

Name: _____

Period: _____

Seat#: _____

Required Sections: (Refer to R-5 for guidelines and requirements. Make note of any specific changes given by your teacher in class.)

Prelab: Purpose, Prelab Questions, Materials, Reagent Table, Procedures, and set up Data Tables before you get to class.

During Lab: Data section – Fill out your data table that is already set up from the prelab.

Post-lab: Discussion Questions Section (done in lab notebook), Post-Lab Two Pager (done on separate worksheet).

REMINDER - USE R-5 TO ENSURE YOU FOLLOW ALL GUIDELINES/EXPECATIONS/ REQUIREMENTS

Background

Have you ever seen a fireworks display? Where do all of the colors come from?

In this activity, you will investigate the colors of flame produced by solutions of metal salts.

A flame test is a procedure used to test qualitatively for the presence of certain metals in chemical compounds. When the compound to be studied is excited by heating it in a flame, the metal ions will begin to emit light. Based on the emission spectrum of the element, the compound will turn the flame a characteristic color. This technique of using certain chemical compounds to color flames is widely used in pyrotechnics to produce the range of colors seen in a firework display.

Certain metal ions will turn the flame very distinctive colors; these colors in turn can help identify the presence of a particular metal in a compound. However, some colors are produced by several different metals, making it hard to determine the exact ion or concentration of the ion in the compound. Some colors are very weak and are easily overpowered by stronger colors.

In this activity, solutions of ionic salts are sprayed into a Bunsen burner apparatus. You will be able to see the different colored flames produced. By comparing the color given off by an unknown with the known metal salts, the identity of the unknown metal salt can be determined.

Materials - Remember that a * means it should be in your reagent table

Equipment

- Bunsen Burner
- Matches

Chemicals

0.1 M solutions of the following compounds:

- * Barium Chloride
- Calcium Chloride
- * Copper (II) Chloride

- * Lithium Chloride
- Potassium Chloride
- Sodium Chloride
- Strontium Chloride
- Barium Nitrate
- Calcium Nitrate

- * Copper (II) Nitrate
- * Lithium Nitrate
- Potassium Nitrate
- * Sodium Nitrate
- * Strontium Nitrate

[Google Folder with Most MSDS Files](https://tinyurl.com/2cyva3ku)

<https://tinyurl.com/2cyva3ku>

To help speed up your reagent table!



[Flinn's MSDS Website](https://www.flinnsci.com/sds/)

<https://www.flinnsci.com/sds/>

For anything that isn't in my Google folder.



Prelab Questions - Do not recopy the questions, just paraphrase them into your answer well enough that it will remind me what the question was about.

1. Draw a labeled diagram of absorption and emission.
2. What subatomic particles are found in the atoms that are responsible for the production of colored light?
3. What does it mean when the electrons are “excited” versus at “ground state?”
4. Which step of the whole process, absorption or emission, is responsible for the production of colored light?
5. Using your answers to questions 1-4, explain in detail how absorption and emission works, and how it is related to the production of colored light.

Procedure – Remember to make a flow chart, include diagrams/drawings of steps/equipment etc. Google “flow chart procedures” if you are not familiar with how to make a flow chart. You aren’t just drawing boxes around all your sentences!

- 1) Light the Bunsen burner and open the air vent to obtain a non-luminous flame with two blue cones.
 - Be sure to avoid a yellow flame.
- 2) Spray the first sample into the bottom of the apparatus.
 - You can spray a few times until you get an intense color, but please do not be wasteful!
 - Spray at a 45-degree angle upwards. Do NOT spray towards anyone!
- 3) Record the color and intensity (bright/faint) of the flame in the data table.
- 4) Repeat steps 2 & 3 with the other salt solutions. Be sure to record the colors as precisely as possible.
- 5) Make sure that you also repeat the steps with Unknown 1 and Unknown 2. You will compare the colors emitted from the unknowns with the known salts/colors to identify what the Unknown solutions were.

Disposal and Cleanup

Your teacher will provide disposal and cleanup instructions.

Data Table - Remember to use enough space, make it look professional, etc!

Make your own data table! Remember, you need to make sure your data table has all required elements! A sample is provided below. You will need to add a descriptive title, etc. The one shown here is not adequate!

Hint - Metal atoms are found in the s-block and d-block of the periodic table. There are a few metals in the p-block but we are not using any of those for this lab. Look at the chemical formula and determine which atom would be the metal. The color we observe is coming from the metal atoms. They are the only atoms in the compounds that have electron transitions in the visible range!

Chemical Formula of Metal Salt	Metal Atom Found in the Salt Compound	Flame Color and Intensity

Sample Table

*Don't forget that you will need rows for Unknown 1 and Unknown 2

Post Lab Discussion Questions – To be done AFTER the lab is done. Do not recopy the questions, just paraphrase them into your answer well enough that it will remind me what the question was about.

- 1) How were the electrons “excited” in this part of the experiment – how did we physically do it in the lab?
- 2) Why do different chemicals emit different colors of light? What is it about the atomic structure that is resulting in different colors being emitted?
- 3) List the colors observed in this lab in order from the highest energy to the lowest energy. (You don’t need to know the actual wavelengths to do this, we are just ranking them from high to low).
- 4) Based on the results of your experiment, what metal(s) was found in the unknown(s)? Explain how you know this.
- 5) Explain why we did not see distinct lines (like on an emission spectrum) when the metal salts were burned. In other words, what piece of equipment didn't we use that would have taken the colored light we saw and turned it into an actual line spectra?
- 6) Do you think we can use the flame test to determine the identity of unknowns in a mixture? Why or why not?
- 7) Colorful light emissions are applicable to everyday life. Where else have you observed colorful light emissions?