

# 6.2 Stars and the Universe

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

**Total: 10 marks**

## Objective

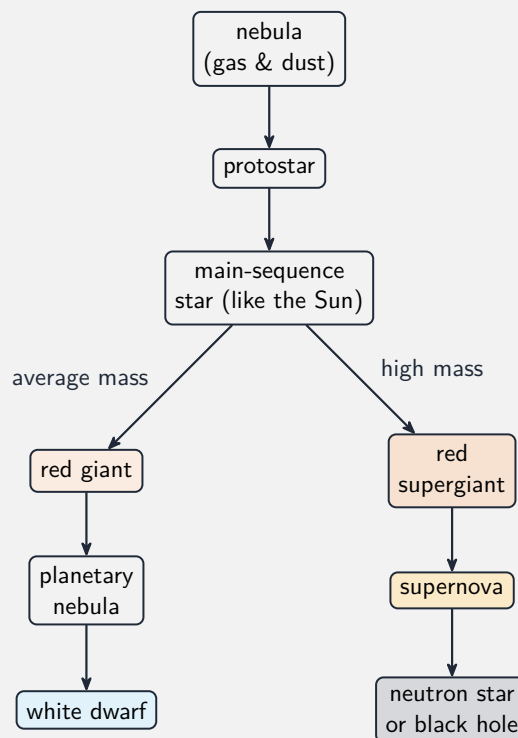
Build the skills to answer exam questions on **stars and the Universe** 恒星与宇宙—the Sun as a star, galaxies and **light-years** 光年, the **life cycle of a star** 恒星演化, **redshift** 红移 and the **Big Bang** 大爆炸.

**You must be able to:**

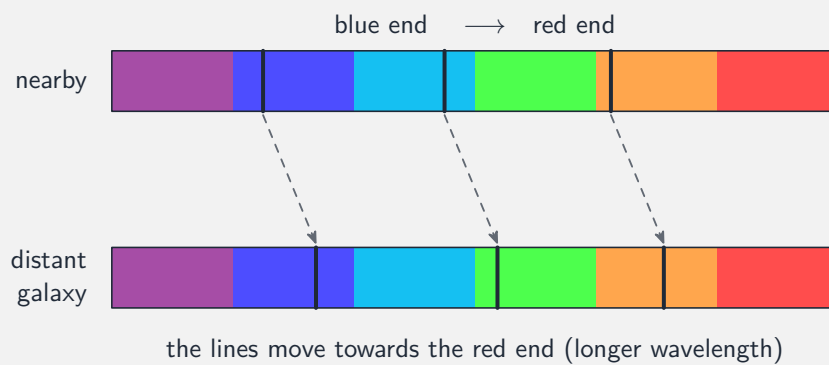
- describe the Sun (fusion of hydrogen to helium) and galaxies
- describe a star's life cycle (by mass)
- explain redshift as evidence for an expanding Universe

## 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]

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

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## 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]

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

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**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]

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

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## 4 Go further

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You are now ready for the real exam questions on this subtopic. Open the **6.2 Stars and the Universe** past-paper sheet in the Library, or try this in **Practice mode**:

- 0625/21 N25 —Q40 (galaxies / redshift)

## Solutions

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**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).