

A-Level Physics

Name: _____ Score: _____

1. The luminosity of a star is:
 - ☐ the total power it radiates
 - ☐ its mass
 - ☐ its surface temperature
 - ☐ its distance from Earth
2. Hotter stars have their spectral peak (Wien's law) at a _____ wavelength.

3. Redshift means a galaxy's spectral lines are shifted to:
 - ☐ no change at all
 - ☐ longer wavelengths (it is moving away)
 - ☐ a higher temperature
 - ☐ shorter wavelengths (it is approaching)
4. Why might one star appear brighter than another? Select **all** that apply.
 - ☐ it is a bluer colour
 - ☐ it is larger in radius
 - ☐ it is closer to us
 - ☐ it has a greater luminosity

Tick every correct option.

5. Which belong in a statement of Wien's displacement law? Select **all** that apply.
 - ☐ it describes the positions of the spectral lines
 - ☐ the wavelength at which the intensity is a maximum
 - ☐ the temperature is in kelvin
 - ☐ is inversely proportional to the thermodynamic temperature

Tick every correct option.

6. In $\Delta\lambda/\lambda \approx v/c$, the λ on the bottom is the observed wavelength.
 - ☐ True
 - ☐ False
7. The flux received from a star falls as 1 over the distance _____.

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

_____ K

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

10. Doubling the distance to a star reduces the radiant flux intensity to one half.

☐ True ☐ False

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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 $\frac{\Delta\lambda}{\lambda} \approx \frac{v}{c}$.

4. **it is closer to us; it has a greater luminosity**

Colour and size only matter through the luminosity they produce. The two marked reasons are greater luminosity and smaller distance.

5. **the wavelength at which the intensity is a maximum; the temperature is in kelvin; is inversely proportional to the thermodynamic temperature**

It is about the peak of the continuous black-body curve, not the lines. Saying only the wavelength loses the mark; say the wavelength of maximum intensity.

6. **False**

It is the EMITTED, laboratory wavelength. At small v/c the difference is slight, but the mark scheme is specific about it.

7. **squared**

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

8. **5800 K**

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

9. **0.02**

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

10. **False**

To one QUARTER. The power spreads over a sphere of area $4\pi d^2$, so flux goes as $\frac{1}{d^2}$. Using πd^2 instead is out by a factor of four.