25. Astronomy and cosmology

Starter Quiz · 课前小测

A-Level Physics Name: _____ Score: _____

1. The luminosity of a star is:

   ☐ the total power it radiates

   ☐ its surface temperature

   ☐ its distance from Earth

   ☐ its mass

2. Hotter stars have their spectral peak (Wien's law) at a _____ wavelength.

   _____

3. Redshift means a galaxy's spectral lines are shifted to:

   ☐ longer wavelengths (it is moving away)

   ☐ shorter wavelengths (it is approaching)

   ☐ no change at all

   ☐ a higher temperature

4. The flux received from a star falls as 1 over the distance _____.

   _____

5. A star's spectrum peaks at $\lambda_{\max} = 500$ nm. What is its surface temperature? ($b = 2.9 \times 10^{-3}$ m·K)

   _____ K

6. A galaxy's lines show $\dfrac{\Delta\lambda}{\lambda} = 0.020$. What is its recession speed, as a fraction of c?

   _____

7. A star gives a flux of 100 $\dfrac{\text{W}}{\text{m}^2}$ at distance d. What is the flux at $3d$?

   _____ W/m^2

8. The Stefan–Boltzmann law gives a star's luminosity as:

   ☐ $4\pi\sigma r^2 T^4$

   ☐ $4\pi\sigma r T$

   ☐ $\sigma r^2 T$

   ☐ $4\pi r^2 T^2$

9. Almost all distant galaxies are redshifted, which shows the Universe is expanding.

   ☐ True ☐ False

10. A standard candle is an object whose _____ is known from its type.

    ☐ luminosity

    ☐ distance

    ☐ temperature

    ☐ mass

A-Level Physics

1. **the total power it radiates**

   Luminosity L is the energy radiated per second in all directions (watts).

2. **shorter**

   $\lambda_{\max} T = b$, so a higher T means a smaller $\lambda_{\max}$ — toward the blue.

3. **longer wavelengths (it is moving away)**

   A receding source stretches the wavelengths — a redshift, with $\dfrac{\Delta\lambda}{\lambda} \approx \dfrac{v}{c}$.

4. **squared**

   $F = \dfrac{L}{4\pi d^2}$ — the inverse-square law.

5. **5800 K**

   $T = \dfrac{b}{\lambda_{\max}} = \dfrac{2.9 \times 10^{-3}}{500 \times 10^{-9}} \approx 5800$ K — about the Sun.

6. **0.02**

   For $v \ll c$, $\dfrac{v}{c} = \dfrac{\Delta\lambda}{\lambda} = 0.020$.

7. **11.1 W/m^2**

   Inverse-square: $\dfrac{100}{3^2} = \dfrac{100}{9} \approx 11 \ \dfrac{\text{W}}{\text{m}^2}$.

8. $4\pi\sigma r^2 T^4$

   $L = 4\pi\sigma r^2 T^4$ — strongly dependent on both radius and temperature.

9. **True**

   They are moving apart on average — the space between them is stretching.

10. **luminosity**

    Knowing L (without first knowing distance) lets you get the distance from the measured flux.