1) -**Definitions** (use Wikipedia for definitions). Be sure and include SI units.

Irradiance

Spectral irradiance

2) **Theory**

Because of the various ways (e.g., describing with respect to frequency or wavelength) of describing blackbody radiation there is some point of confusion in the units being used for a particular form or equation.

 An additional point of confusion is the use of different terminology for the different branches of physics.

For example, in the PASCO write-up on page 2, the relationship below (Eq-1) is called **intensity per wavelength**.

$I\left(λ,T\right)=\frac{2πc^{2}h}{λ^{5}}\left(\frac{1}{e^{^{hc}/\_{λkT}}-1}\right)$ Equation 1

According to **Optics** by Hecht (4th Ed) intensity is being replaced (in Optics) by the **radiometric term of irradiance.** Hecht defines quantity defined by Eq-1 as **‘**spectral irradiance’.

Show that the units of Equation 1 are the same as spectral irradiance.

3) **Examination of photometer sensor**

The ‘sensing element’ used by the PASCO high sensitivity light sensor uses a BaF2 window & a xenon gas-filled thermopile.

What is the definition of a thermopile?

What desirable properties does a BaF2 window possess that makes it particularly useful for this experiment?

See website below to answer question above on ‘window’ properties.

https://www.ebetteroptics.com/article/view/id/122.html?http://www.ebetteroptics.com/ybt2020=33&gclid=EAIaIQobChMIntz1gsLG9wIVCWpvBB1qfAI\_EAAYASAAEgKFCvD\_BwE

**Experiment analysis**

4) The index of refraction of the glass prism varies with the wavelength of light.

Using Eq-A4 from the PASCO write-up, calculate the index of refraction for angles measured for the peak intensity for the voltages measured in the experiment.

This will give you 3 indices of refraction that will correspond to the respective peak wavelengths (i.e., 3 different peak angles) of the 3 voltages used in the experiment.

 Once you calculate the indices of refraction, use the attached graph to read off the wavelengths (i.e., $λ\_{max}) $which correspond to the indices. Show work (lines) on the graph.

5) Finding temperature of bulb (at the various experimental voltages) using resistivity of tungsten

The temperature of the bulb used in this experiment can be obtained from Eq- A6 (page 14).

First you need to calculate the respective resistivities associated with the 3 voltages at which the experiment was run (i.e., 4, 7 & 8 V). Use Eq- A7.

Use Rholder @ 4 volts = 1 Ohms, Rholder @ 7 volts = 2 Ohms & Rholder @ 8 volts = 2.5 Ohms. These values were provided by PASCO. *Please note that V & I are the values that were recorded in lab for the 3 runs.*

Temperatures at 4, 7 & 8 volts can be calculated.

6) In question 4 above, you calculated 3 wavelengths at peak intensity. Wein Displacement Law can also be used to calculate the peak wavelength if the temperature of the blackbody is known. Using

$$λ\_{max}T=constant=0.002898 m\*K$$

Calculate the $λ\_{max}$ for the 3 runs. Compare these values to those obtained in question 4 above.