emission spectra and flame tests essay sample

Intro

The emission spectrum is used in modern chemistry to help further studies of wavelengths and the spectrum. When a metal in a compound reacts in a flame and produces a color, it helps to show the strongest color in the emission spectrum. The purpose of performing these operations on the flame was to see how different metals would react. Using a spectroscope, it is possible to observe the line emission spectrum produced by sunlight, artificial light, and various other gases. The operations performed relates to the bands of light and wavelength studied in class.

Procedure

In part one of the lab, a spectroscope is used to study the light emission spectrum emitted from sunlight, artificial light, and various other gases. To become organized; drawing boxes, collecting colored pencils, and picking a spectroscope is the first thing to do. After setting up the boxes, a spectroscope is used to study the light from outside, inside (artificial), and from three spectroscope tubes. It is detrimental to write down where each spectral line falls and what color it is, especially for identifying the unknown " D". The spectroscope illustrates where each individual light's spectral lines are apparent.

In the second part of the lab, flame tests are conducted on different metallic compounds. A Bunsen burner is used along with ten compounds to test to see which color is the strongest in each element's spectrum. Three pairs of the compounds are the same. Each compound is soaked into a wooden stick. It's important that not only does the stick not burn when testing the compound but also that the compound doesn't drip and cause contamination. Colors that are emitted from the flame, when the metal in the compound reacted, are observed and noted.

Results

In part one, a spectroscope is used to see the line emission spectra in various types of light. Hydrogen, nitrogen and “ unknown D” were observed in spectrum tubes while the natural sunlight was observed from outside the window and artificial light from the lights in the classroom. Hydrogen had four distinct lines of red with the wavelength 650 nm, teal with the wavelength of 480 nm, blue with the wavelength of 430nm , and purple with the wavelength of 410 nm. In nitrogen, its spectrum has many lines for each color of red, orange, yellow, green, blue, and purple. The red wavelength started on 630 nm, orange on 620 nm, yellow on 570nm, green on 500 nm, blue on 430 nm, and purple on 400 nm.

The “ unknown D” was to be found as Sn, or Tin. It has a few thin wavelength lines for the colors red, orange, yellow, green, and with only one blue wavelength line at 450 nm and no purple wavelength lines. The element was found by comparing the drawing to an online source of element’s emission spectrum. The natural light and artificial light were very different. Natural light had no distinct lines and included all the colors flowing together. The artificial light was found to have a few distinct lines of red, orange, green, blue, and purple. Flame tests were conducted in the second part of the lab. Compounds used were potassium chloride (KCl), barium chloride ($BaCl_2$), calcium chloride ($CaCl_2$), strontium nitrate ($Sr(NO_3)_2$), sodium chloride (NaCl), lithium chloride (LiCl), copper II nitrate ($Cu(NO_3)_2$), and three unknown compounds. The metal in these compounds became excited when put into the flame and each made a brilliant color.

In potassium chloride, the potassium was excited and produced a light lavender color in the flame. Barium chloride produced a lime-yellow color when the barium was excited in the flame. In calcium chloride the calcium was excited to make a deep orange color. Strontium nitrate, whose metal is strontium, produced a bright red color in the flame. The sodium in sodium chloride made an orange color when it was tested in the flame. Lithium chloride was an exciting purple color that switched back and forth to orange as well when the lithium metal mixed with the flame. The orange color could be due to the wooden stick burning in the flame. Copper II nitrate produced a green color in the flame when Copper was excited.

The first unknown compound " A" is identified as sodium chloride because of it's matching orange color that the sodium produced in the flame. The unknown metal of " B" is copper because of its identical green flame that the compound copper II nitrate produced. The unknown " B" and copper II nitrate also has the same color liquid so it was predicted before the test that they would be the same. The unknown compound " C" produced a red very similar to the strontium nitrate produced when the strontium metal reacted in the
flame.

Error Analysis

Although calculations cannot be taken for the percent error, inaccuracy can be detected in both part one and two of the lab. In part one, the glasses used were not always clear. The numbers on the spectrum could not always been seen due to lack of light. This can be fixed by acquiring new glasses that were all equal and the numbers clear. In part two of the lab, errors can come from two different aspects. The first is that the metal compound dripped from the wooden stick and contaminated the flame. This would make the flame bright orange (depending on the metal compound) and thus make the color recordings flawed. Mistakes can also be made because the wooden stick could burn in the flame. When the wooden stick burned it would make the flame a bright orange. These two different errors cannot be fixed. The only way for the flame to not get contaminated is if instead of using a wooden stick, another object could be used that doesn't burn as easily in the flame and doesn't let the metal compound drip so easily.

Conclusion

The wavelengths of elements can be determined by using a spectroscope and spectrum tubes. The atoms in their excited state were able to go back to their low energy conditions in which some generated strong lines to produce the emission spectrum. The spectroscopes helped identify where these spectra lines are. The flame tests showed the color that the strongest spectral lines are for each element.