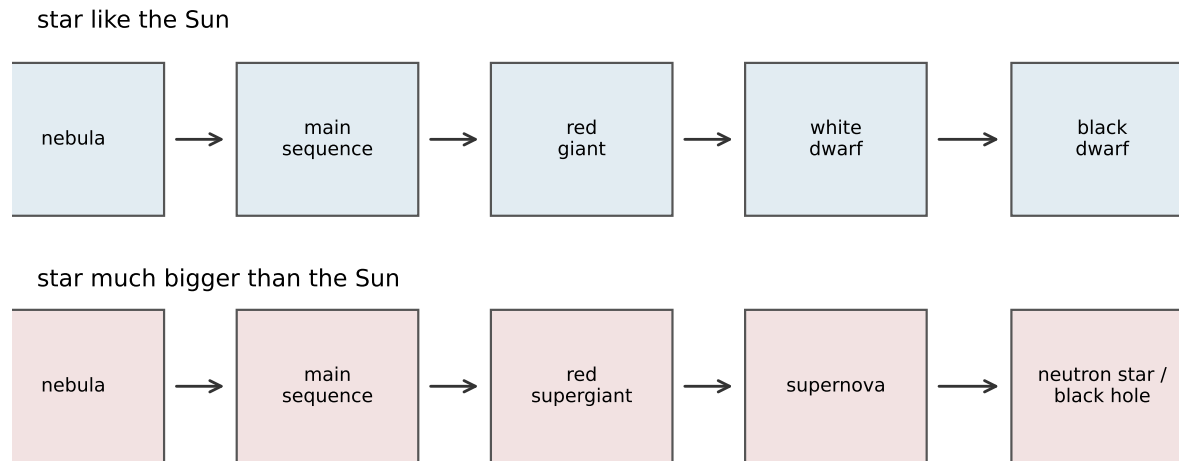
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The method

Method — Two endings set by mass

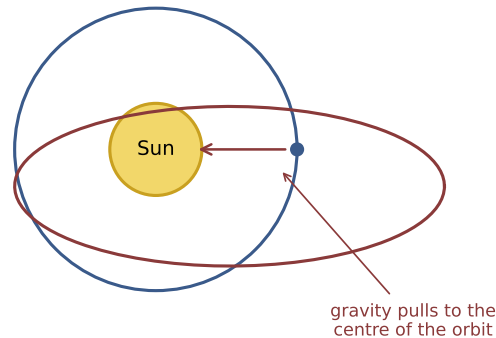
Massive cores fuse heavier nuclei and end in supernovae; Sun-like cores end as white dwarfs.



Sun-like and massive star tracks.

Method — Orbits and gravity

Gravity = centripetal force: it changes direction, not speed; weaker at greater separation, so higher orbits are slower orbits.



planet: near-circular; comet: eccentric,
faster near the Sun (off-centre)

Gravity pulls to the centre; separation sets the speed.

Exercises 2.1·2.3

2.1 What force forms stars from dust and gas? [1]

2.2 What fusion happens in a main-sequence core? [1]

2.3 List the three stages a Sun-like star passes through after its main sequence. [3]

Exercises 2.1·2.3

2.1 What force forms stars from dust and gas? [1]

2.1 Gravity (gravitational attraction).

2.2 What fusion happens in a main-sequence core? [1]

2.2 Hydrogen nuclei fuse to form helium.

2.3 List the three stages a Sun-like star passes through after its main sequence. [3]

2.3 Red giant, white dwarf, black dwarf.

Exercises 2.4·3.1

2.4 What follows a red supergiant? [1]

2.5 Name the two artificial orbit types. [2]

3.1 Explain how the elements are distributed through the universe. [3]

Exercises 2.4·3.1

2.4 What follows a red supergiant? [1]

2.4 A supernova.

2.5 Name the two artificial orbit types. [2]

2.5 Geostationary and low polar.

3.1 Explain how the elements are distributed through the universe. [3]

3.1 Stars fuse light nuclei into heavier elements up to iron; elements heavier than iron form in supernova explosions; the explosion scatters all these elements through space, where later stars and planets incorporate them – the early universe held only hydrogen.

Exercises 3.2·3.3

3.2 A satellite fires its engine to slow down. Explain what happens to its orbit. [3]

3.3 Compare the motion of a planet's orbit with a comet's. [3]

Exercises 3.2-3.3

3.2 A satellite fires its engine to slow down. Explain what happens to its orbit. [3]

3.2 Slowing means gravity now exceeds the speed needed at that radius; the satellite falls inward, settling into a smaller-radius orbit; at the lower orbit the matching speed is higher – it has traded height for speed.

3.3 Compare the motion of a planet's orbit with a comet's. [3]

3.3 A planet's orbit is nearly circular: roughly constant speed, with gravity always turning it towards the Sun; a comet's orbit is highly eccentric – fast near the Sun where gravity is strongest, slow far away.