Laboratory 6: Photovoltaic and LED Circuits

Part1:

1. Plot voltage vs current for four different colors (red-orange, yellow, green, blue) of LEDs (place the LEDs in series with a 330Ω resistor. Do not exceed 20mA.

2. Fit a line to the higher current measurements for each LED and use the equation for this line to estimate both $V_{turn\ on}$ and the resistance of the diode when conducting.

3. Plot V_{turnOn} vs $1/\lambda$ (see drawer label for wavelength values) for these four LEDs and use the slope of this line to determine the value of Planck's Constant. Be sure to constrain the line to pass through zero - zero. Compare your result to the accepted value.

Part 2:

1. Connect the green LED to the DC power supply and measure the LED's luminosity for a variety of current values (keep current <20mA).

2. Plot the current versus luminosity and comment on the shape of this curve based on what we know about the behavior of solar cells under illumination.

Part 3:

1. Illuminate the solar cell with an incandescent light bulb. Measure the open circuit voltage and light intensity. You will vary the light intensity by changing the distance from the bulb to the solar cell. Repeat your measurements using the compact fluorescent bulb.

2. Plot open circuit voltage vs the natural log of the light intensity for the individual solar cell you used. Make a separate plot for the incandescent light bulb and for the compact fluorescent bulb. Fit a line to each curve.

3. Based on what you know from Physics of Renewable Energy about the relationship between open circuit voltage and the short circuit current (which is proportional to the light intensity) for a solar cell, explain the shape of these two curves. Make your best estimate of the dark current I_o for the solar cell using both the incandescent light bulb and the compact fluorescent bulb.

4. The compact fluorescent bulb appeared far brighter to us than the incandescent bulb. Explain why the solar cell you used showed a higher voltage (i.e. a higher light intensity) for the incandescent bulb than the CFL.