

6.2 Stars and the Universe

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS redshift 红移 • big bang 大爆炸 • light-year 光年 • cosmic microwave background radiation 宇宙微波
• stars and the universe 恒星与宇宙

Objective

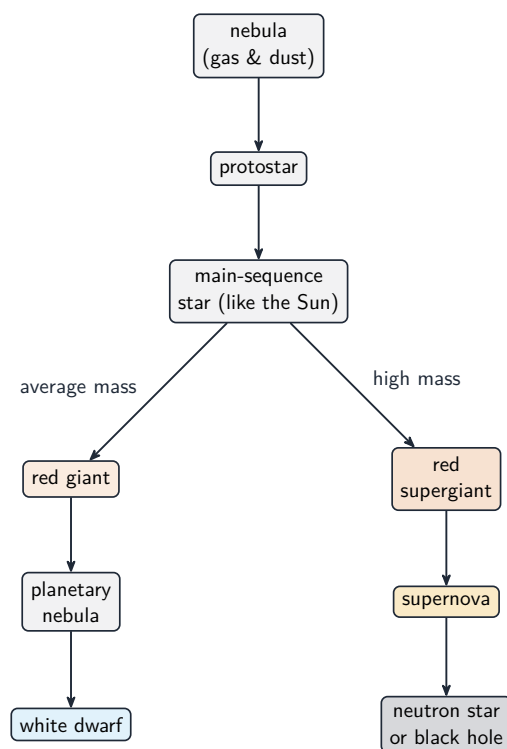
Build the skills to answer exam questions on **stars and the Universe** 恒星与宇宙 — the Sun as a star, galaxies and **light-years** 光年, the **life cycle of a star** 恒星演化, **redshift** 红移 and the **Big Bang** 大爆炸.

You must be able to:

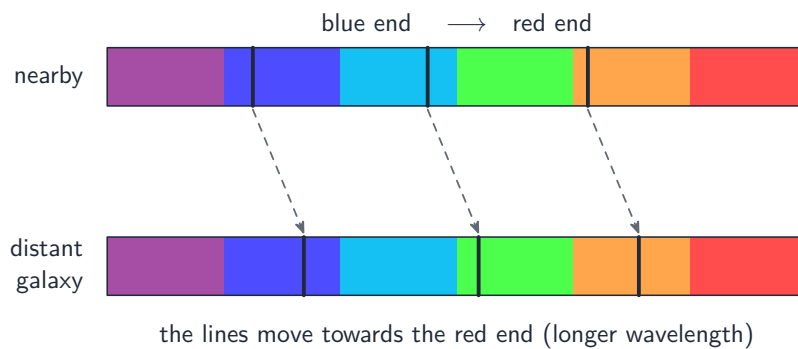
- describe the Sun (fusion of hydrogen to helium) and galaxies
- describe a star's life cycle (by mass)
- explain redshift as evidence for an expanding Universe

1 Worked examples

- Life cycle & redshift



Every star begins in a nebula; a heavy star ends in a supernova → neutron star or black hole



Light from receding galaxies is redshifted; the farther the galaxy, the bigger the redshift

Sun: a medium star, powered by fusion of hydrogen into helium. **Hubble:** $H_0 = \frac{v}{d}$,
and age $\approx \frac{1}{H_0}$.

2 Practice

2.1 State the nuclear reaction that powers the Sun. [1]

2.2 State what a light-year measures. [1]

3 Exam-style questions

3.1 Redshift of light from distant galaxies is evidence that the Universe is: [1]

- **A** shrinking
 - **B** expanding
 - **C** unchanging
 - **D** rotating
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3.2 A medium-mass star like the Sun runs out of hydrogen fuel.

(a) Describe what it becomes, in order, after this. [3]

(b) State what is left at the very end. [1]

3.3 The Hubble constant is about $H_0 = 2.2 \times 10^{-18} \text{ s}^{-1}$.

(a) Estimate the age of the Universe in seconds. [2]

(b) State one other piece of evidence for the Big Bang. [1]

Solutions

2.1 nuclear fusion (of hydrogen nuclei into helium).

2.2 distance (the distance light travels in one year).

3.1 B. Redshift shows galaxies are receding — the Universe is expanding.

3.2 (a) it swells into a red giant; throws off its outer layers as a planetary nebula; leaving a white dwarf.

(b) a white dwarf.

3.3 (a) $\text{age} \approx \frac{1}{H_0} = \frac{1}{2.2 \times 10^{-18}}; = 4.5 \times 10^{17} \text{ s.}$

(b) the cosmic microwave background radiation (CMBR).