Name_____Date_____Period_____

Line Emission Spectra of Elements

Pre-Lab Discussion

Each element in the Periodic Table has a specific number of electrons in specific energy levels. When atoms of any element absorb energy, electrons move from lower to higher energy levels. As these electrons fall back into their original energy levels, the excess energy is released as electromagnetic radiation.

The characteristic patterns of radiation for different elements are called atomic spectra. For some elements, this radiation is in the visible region of the spectrum. Atoms of gases can emit visible light of characteristic wavelengths when excited by electricity. The color you see is the sum of all of the emitted wavelengths. In this experiment, you will use a spectroscope to separate these wavelengths into emission line spectra. The purpose of this activity is to observe and compare a spectrum from white light with the emission spectra of several elements.

1. Explain how electrons in an element's atoms produce an emission spectrum.

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2. Distinguish among a continuous spectrum and an emission spectrum.

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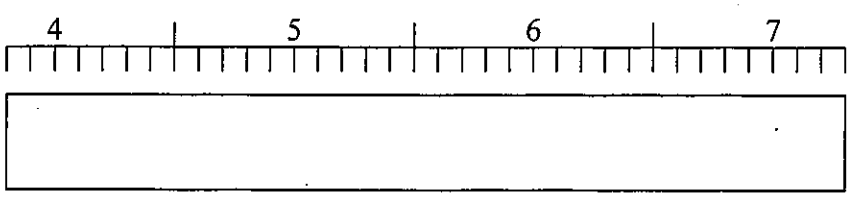
Procedure

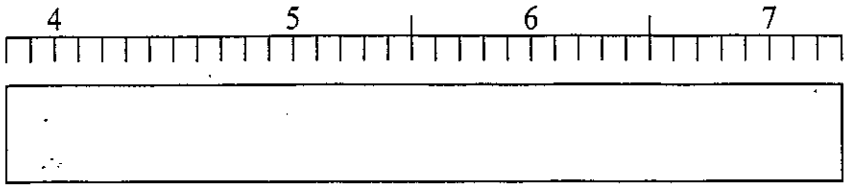
1. Obtain a spectroscope. Hold it with the straight edge to the left and the angled edge to the right. Avoid touching the transparent material that encloses the diffraction grating.

2. Aim the slit directly at (or slightly to the right of) the light source; look to the right to view the diffraction grating. There should be numbers ranging from 4 to 7 with colored bands underneath.

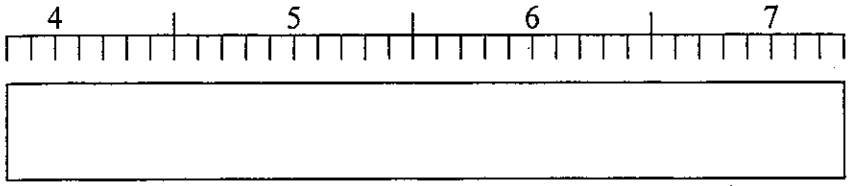
3. Use the spectroscope to view an incandescent light bulb. What do you observe? Draw the spectrum using colored pencils.



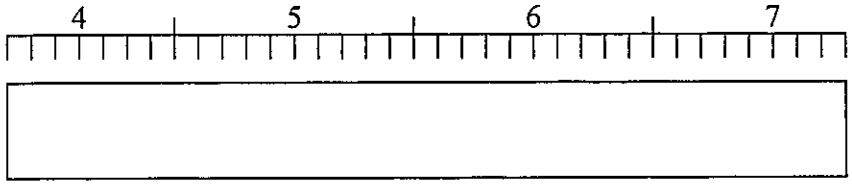
4. Next, observe the light produced by the spectrum tube containing hydrogen gas and record your observations.



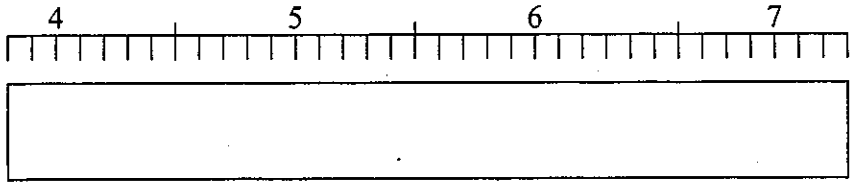
5. Observe and draw the emission spectra for Helium.



6. Observe and draw the emission spectra for Mercury.



7. Observe and draw the emission spectra for the florescent lights.



8. Compare the spectra of the florescent light to that of Helium and Mercury. What is the gas inside the fluorescent light bulb? Support your conclusion with data from your observations.

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Analysis and Conclusions

1. How can the existence of spectra help to prove that energy levels exist in atoms?

2. How can the single electron in a hydrogen atom produce all of the lines found in its emission spectrum?

3. How do you interpret the fact that other elements emit many more spectral lines than hydrogen atoms?

4. How can spectra be used to identify the presence of specific elements in a substance?

5. Helium was discovered in the Sun's corona during the eclipse of 1868. In 1888, traces of helium were isolated on Earth. Discuss how scientists could tell this was the same gas that had been identified in the Sun's corona.