8.1 Orbits and stellar evolution

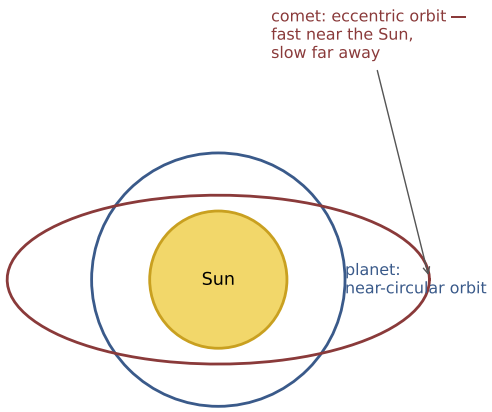
Name: _____ Class: _____ Date: _____ **Total: 20 marks**

Objective

Cover motion in the universe and stellar evolution (8.2–8.12P): the structure of the universe, gravity and orbits, orbital-speed calculations, star classification and life cycles, (P) absolute magnitude and the HR diagram. Original IGCSE-level practice.

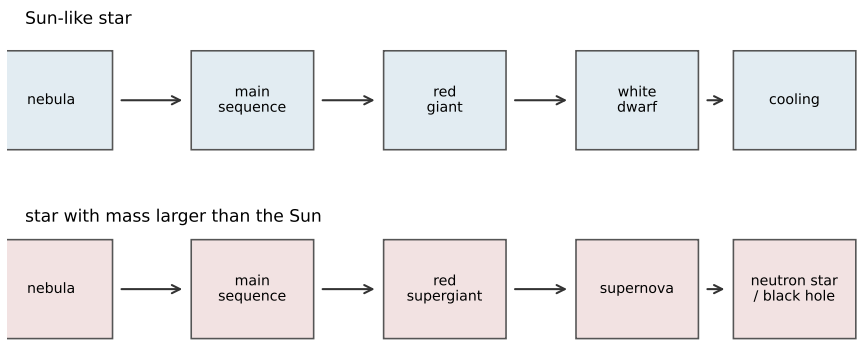
1 Key knowledge and worked examples

■ Gravity draws every orbit



$$v = \frac{2\pi r}{T}$$

■ Two life cycles



Colour ⇒ surface temperature: blue hottest, red coolest.

2 Practice

2.1 Name the galaxy that contains our solar system. [1]

2.2 State the orbit shapes of planets and comets. [2]

2.3 Which force keeps satellites in orbit? [1]

2.4 A satellite orbits at r = 10 000 km with T = 5600 s. Calculate v. [3]

2.5 List the four stages of a Sun-like star's life after the nebula. [4]

3 Exam-style questions

3.1 Explain why a comet travels fastest near the Sun. [2]

3.2 Compare the final stages of a Sun-like star and a star more massive than the Sun. [4]

3.3 (P) Describe the main components of the HR diagram. [3]

Solutions

2.1 The Milky Way.

2.2 Planets – nearly circular; comets – highly eccentric.

2.3 Gravity (gravitational attraction).

2.4 $v = 2\pi \times 1.0 \times 10^7/5600 = 1.12 \times 10^4$ m/s $\approx$ 11 km/s.

2.5 Main sequence, red giant, white dwarf, (cooling black dwarf).

3.1 Its eccentric orbit brings it closest to the Sun there; gravity is strongest at the closest approach, so it accelerates to its greatest speed.

3.2 Sun-like: expands to a red giant, sheds its outer layers and collapses to a small, dense white dwarf that slowly cools; massive: swells to a red supergiant, explodes as a supernova, collapsing the core to a neutron star or black hole.

3.3 (P) Absolute magnitude (brightness) on one axis against temperature (or colour/spectral class) on the other; most stars lie on a diagonal band – the main sequence – hot-bright to cool-dim; giants and supergiants sit above it, white dwarfs below.