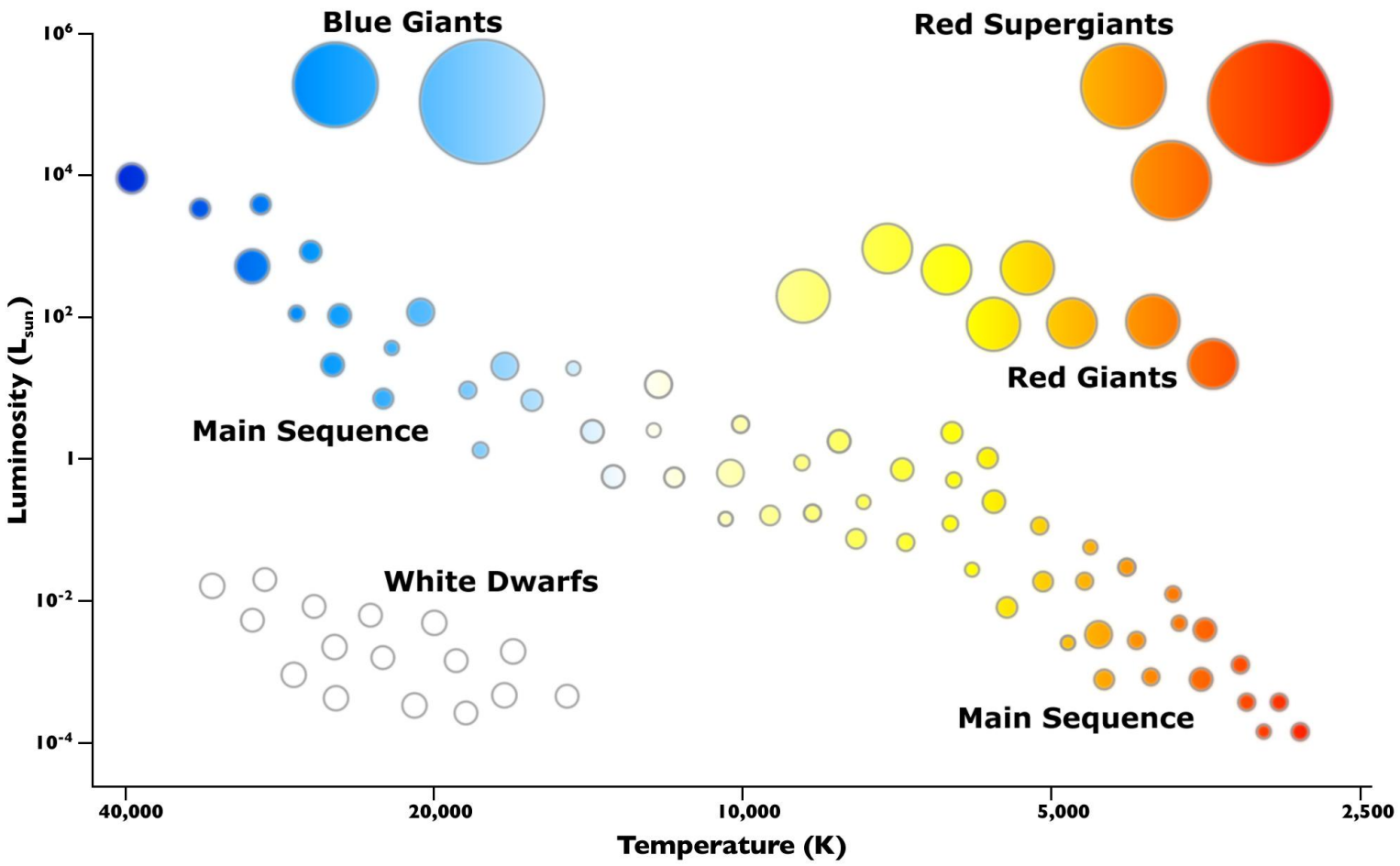
E.5

Organizing the Stars

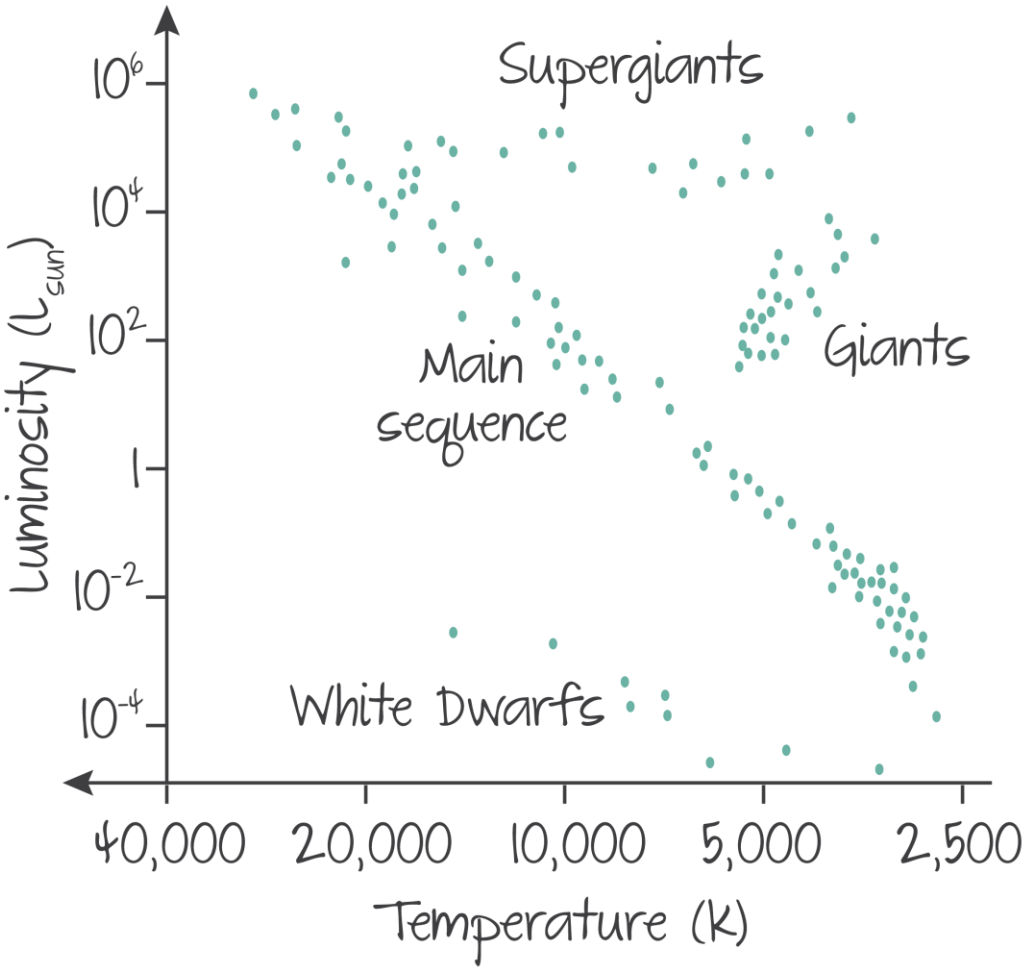
IB PHYSICS | ASTROPHYSICS

E.5

H-R Diagrams



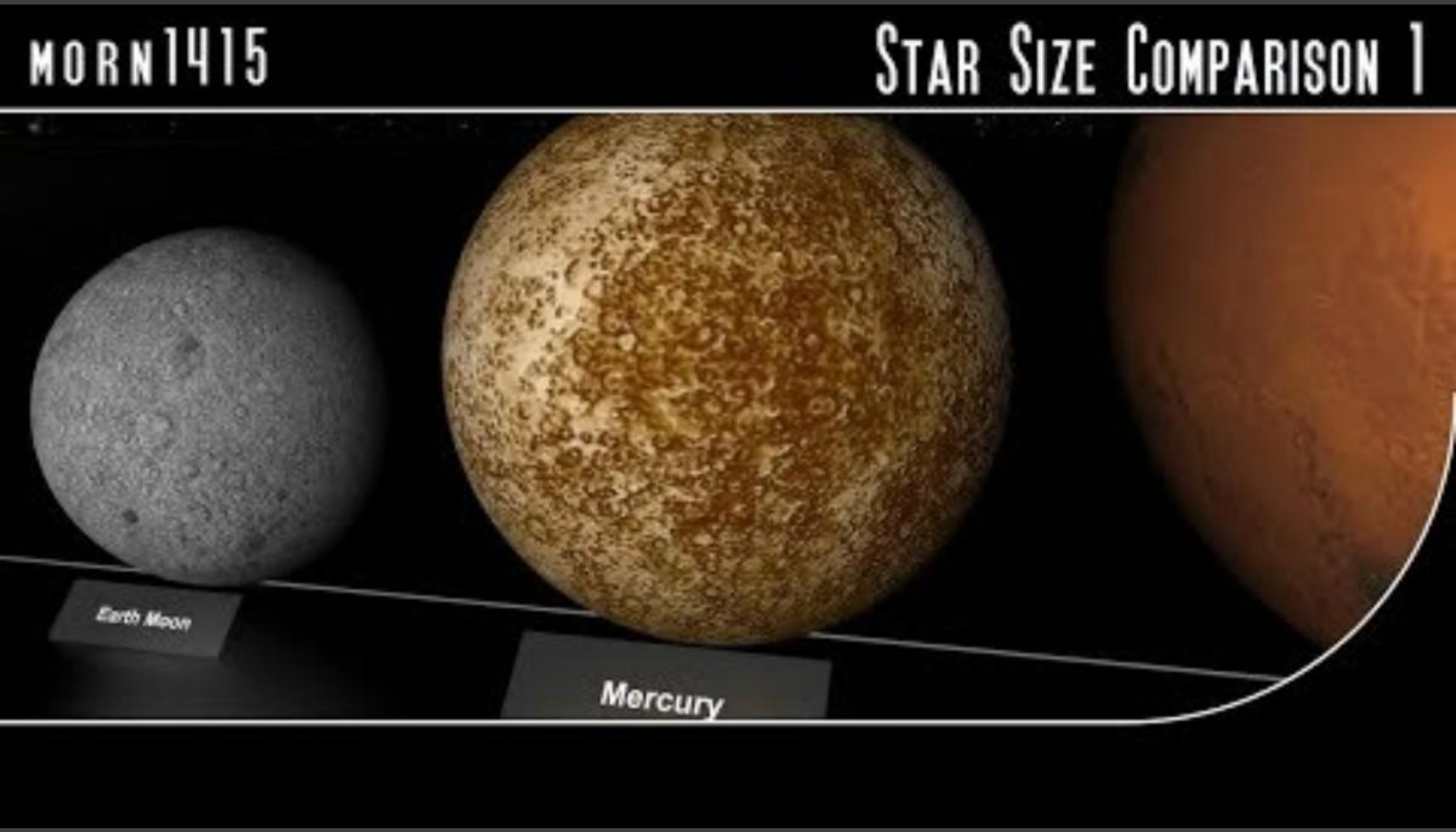
H-R Diagrams


Supergiants
Giants
Main sequence
White Dwarfs
Luminosity (L_{sun})
10^6
10^4
10^2
1
10^{-2}
10^{-4}
40,000
20,000
10,000
5,000
2,500
Temperature (K)

H-R Diagrams

E.5

Sizes of Stars



Equation Reminders

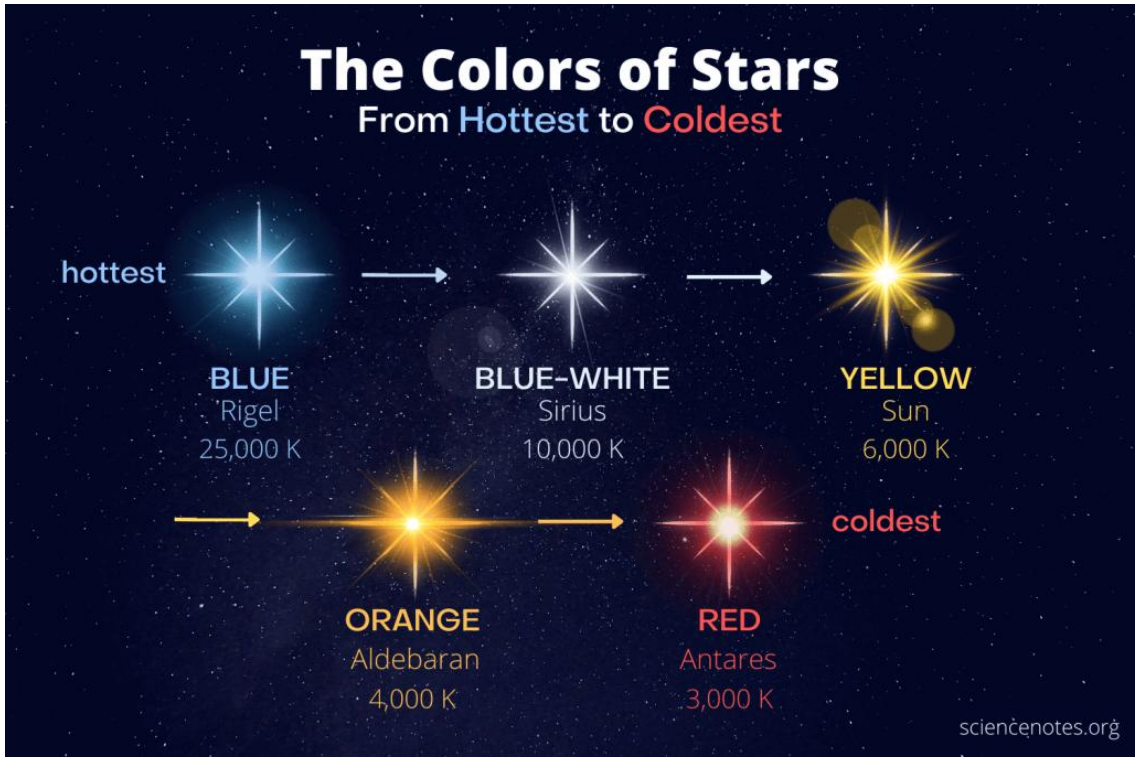
B.1

B.1 Thermal energy transfers	
	$\rho = \frac{m}{V}$
	$\overline{E_k} = \frac{3}{2} k_B T$
	$Q = mc\Delta T$
	$Q = mL$
	$\frac{\Delta Q}{\Delta t} = kA\frac{\Delta T}{\Delta x}$
	$L = \sigma A T^4$ ← Luminosity
	$b = \frac{L}{4\pi d^2}$ ← Brightness
	$\lambda_{max} T = 2.9 \times 10^{-3}\,\text{mK}$ ← Temperature

B.1

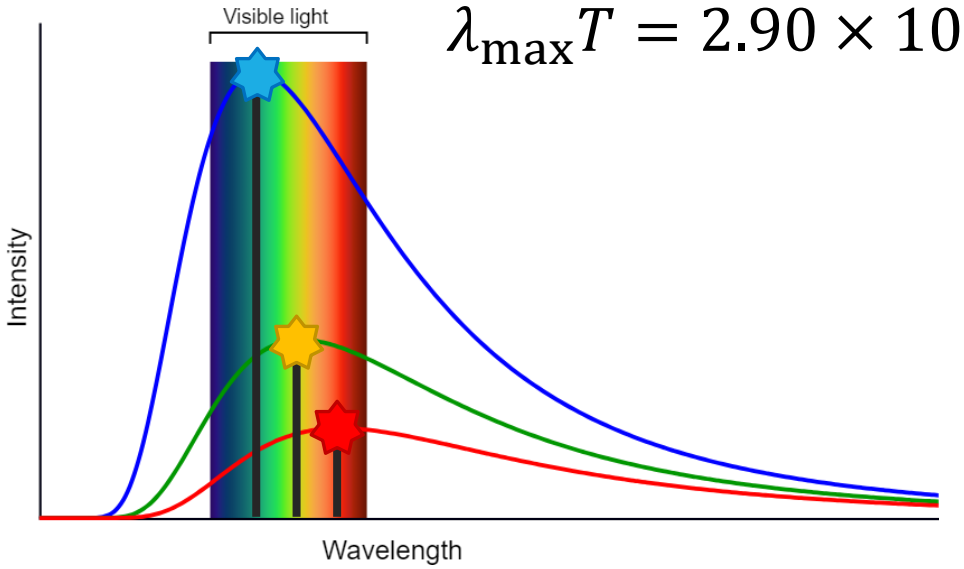
Star Color

The color that a star appears is dependent upon its _____



Wien's Displacement Law

B.1

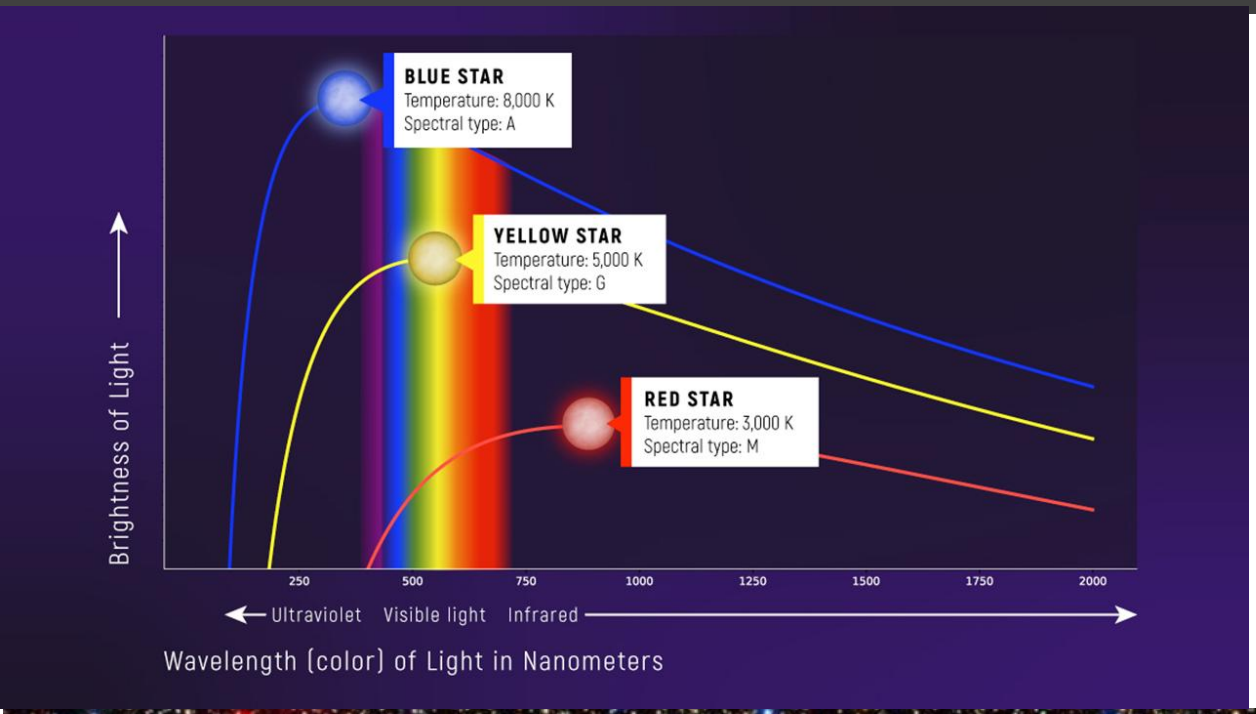


$$\lambda_{\max} T = 2.90 \times 10^{-3}\ \text{mK}$$

Temperature (T)	6000 K	5000 K	4000 K
Max Wavelength (λ_{max})			

B.1

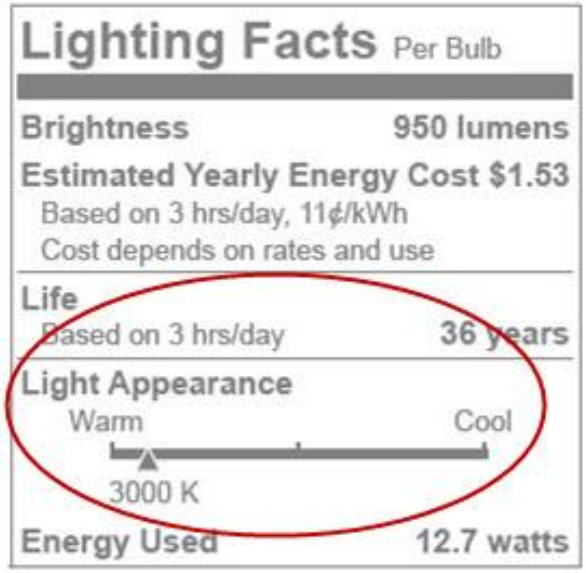
Why no green or purple stars?

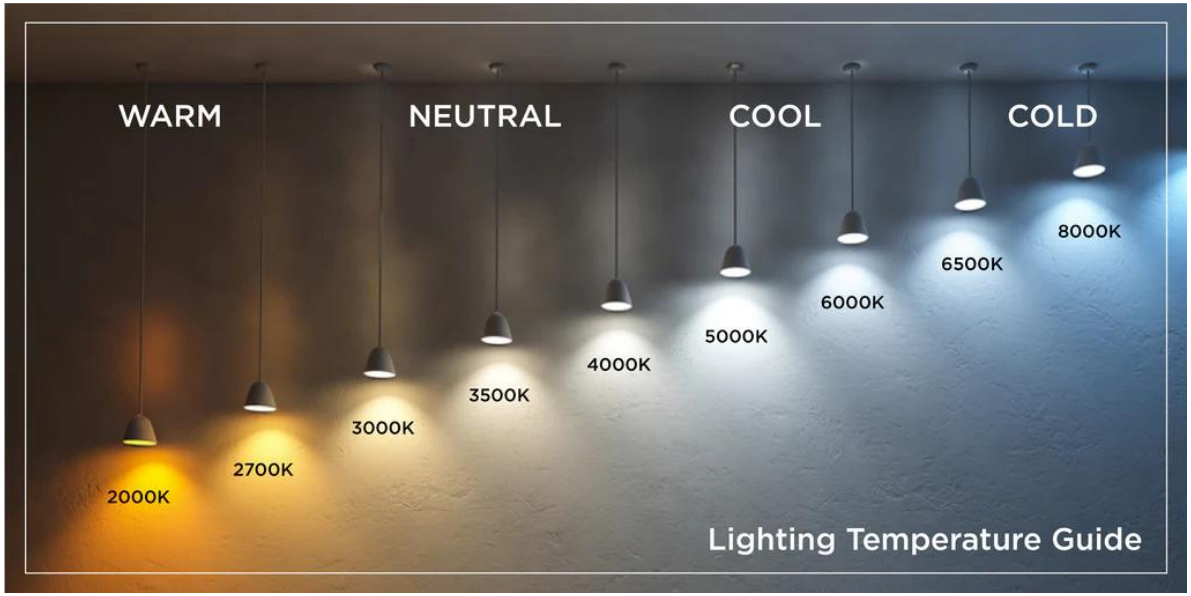


*Star image intensified to show colors more dramatically

Light Bulbs and Color

B.1

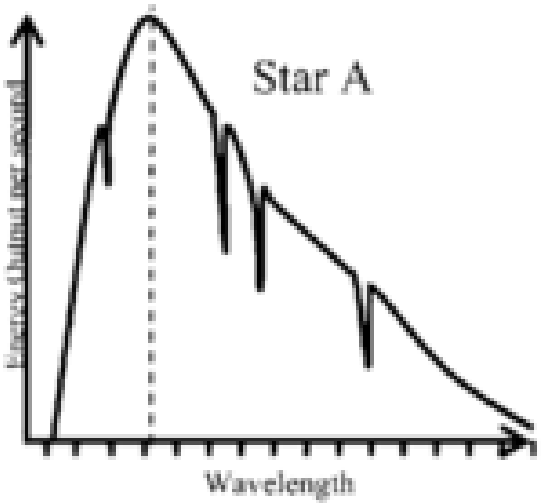


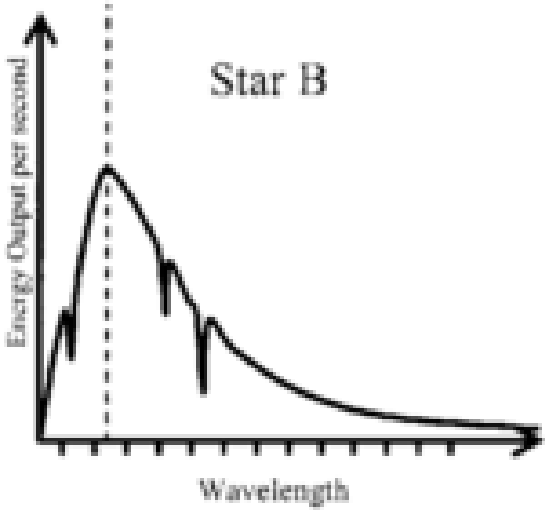


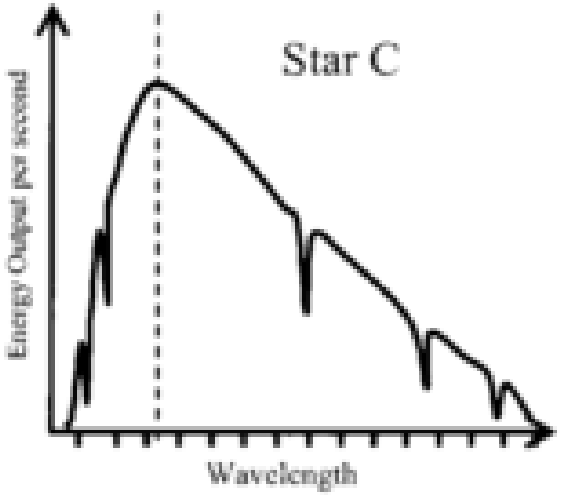
Lightbulbs are sold based on this temperature/color relationship

The Curve isn't Smooth…

B.1

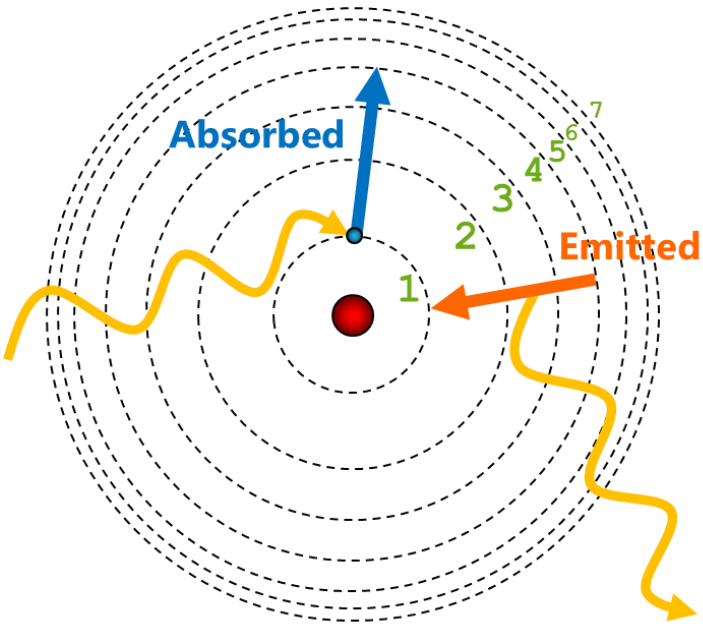


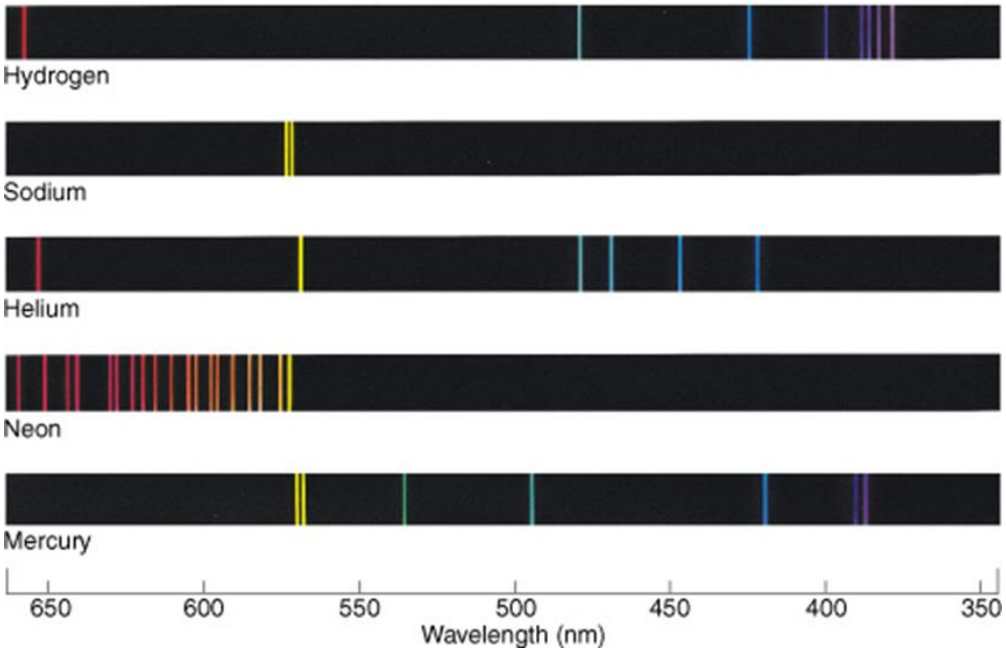




Remember Light Spectra?

Each element has specific wavelengths that match the electron energy level drops



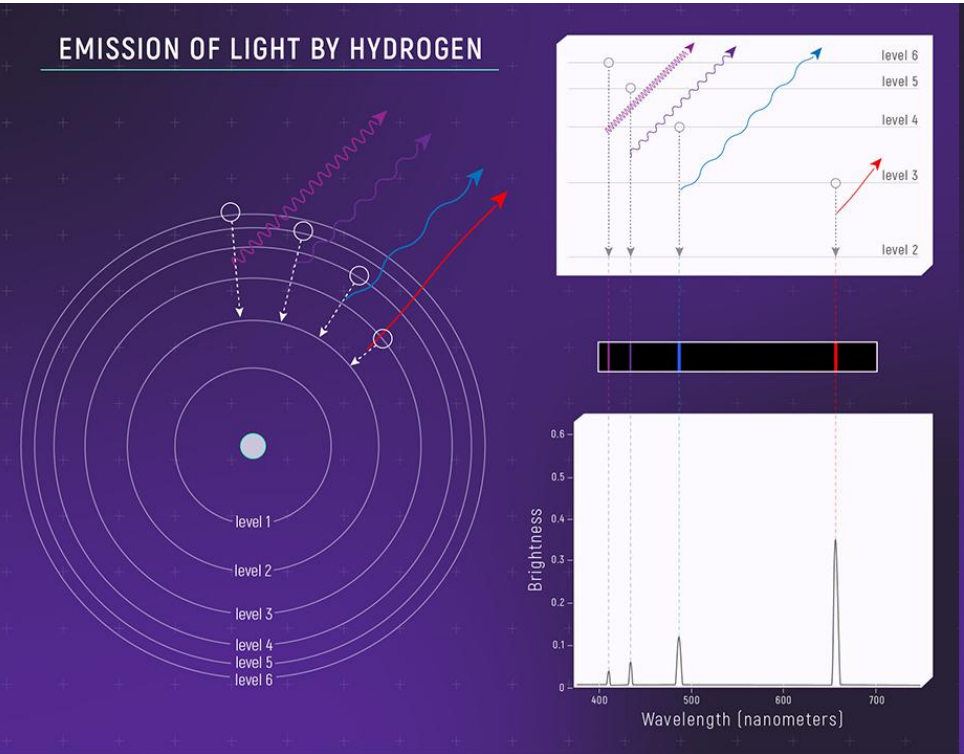


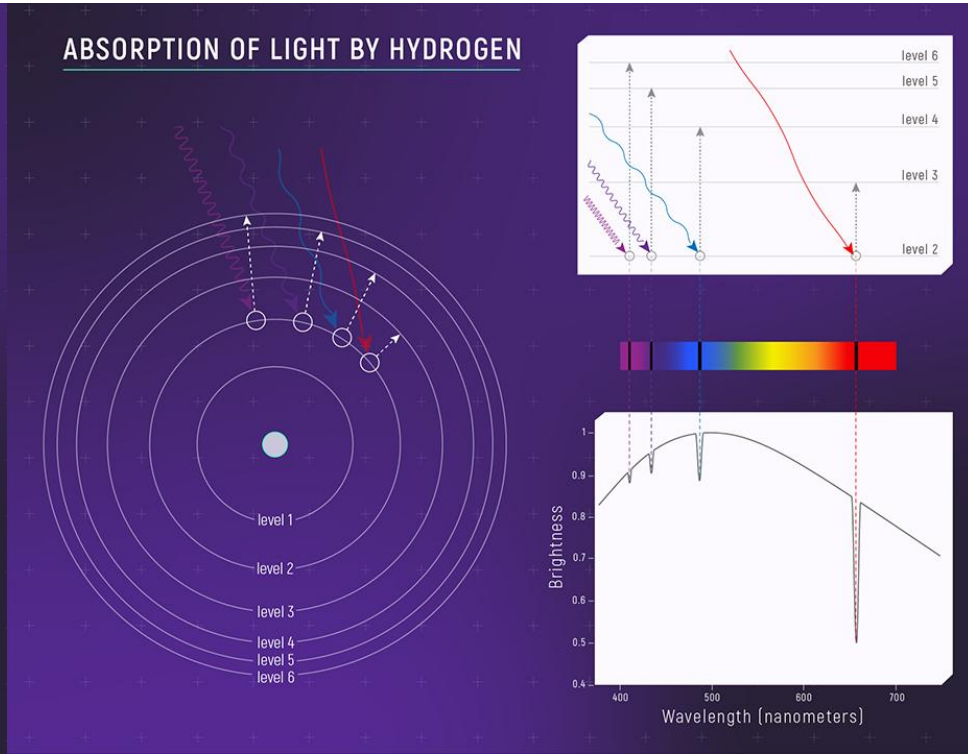
E.1

Light Spectra and Electrons

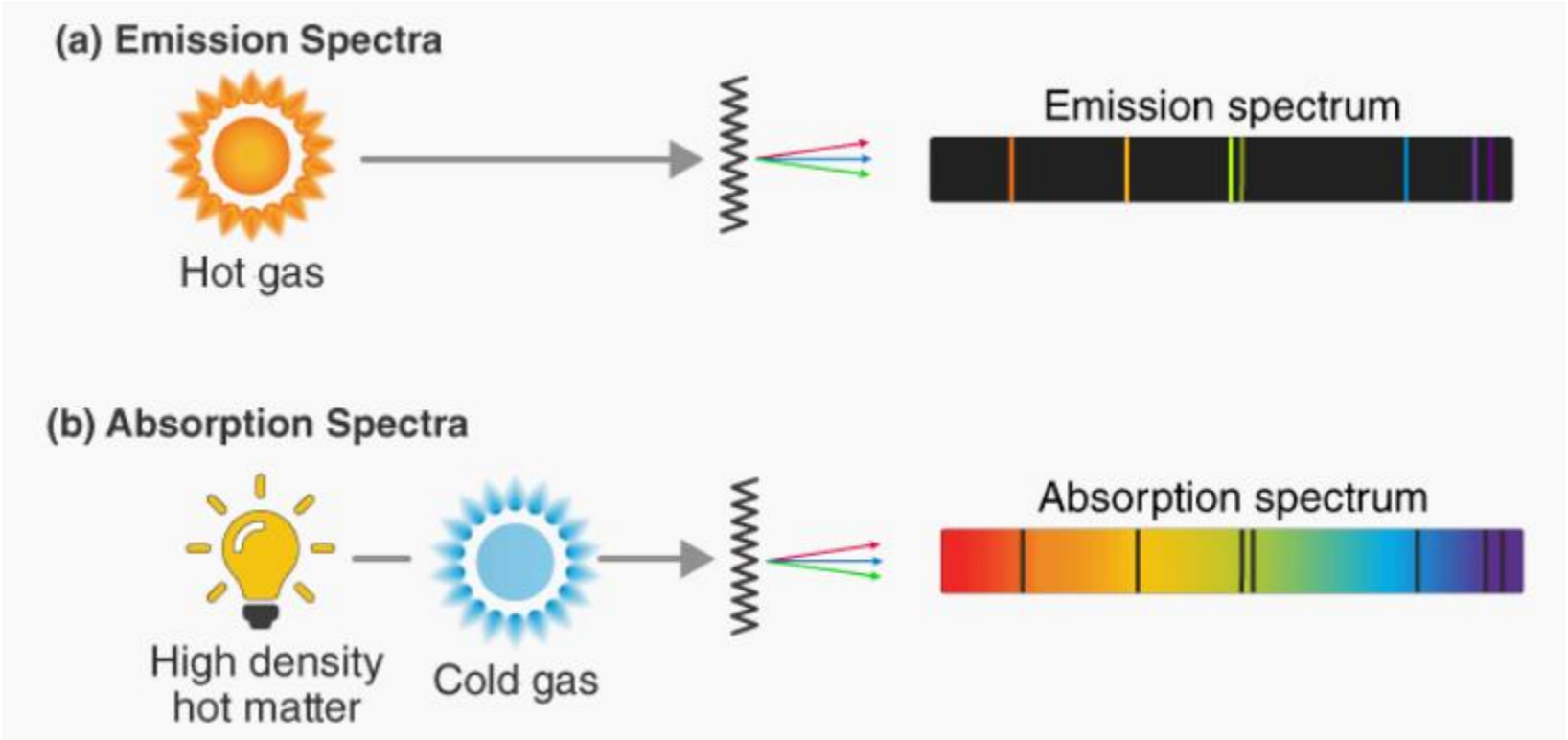
Electrons _____ energy when they fall down

and they _____ energy to jump up



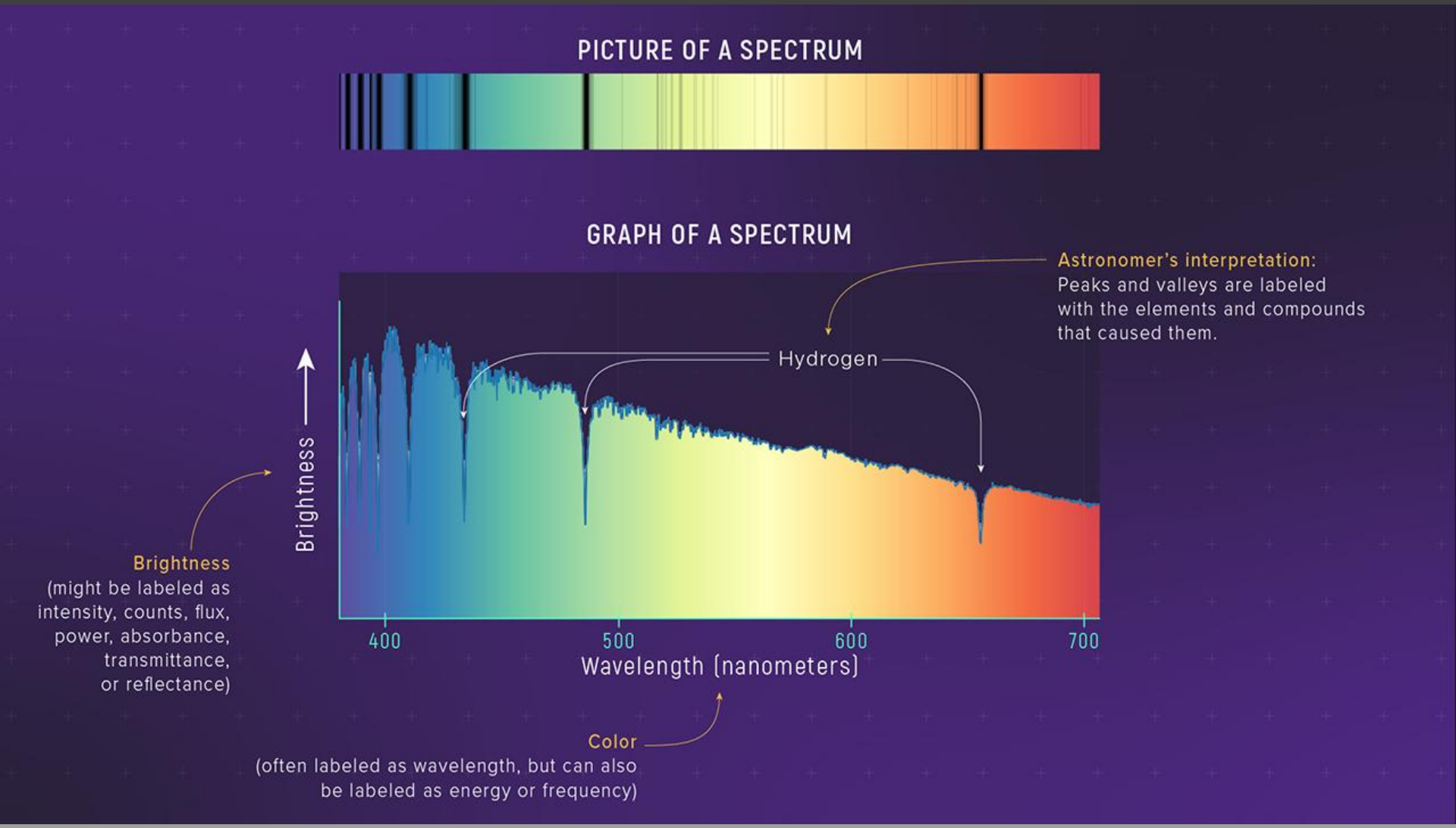


Emission and Absorption



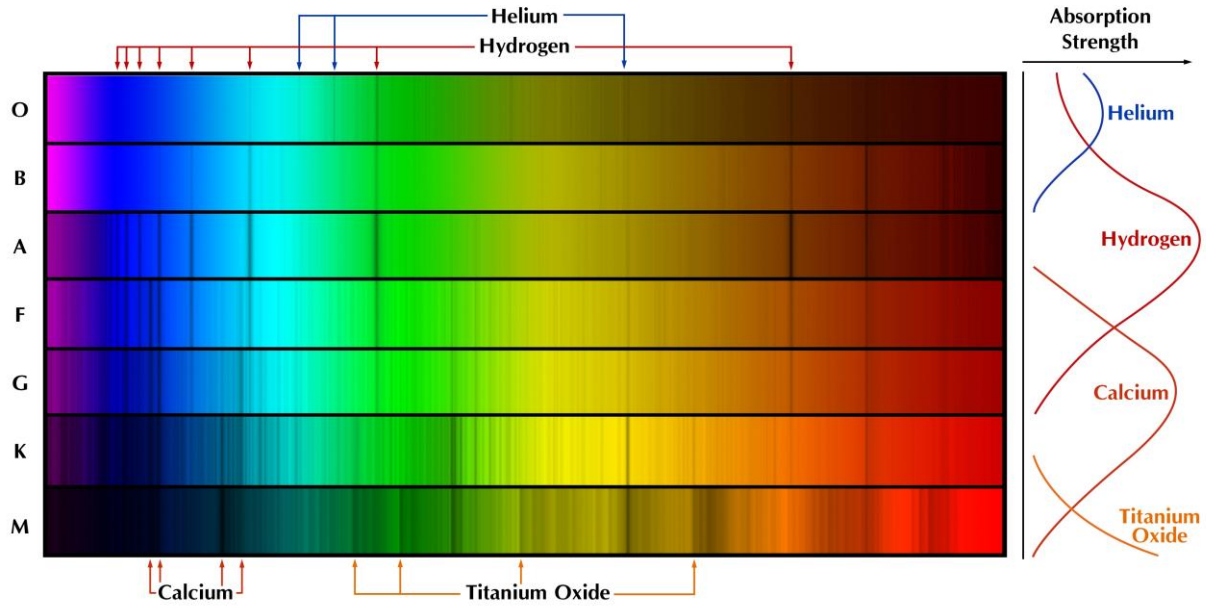
E.1

Stellar Spectrum



Stellar Spectra

Studying the Spectra of Stars can help determine what the stars are made of



Are these **Emission Spectra** or **Absorption Spectra**?

Lesson Takeaways

E.5

- ❑ I can place a star on an axis showing luminosity vs temperature
- ❑ I can describe the organization of the Hertzsprung-Russell Diagram
- ❑ I can use the main sequence to calculate the distance of a star from its wavelength and brightness
- ❑ I can identify the chemical makeup of a star from its absorption spectrum