Light from various sources can produce different color spectra. Two of the most commonly used light sources that can produce spectra are fluorescent and incandescent light bulbs. The spectra produced by the lights can be observed through a diffraction grating or prism. The class observed and was able to tell the differences between the two lights and how they work just by seeing the colors that they give off in the diffraction grating. Another item that was observed in the lab was a hydrogen discharge tube. The class found the colors that were emitted in the diffraction grating and then researched the actual colors that hydrogen produced and also did the math to see which colors should have appeared according to The Bohr Model.

In researching fluorescent light bulbs, one finds that they work because mercury is ionized within the bulb itself, therefore causing the electrons in the gas to emit photons. The photons created are at UV frequencies which are morphed into visible light by the phosphor coating on the inside of the bulb. The process previously mentioned is achieved by the use of a sealed glass tube containing a small amount of mercury and an inert gas such as argon. The phosphor powder is also coated all inside the glass of the tube. Two electrodes that are located inside the tube and hooked up to an electrical current are also an important component of the process. Once the light is turned on, the electrical current causes the electrons to move across the tube therefore changing some of the mercury from a liquid to a gas. The gaseous mercury then collides with charged atoms and electrons, causing the atoms to jump to higher energy levels. When the atoms come back down to their normal energy level, light photons are then released.

Incandescent light bulbs are different from fluorescent light bulbs in the way they create light. When the electricity passes through into the wire or filament, it uses that energy to get extremely hot to the point of it glowing and giving off its own light. The filament used to create this light is normally tungsten. The processes of incandescent light bulbs relates to the

photoelectric effect. The photoelectric effect is when a current travels through a metal when a light is shone onto it. This can happen because the light gives some of its energy to the electrons in the metal which causes them to move around. However, the color of the light seemed to affect the amount of energy transmitted into the metal. This could only be explained by the idea of photons. The photons are what cause the incandescent light to work.

In the experiment conducted during class, the differences between fluorescent and incandescent light bulbs are evident through the colors that were visible using the diffraction grating. With the fluorescent light the colors red, orange, green, blue, and purple were all clearly visible. However, with the incandescent light only the colors red, green, blue, and purple were clearly seen. This experimental evidence helps to give visible proof of the differences between fluorescent and incandescent light bulbs.

A hydrogen discharge tube is a small tube that contains hydrogen gas and has an electrode at each end of the tube. The light appears in the tube when the electrodes on the outer edges allow the electrical current through, therefore exciting the hydrogen atoms and electrons. Based on research from a few sites, the most common colors that appear through the diffraction grating when it is pointed at the hydrogen are red, green-blue, blue, and purple. However, according to the experiment conducted during class, the green-blue color just seemed to be a straight green color. Then according to The Bohr model calculations and what can be found online, the numbers calculated for each color and the numbers found for each color were very similar.

1 Works Cited

2 Harris, T. (2014, January 1). How fluorescent lamps work. Retrieved October 1, 2014.

3 http://home.howstuffworks.com/fluorescent-lamp2.htm

4 Photoelectric effect. (2007, January 1). Retrieved October 1, 2014.

5 http://www.einsteinyear.org/facts/photoelectric effect/

1

The Bohr Equation:

$E = -R_H c\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$

a) $n=6 \rightarrow n=2$

$E = -(1.0974 \times 10^7\ m^{-1})(6.626 \times 10^{-34}\ J \cdot s)(2.998 \times 10^8\ m/s)\left(\frac{1}{2^2} - \frac{1}{6^2}\right)$

$E = -2.179 \times 10^{-18}\ J/\text{atom}\left(\frac{1}{36} - \frac{1}{4}\right)$

$E = -2.179 \times 10^{-18}\ J/\text{atom}\left(\frac{1}{36} - \frac{9}{36}\right)$

$E = -2.179 \times 10^{-18}\ J/\text{atom}\left(-\frac{8}{9}\right)$

$E = 4.842 \times 10^{-19}$

$4.842 \times 10^{-19} = \frac{(6.626 \times 10^{-34})(3.00 \times 10^8)}{\lambda}$

$\frac{4.842 \times 10^{-19}}{4.842 \times 10^{-19}}\lambda = \frac{1.9878 \times 10^{-25}}{4.842 \times 10^{-19}}$

$\lambda = 4.1059 \times 10^{-7}$

b) $n=5 \rightarrow n=2$

$E = -2.179 \times 10^{-18}\left(\frac{1}{25} - \frac{1}{4}\right)$

$E = -2.179 \times 10^{-18}\left(\frac{1}{25} - \frac{1}{4}\right)$

$E = -2.179 \times 10^{-18}\left(\frac{4}{100} - \frac{25}{100}\right)$

$E = -2.179 \times 10^{-18}\left(-\frac{21}{100}\right)$

$E = 4.5759 \times 10^{-19}$

$4.5759 \times 10^{-19} = \frac{(1.9878 \times 10^{-25})}{\lambda}$

$\lambda = 4.3446 \times 10^{-7}$

d) $n=3 \rightarrow n=2$

$E = -2.179 \times 10^{-18}\left(\frac{1}{3^2} - \frac{1}{2^2}\right)$

$E = -2.179 \times 10^{-18}\left(\frac{1}{9} - \frac{1}{4}\right)$

$E = -2.179 \times 10^{-18}\left(\frac{4}{36} - \frac{9}{36}\right)$

$E = -2.179 \times 10^{-18}\left(-\frac{5}{36}\right)$

$E = 3.0264 \times 10^{-19}$

$3.0264 \times 10^{-19} = \frac{(1.9878 \times 10^{-25})}{\lambda}$

$\lambda = 6.5688 \times 10^{-7}$

c) $n=4 \rightarrow n=3$

$E = -2.179 \times 10^{-18}\left(\frac{1}{9} - \frac{1}{16}\right)$

$E = -2.179 \times 10^{-18}\left(\frac{1}{16} - \frac{1}{9}\right)$

$E = -2.179 \times 10^{-18}\left(\frac{1}{16} - \frac{11}{144}\right)$

$E = -2.179 \times 10^{-18}\left(-\frac{7}{144}\right)$

$E = 4.0558 \times 10^{-19}$

$4.0558 \times 10^{-19} = \frac{(1.9878 \times 10^{-25})}{\lambda}$

$\lambda = 4.9026 \times 10^{-7}$

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