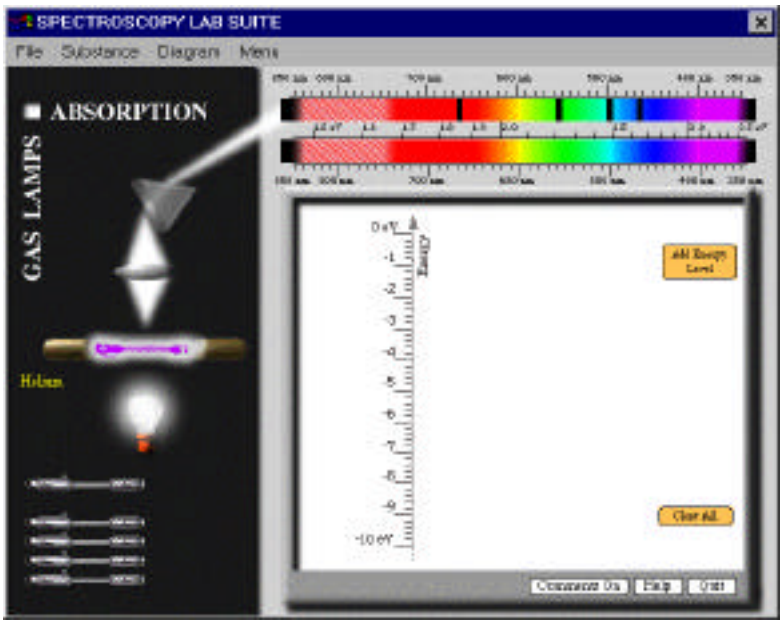
Tutorial Homework: Spectroscopy **Name**_____

A. For this tutorial homework, you will need to use the *Spectroscopy Lab Suite Gas Lamp Emission* program.[1] Below is the gas lamp **absorption** screen with **helium** placed in the socket. You can also use the program to look at **emission** spectra of different gases.



1. Describe the physical laboratory setup needed to create an absorption spectrum.

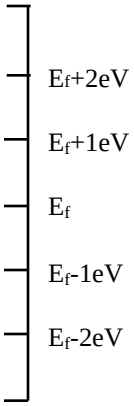
2. Do gases have the same absorption and emission lines? Use the program to observe.

3. How, if at all, can you account for your answer to question 2?

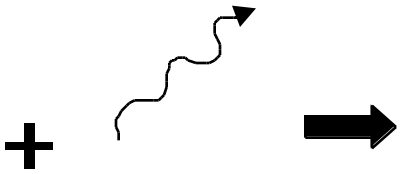
[1] This program may be found on the web at *http://phys.educ.ksu.edu/vqm/html/absorption.html*

B. Consider the 495 nm photon absorption line. Assume the absorbing gas has an energy of E_f after the photon contributing to this line is absorbed. Use the different representations from the tutorial to fill in the following three diagrams:

1. Draw the energy level diagram that is associated with this spectral line. Explain.



2. Use the energy diagram model:



E_i E_f E_i

Initial State Photon Final State

3. Use the histogram model:

Initial Energy of Emitter | Final Energy of Emitter | Energy of Photon from 495 nm line

Using typical mathematical symbols (+, -, =, etc.) show the relationships between the above pictures. Explain.

Did the energy of the absorbing atom *increase, decrease,* or *stay the same* when the photon was absorbed? Explain how you know.