Names: ______________________ ______________________

______________________ ______________________

Teamwork (5)	Discussion (5)	Completeness (5)	Correctness (5)	Total (20)

Introduction to Spectroscopy

A sturdy back and legs counting four

I was once alive, but I am no more.

What am I?

____

Pre-Lab Quiz

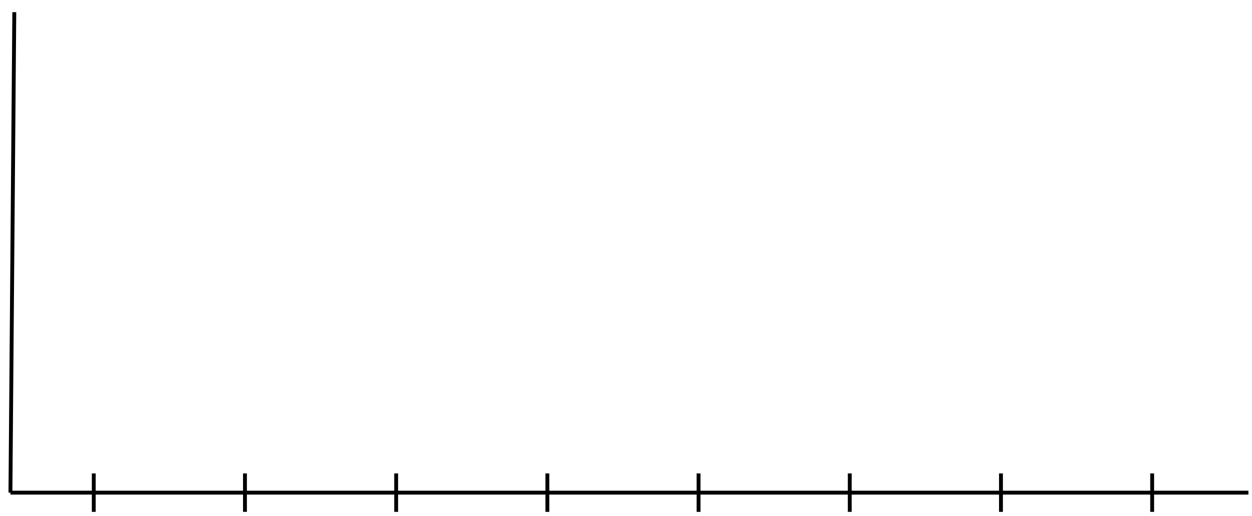
Record your team's answers as well as your reasoning and explanations.

1.
2.
3.
4.

Part 1: Visible Light

1. On the plot below, label the axis (x = Wavelength, y = Intensity) and let the wavelengths span 300 to 1000 nm. Then, for each bulb in the box, record its color, the wavelength at which the intensity is greatest λ_{peak}, and draw a sketch of the spectrum (focus more on the shape, rather than the specific value for the intensity).

Bulb	1	2	3	4	5	6
Color						
λ_{peak} (nm)						



2. **Class Discussion** Be prepared to discuss the following questions with the class:

- What type of bulb is bulb #6 and why does it not appear to light up?
- Why is the range in wavelength for white light (bulb #1) so large compared to the other colors?

Part 2: Emission Spectra

Make sure to ***turn off*** *the carousel when not in use.*

1. The prominent lines in the visible portion of the Hydrogen spectrum are part of the Balmer series. These emission lines occur when an electron transitions from a higher energy level to the 2^{nd} energy level.

The Balmer line with the **longest wavelength is Hα** (H-alpha), which corresponds to a transition from the 3^{rd} to the 2^{nd} energy level. This is followed in decreasing wavelength by Hβ (H-beta), Hγ (H-gamma), and Hδ (H-delta), with Hε (H-epsilon) occurring in the ultraviolet part of the spectrum at $\lambda = 397$ nm.

Using the Hydrogen sample, find the wavelength of the Hα, Hβ, and Hγ emission lines, record their color (use the diffraction glasses), and measure their **relative intensity** (which is found by dividing their intensity by the Hα intensity).

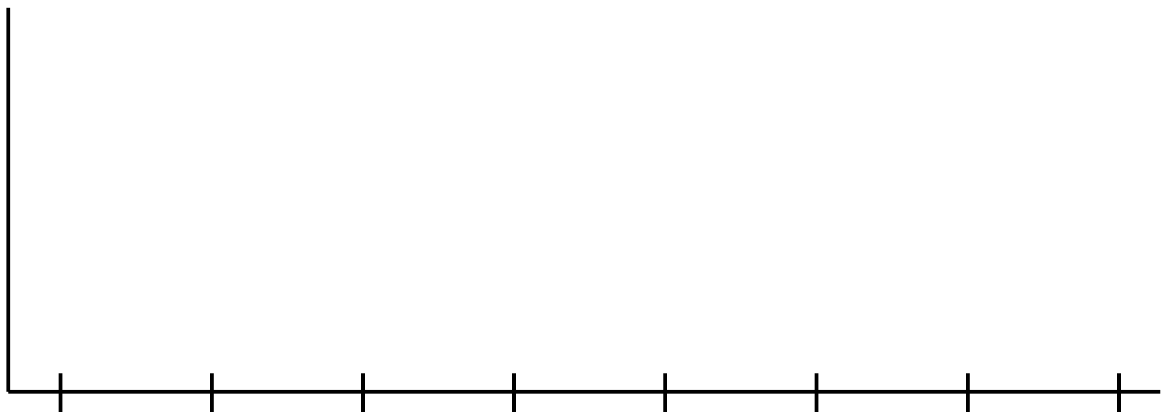
Line (Transition)	λ (nm)	Color	$I \,/\, I_{H\alpha}$
Hα ($3 \to 2$)			1
Hβ ($4 \to 2$)			
Hγ ($5 \to 2$)			

2. Find the four prominent Helium lines in the visible portion of the spectrum ($400 \to 700$ nm) and record their wavelengths as well as their color. **Note:** If you look closely, you'll see that the prominent infrared emission line just past 700 nm is visible to your eye, but appears much fainter than the spectrum indicates.

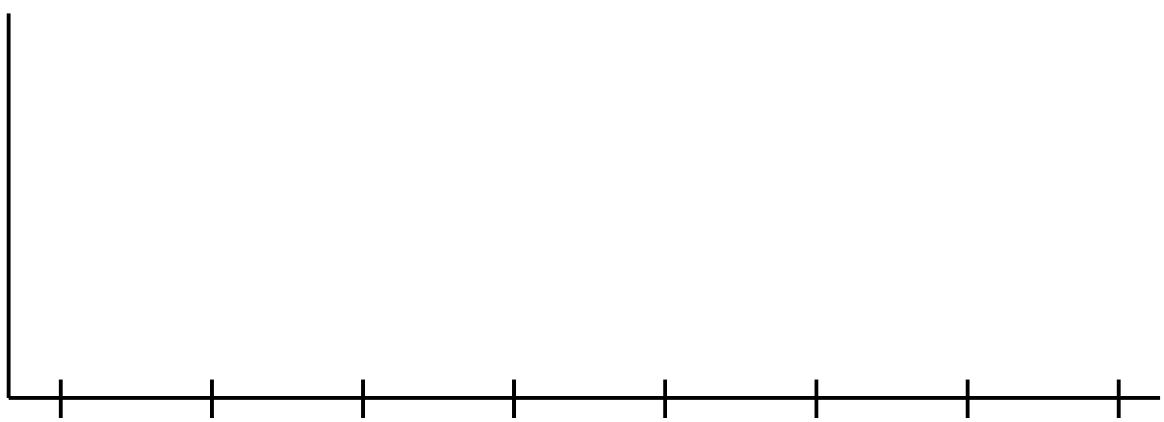
λ (nm)				
Color				

3. After looking at the spectrum of neon (Ne) and argon (Ar) with OceanView, **have a discussion with another group** about why neon is orange and argon is purple. Once you've reached a consensus, go over your explanation with the TA, then illustrate your explanation by sketching the spectrum of each below and indicate where the colors are coming from. Make sure to label the axis.

Gas: ____________________



Gas: ____________________



Part 3: Color and Temperature

*Try using your **peripheral vision** rather than looking directly at the light bulbs.*

1. Using the diffraction glasses, describe the appearance of the diffraction pattern and compare it to the bulb's spectrum. If you see white in the diffraction pattern, try moving further away to see if it disappears.

LED (A)	
Fluorescent (B)	
Incandescent (C)	

2. Working with another group, on a white board isolate the temperature T in Wein's law $T \cdot \lambda_{\text{peak}} = 0.0029\,\mathrm{K \cdot m}$ then estimate the temperature of the incandescent bulb and the Sun from the peak wavelength in their spectrum. Go through your calculations with your TA and have them mark below. Be prepared to compare their temperature and color.

TA	

3. **`Class Discussion`** Why are there large dips in the Solar spectrum? Write your thoughts on the white board where the TA has indicated. Make sure to write your names next to your response.