Colored Flame Lab Name:_____

You have probably seen Fourth of July fireworks, or maybe you have been entertained by them at a game. Well, here is some chemistry in action. It is the same chemistry that you see when a few drops of soup or milk spill into the gas flame on your stove. Likewise, chemicals are added to fireplace logs to give the fire interesting colors. When an element is heated, its electrons absorb energy and move from one energy level to a higher one. As they drop back to position they emit energy, in the form of light, and this is the light you are seeing in the firework.

In any atom, there are always higher energy levels that are unoccupied. If an electron acquires sufficient energy (from heat, light, or electricity, for example) it can jump to one of the higher energy levels. When this happens, the atom is said to be excited. The "excited" state is unstable though, and that electron drops back to its original position or "ground state", though it may drop through intermediate levels on its way down. Radiant energy is emitted at every drop. The radiant energy emitted as the electron drops back to lower available levels is equal in amount to the difference between the two energy levels. The color of the light emitted corresponds to this energy change. A series of lines is produced for each element because there are many energy level transitions possible. Since every element has a unique electron arrangement, every element produces its own pattern or "spectrograph". These line patterns can be used to identify elements, and this field of study is called spectroscopy.

When you heat an element you should see one color, and that element will always produce the same color when heated. This is a combination of all the spectral lines produced by the element's moving electrons. To see individual spectra lines, a spectroscope is used. It splits the flame into its component colors (wavelengths) by means of a light diffraction grating.

Materials

Bunsen burner

250 ml beaker full of tap water

Wood splints (known chemicals)

Unknown wood splints

Procedure

1. Get safety glasses and put them on. Make certain all long hair is tied back.
2. Fill a 250 ml beaker with tap water. This will be used to extinguish flames from the wooden splints you will use.
3. Set up a Bunsen burner at your table do not light it until you are ready.
4. Obtain your known samples. Be careful not to let the wet wood splints touch each other or you will contaminate them and your data will be incorrect.
5. Record the chemical name and formula of the chemical each splint was soaking in on the data table.
6. Light your Bunsen burner and carefully test each splint, as it was demonstrated. Record the color of the flame in the data table.
7. Extinguish the wood splint in your beaker of water.
8. Test all known samples.
9. Test the unknown samples and determine the ion responsible for the color of the flame. Record this data in another chart and include both charts in your report. You will be graded on your ability to identify the unknowns so work carefully!

Questions

1. Why do you think that you see different flame colors for different compounds?

2. What ion could be used to make Green fireworks?

3. What ion could be used to make Red fireworks?

4. What ion could be used to make Yellow fireworks?

5. What ion could be used to make Pink/Purple fireworks?

6. Looking at your data, which ion (cation or anion) is responsible for the flame color?