**Spectroscopy**

**Purpose:** To acquire a better understanding of emission spectrum, absorption spectrum and how they are related to atomic structure

**Items:** Calculator

**Introduction:** A line spectrum can be used to determine the element(s) that are producing the spectrum. The spectral lines are the results of electrons moving from one orbit into another. The amount of energy required to jump or fall into another orbit is specific to each element. Thus the spectral lines are a set of finger prints that can be used to identify elements.

In this exercise, you will use the absorption spectrum to identify elements present in the atmosphere of mystery stars. You will then use the model of the hydrogen atom to calculate wavelengths of emission lights in Balmer series.

**Procedure:**

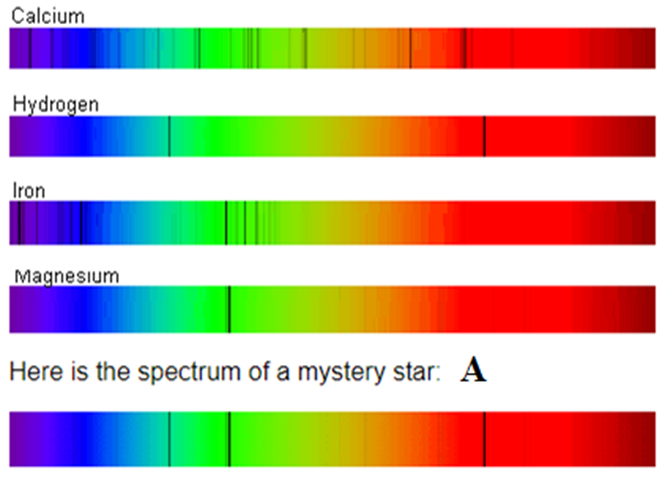
**Part I : Identify elements using absorption spectrum**

If you look more closely at the Sun's spectrum, you will notice the presence of dark lines. These lines are caused by the Sun's atmosphere absorbing light at certain wavelengths, causing the intensity of the light at this wavelength to drop and appear dark. The atoms and molecules in a gas will absorb only certain wavelengths of light. The pattern of these lines is unique to each element and tells us what elements make up the atmosphere of the Sun. We usually see absorption spectra from stars, planets with atmospheres, and galaxies. Astronomers also have the ability to measure amounts of an element present in an object by measuring the thickness of the dark lines.

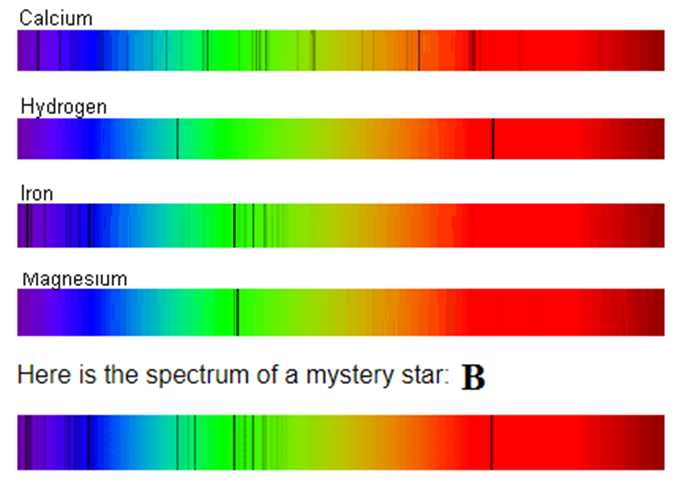
Detailed image of our Sun's Absorption Spectrum 

Detailed image of our Sun's Absorption Spectrum

Using spectra for some elements common (Calcium, Hydrogen, Iron and Magnesium) in the atmosphere of the stars to identify element that present in the atmosphere.



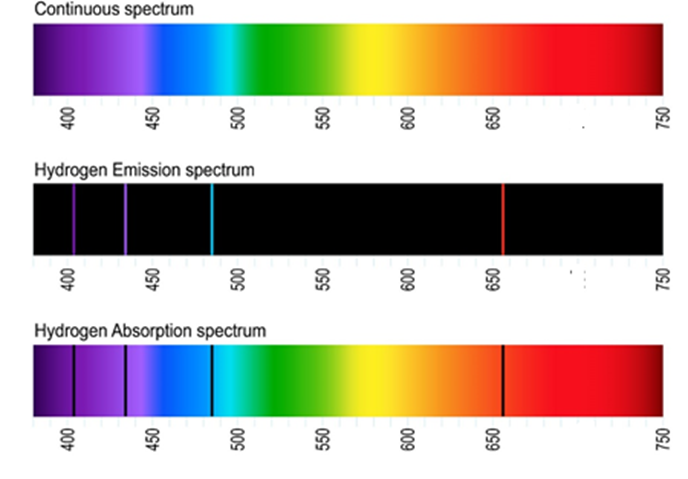
1. Which elements are present in atmosphere of star A? showing above



1. Which elements are present in atmosphere of star B? showing above

1. Which element present in both star A and star B?

**Part II : Hydrogen Atom**



Each of these emission line has particular wavelength associated with the specific amount of energy electron emit to transit from higher energy levels (n>2) to second energy level (n=2), also known as Balmer series. The following equation will allow you to calculate the wavelength of the emission line associated with specific higher energy level the electron transit from.

λ is wavelength in nm, *n* is the energy level.

1. Using above formula to calculate the wavelength for n=3. Round the wavelength value to a whole number and record the wavelength it in the table below.

1. Write and record the corresponding color for the wavelength calculated above. Please choose from the following available colors: violet, blue and red.

1. Repeat above steps for n=4 and n=5 to complete the table.

|  |  |  |
| --- | --- | --- |
| n | wavelength (nm) | color |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |

1. On the electron orbits model for hydrogen atom, use arrows to indicate the three electron transitions that emit light at the wavelengths you calculated in the table. Draw each arrow in its corresponding color.

