

1 Fluorescent light, incandescent light, and hydrogen discharge light are very similar in the
2 fact that they release a photon to create light (How Stuff Works 2). In atoms, when the electrons
3 are in an excited state, they jump. Due to the large amount of energy needed to be held in a higher
4 orbital, electrons fall quickly. During the fall, the electron releases energy. The release of energy
5 comes in the form of a light photon (2). These photons have then been refined and applied to each
6 light source. The goal of any light source is to channel photons through a chemical reaction.
7 Thus, this makes fluorescent light, incandescent light, and hydrogen discharge similar because they
8 all use a chemical reaction (2).

9 These chemical reactions also cause a major difference between the three light sources.
10 For fluorescent lighting, it all begins with an electrical current traveling down the tube. This
11 causes the negatively charged electrons to move to the positive side of the tube. When the
12 electrons quickly travel to the other side of the tube, they collide with the large mercury atoms.
13 Thus, the electrons become excited and travel to the next energy level. After all the energy is
14 released, they fall down releasing a photon (2). The light spectrum from an electron comes from
15 the different electron configuration in the atom. All elements have differing arrangements and
16 scientists have found:

17 'The electrons in mercury atoms are arranged in such a way that they mostly release
18 ultraviolet wavelength range. Our eyes don't register ultraviolet photons, so this sort of
19 light needs to be converted into visible light to illuminate the lamp" (3).

20 This has to be countered to create a visible light source which is done by using a phosphorus
21 coating.

1 Incandescent lighting uses a polar opposite technique: heat. Incandescent light is
2 formed when a filament, generally tungsten, is heated, it begins to glow due to energy transfer
3 through the electrons in the bulb (Wise Geek 1). Similar to the fluorescent bulb, the electrons
4 in the tungsten become excited and release a photon due to the process described above.
5 "About 12% of the radiation is visible light" (1). As a result, no method is required to turn it
6 into visible light.

7 The final lighting method is hydrogen discharge. This works similar to the fluorescent
8 lighting due to the fact that the electrons in hydrogen are excited from an electrical current
9 traveling through the tube. When the electrons become excited from the electricity, they jump
10 energy levels. This method differs from the fact that no gas or heat is used to excite the atoms.
11 They move due to the electricity and how it reacts with hydrogen.

12 The similarities and differences cannot only be described from the creation of each light
13 source, but also through experimentation and diffraction gratings. Each of the light sources
14 contains a red and green band, except for fluorescent light. Incandescent light releases the most
15 visible light while fluorescent light releases the least, containing only one band of visible light.
16 Incandescent light and hydrogen light had very similar bands except for the fact that the
17 incandescent light contained blue while hydrogen discharge contained purple. These differences
18 and similarities can be accounted for due to the fact each element contained in the light source
19 has a different electron configuration (How Stuff Works 2). The differences are dictated by the
20 fact that each element has a number of orbitals. Hydrogen has only one electron causing it to
21 occur at a lower diffraction scale while tungsten and the elements contained inside a fluorescent
22 light have a higher number of electrons thus allowing more energy to be released as it falls.

1 The final way to determine similarities and differences between the three light sources is
2 through a mathematical equation, specifically the Bohr model. This model demonstrates the
3 correlation between levels moved and the amount of energy released: $E = -Rhc\left(\frac{1}{n_{2f}} - \frac{1}{n_{2i}}\right)$
4 For the four hydrogen emission lines, this equation was used to find the amount of energy
5 released.

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

-4.84×10^{-19}

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

-4.57×10^{-19}

C) $n=4 \rightarrow n=2$

-4.08×10^{-19}

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

6 -3.03×10^{-19}

7 This information can now be used to find the wavelength, with the equation: $E = hc/\lambda$.

8 A) 2.44×10^6

9 B) 2.30×10^6

10 C) 2.05×10^6

11 D) 1.53×10^6

12 These lines demonstrate a correlation between the amount of energy lost and the height of the
13 electron in the orbital, the higher the electron jumped the higher the energy released.

1 Bibliography:

Diffraction Grating. (n.d.). Retrieved September 29, 2014, from <http://www.physics.smu.edu/~scalise/cmmanual/diffraction/lab.html>

Harris, T. (n.d.). How Fluorescent Lamps Work. Retrieved September 28, 2014, from <http://home.howstuffworks.com/fluorescent-lamp.htm>

2 What Is Incandescent Lighting. (n.d.). Retrieved September 28, 2014, from <http://www.wisegeek.com/what-is-incandescent-lighting.htm>

Work Sample Evaluation

Subject Area: Chemistry

Task Title: Why Are the Colors in Some Rainbows Broken?

Student Work Sample Title: Spectrum 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: <i>Locating resources independently and/or identifying information within provided texts</i>	4		While the work sample includes references to “How Stuff Works” and “WiseGeeks,” these are not authoritative sources for a scientific paper. However, the college resource does work.
	1-3		While it is apparent that the student located the resources, there is not enough evidence to determine how well they were used in the work sample. The student used a few citations scattered throughout, but it is obvious that there should have been more.
Ideas and Content: <i>Presenting a thesis and understanding concepts</i>	1	6-8	While there is a thesis statement present, it is somewhat unclear what the student will be addressing in the work sample. The discussion of a chemical reaction seems inappropriate because the entire production of photons comes through the excitement of electrons not the change of a chemical substance into something new.
	1-3		The rest of the document discusses the different types of light and contains very few errors.
Reading and Analysis: <i>Evaluating sources and selecting evidence to support the central idea</i>	1-3		The student does integrate some of the resource materials into the work sample, however this occurs only where the writer is presenting factual information and no evaluation of the information is indicated.
Communication: <i>Using subject-appropriate language and considering audience</i>	1-3		The language used throughout the work sample is appropriate for a science report.
	1	6-8	I believe the use of the wording, “chemical reactions,” is incorrect. I believe the writer was trying to use appropriate language throughout the work sample without an understanding of what sources to use in this instance.
Organization: <i>Structuring main ideas and supporting information</i>	1-3		There is an introduction, discussion of the different forms of light, and discussion of similarities and differences; however, two things are blatantly missing. The discussion of the limitation of Bohr’s Model of the atom and a conclusion are not present in the work sample.
	2	12-22	This section discusses the similarities and differences in the different types of light; however, the student could bring in more information and report actual data from the experiment in order to appropriately represent the content more.
	1	3	The terms “they jump” could be rephrased in a more appropriate scientific way.
Accuracy: <i>Attending to detail, grammar, spelling, conventions, citations, and formatting</i>	1-3		The grammar and sentence structure used in the work sample were not major issues throughout this section.
	1	8	In other areas of the document, the limited use of In-text citations narrowed the score in this area.