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) $n=4 \rightarrow n=3$

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

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

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

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

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

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

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

2

Work Sample Evaluation

Subject Area: Chemistry
Task Title: Why Are the Colors in Some Rainbows Broken?
Student Work Sample Title: RAINBOW PROJECT

The document was scored using the *CCR Task Bank Rubric*. The final scores are indicated in the following chart.

Scoring Criteria	Insufficient Evidence	Developing	Progressing	Accomplished	Exceeds
Research and Investigation	**X**				
Ideas and Content			**X**		
Reading and Analysis		**X**			
Communication			**X**		
Organization		**X**			
Accuracy		**X**			

Annotations: The following evidence from the work sample and the reviewer's comments support the scores above. Page and line numbers refer to the original work sample.

Scoring Criteria	Page #	Line #	Commentary about the work sample
Research and Investigation: *Locating resources independently and/or identifying information within provided texts*	1-3		The score is insufficient evidence because no actual sources were cited within the text, even though the student listed resources in the Works Cited page. Therefore, there is no way to determine how well the sources were utilized.
Ideas and Content: *Presenting a thesis and understanding concepts*	1	1	The first sentence of the document seems to contain the thesis. It is extremely simple and does not include any specific information about the types of light or how this is addressed within the paper.
	2	18-20	The student discusses the Bohr Model of the atom. However, the student provides only a brief explanation and adds nothing about the limitations to the model.
Reading and Analysis: *Evaluating sources and selecting evidence to support the central idea*	1-2		The student does not appropriately evaluate the sources being used (the two sources would not be considered strong sources for a scientific document).
	1-2		The central idea presented on the spectra of various types of light is addressed well. However, due to the lack of citations, it is difficult to determine how the writing is related to information presented in research.
Communication: *Using subject-appropriate language and considering audience*	1-2		The paper is well written with appropriate language for a scientific document.
	1-2		It is easy to understand the writing in the work sample.
Organization: *Structuring main ideas and supporting information*	1-2		While there is an introduction, followed by discussions of fluorescent light, incandescent light, experimentation, and Bohr's Model, no connection is drawn between the different types of light.
	2	20	There is no conclusion presented to wrap up the entire document and review information that has been addressed.
Accuracy: *Attending to detail, grammar, spelling, conventions, citations, and formatting*	1-2		References were provided in a Works Cited page but were not documented in the text. Without in-text citations, there is no way to determine how the research was used within the paper.
	1-2		Though the grammar and sentence construction were appropriate within the work sample, the lack of citation is a critical fault in this paper.