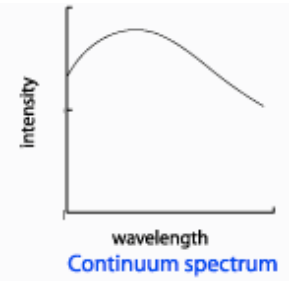
Spectroscopy Questions

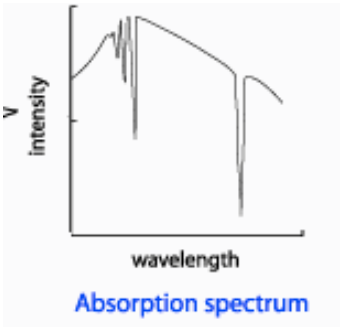
Name _____

1. Sketch intensity plots for

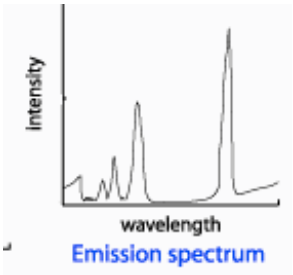
i) a continuous spectrum



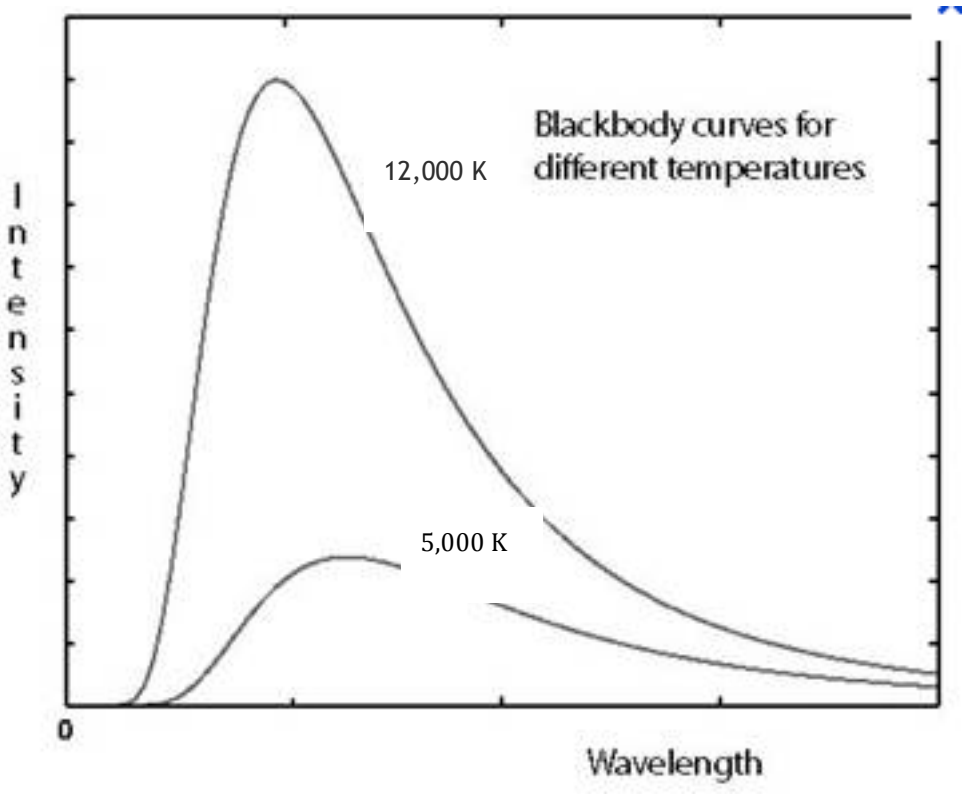
ii) an absorption spectrum



iii) an emission spectrum.



2. Sketch Blackbody curves for a 12,000 and a 5,000 K black body on the same axes.



Identify and account for two differences in the curves. In what ways are they similar? Both peak at particular wavelengths, but the wavelengths are different.

The higher temp gives off more light so its curve is bigger

3. Identify an astronomical source for each of the following types of spectrum:

i) An emission spectrum nebula

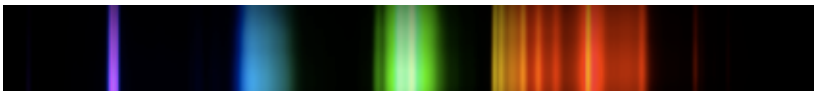
ii) an absorption spectrum star

4. Sketch the photographic spectrum (picture not graph) you would expect to see from

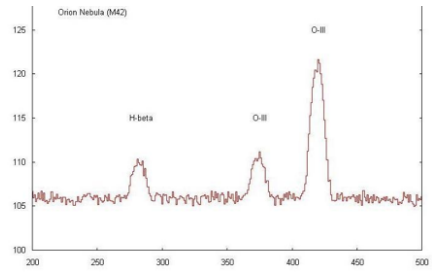
i) an incandescent lamp 

ii) a hydrogen gas discharge tube 

iii) reflected sunlight 

iv) a fluorescent lamp 

5. Explain the spectral features you would expect to find in an emission nebula such as M 42, the Great Nebula of Orion.



Emission spectra – emission lines will be present because the nebula is a cooler, low density object

6. Why do we see spectral lines of ionised He^{+} in O-class stars but not in the Sun's spectrum?

O class stars are hot enough to strip He of its electrons to make it an ion. The Sun is not so neutral He is seen.

7. What does the presence of large number of molecular spectral lines (from molecules) in M-class stars suggest about their effective temperature? That they are cooler stars, cool enough to allow molecular bonds to stay connected

8. Describe two ways in which the spectrum of a star can be used to determine its effective temperature.

The peak wavelength will tell you if it is hotter or cooler. The type of spectral lines, ions, neutral atoms or molecules, that are present indicate if it is hotter or cooler.

9. If the core of a main sequence star acts like a black body source of a continuous spectrum, why do we typically see absorption lines in stellar spectra?

The light coming from the interior has to pass through the outer atmosphere of the star. This is where light is absorbed, causing absorption lines.

10. Why do most modern astronomical spectrographs uses diffraction gratings rather than prisms to disperse light?

They are much lighter than a prism and gives a better spectrum. The grating is considered a “super prisim”

11. Why does an O-class star appear blue and an M-class star appear red?

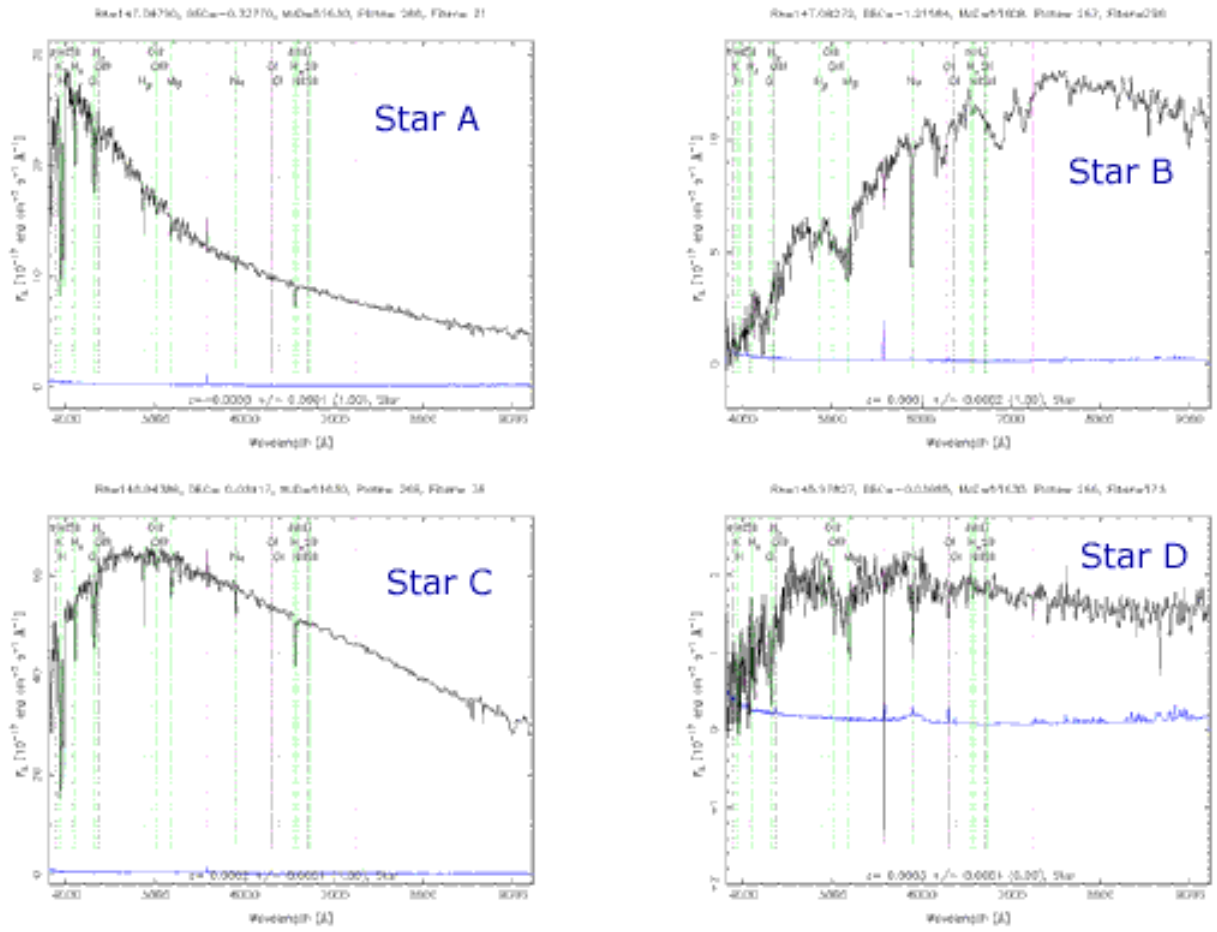
The O class star gives off far more blue light that red light because its peak wavelength is in the violet, ultraviolet range because the O class star is very hot.

12. If a star has a peak wavelength of 450 nm at maximum intensity calculate its effective temperature.

6439 K wavelength = 0.0029 mK / temp

13. Which of the four stars below, A, B, C or D is hottest? Justify your answer. (Ignore the blue background lines in each spectrum).

A is the hottest because its peak wavelength is the shortest wavelength of the four stars. In order of hottest to coolest – A, C, D, B



Credit: Spectra courtesy of *The Sloan Digital Sky Survey*

14. In the diagram in question 19 above, which star is coolest? How can you tell?

This question should have read "In the diagram in questions **13** …"

Star B is the coolest because its peak wavelength is the longest wavelength of the 4 stars

15. Construct a table showing the spectral classes, key spectral features, color and effective temperature range for stars.

Spectral Class Characteristics

Spectral Class	Intrinsic Color	Surface Temperature (K)	Prominent Absorption Lines
O	Blue	41,000	He^+, O^{++}, N^{++}, Si^{++}, He, H
B	Blue	31,000	He, H, O^+, C^+, N^+, Si^+
A	Blue-white	9,500	H(strongest), Ca^+, Mg^+, Fe^+
F	White	7,240	H(weaker), Ca^+, ionized metals
G	Yellow-white	5,920	H(weaker), Ca+, ionized & neutral metal
K	Orange	5,300	Ca^+(strongest), neutral metals strong, H(weak)
M	Red	3,850	Strong neutral atoms, TiO