Emission Spectra

Introduction

Some elements, especially metals, give off light in the visible spectrum when heated. This is because the heat causes some of the electrons in the atoms to be excited and to occupy higher energy states. These electrons rapidly move back to their "ground state" and give off light. Since there are many different kinds of electrons that are moving the color you see is a result of several colors of light being added together. These individual colors can be seen with a spectroscope and this type of spectrum is called an ***emission spectrum***. These colors can be quite vivid and are responsible for the beautiful colors of fireworks. These colors are also useful for identification of the metals (the procedure is called a flame test) and can be used in much more sophisticated instruments to even tell how much of a particular metal is present. In this lab exercise you will observe the characteristic colors of several metals. These metals are in compounds with nonmetals, but the nonmetals (chlorides) do not give off visible light when heated.

Another method of identification is to take a gas vapor of a metal or nonmetal and run electricity through it. This excites the atoms and causes them to emit light, sometimes in the visible region. You will also explore this technique (the gas discharge tube) in this lab.

Finally you will observe the type of spectrum when a solid or liquid is heated to a very high temperature. All the colors seem to run together. This is called a ***continuous spectrum***. Although not a solid the sun also gives a continuous spectrum to a good approximation.

Procedure

1. Take a wooden splint that has been saturated in either a solution sodium chloride, strontium chloride, barium chloride, cupric chloride, potassium chloride, lithium chloride, or calcium chloride and hold momentarily in a Bunsen burner flame. Record the color of the flame. Repeat with the other solutions.

Substance	Color
sodium chloride	
strontium chloride	
barium chloride	
cupric chloride	
potassium chloride	
lithium chloride	
calcium chloride	

Unknown number	Color	Identity

2. Take a holographic grating film (or spectroscope) and look at outside daylight and an incandescent light. (Don't look at the sun!)

Describe what you see.

This is an example of a _____ spectrum.

3. Now your instructor will take a tesla coil (or power supply) and will excite a rarified gas in a tube. Observe the color. Then take a holographic grating film (or spectroscope) and observe how the color is broken down into individual colors. Each color is caused by a different type of excited electron moving from a higher energy state to a lower one.

How is this spectrum different from the previous one?

This is an example of an _____ spectrum.

Gas in tube	Apparent color	Different colors seen with grating

Describe applications of this technique that you see in everyday life.

4. Access the web site, http://scifun.chem.wisc.edu, and link to the "Chemical of the Week". Then go from there to "Gases that emit light", and read and explain how fluorescent lights work.