

Flame Tests of Elements - VIRTUAL

Laboratory Experiment # _____

RESEARCH QUESTION: Could flame tests be useful in identifying the identity of elements?

Background: When metals are heated, their valence electrons become excited and jump up to higher energy levels. These energized electrons are not stable at higher energy levels so they fall back down to lower energy levels, giving off their extra energy as specific wavelengths of light. As a result, metals impart characteristic colors to a flame. The flame test is used to visually determine the identity of an unknown metal or metalloid ion based on the characteristic color the salt turns the flame of a Bunsen burner. The heat of the flame excites the metals ions, causing them to emit visible light. The characteristic emission spectra can be used to differentiate between some elements.

Pre-Lab:

1. Fill in the blanks (rewrite in lab notebook under "Pre-Lab")

When the atoms of metals in solution are excited by heating, their _____ are able to move from their _____ state to an _____ state. This high energy state is _____ so the electrons return to ground state releasing _____. This energy corresponds to particular wavelengths of _____, and so produces particular _____ of light. Each element has its "fingerprint" in terms of its _____ line emission spectrum.

2. CLAIM: Answer the research question from above here...

3. Complete the second column of Data Table 2 by filling in the cations, positive ions, for each of the given salts (one has been done for you)

Objective: To perform flame tests with a variety of metal compounds and identify unknowns based on these flame test results. You will be identifying the metals that exist as cations in solution.

Materials:

Bunsen burner, cleaning solution, wire loop, solid samples of NaCl, KCl, LiCl, CaCl₂, SrCl₂, BaCl₂, CuCl₂, BaCO₃, 1 Unknown

Caution:

- Wear your safety goggles at all times (if you were in person)
- Do not leave a flame unattended (if you were in person)
- Do not taste any of the substances or touch them with your hands (if you were in person)
- Make sure to place the wire loop in the cleaning solution after each salt to avoid cross-contamination

Procedure:

1. Use the following link to get to the simulation: https://www.newpathonline.com/free-curriculum-resources/virtual_lab/Flame_Test/9/12,13,14/1914
2. Follow all steps as outlined in the simulation
3. Dunk the wire loop into the cleaning solution
4. Now put the wire loop into the cup on solid salt so that some sticks to the wire loop. Place the wire loop into the flame/click on the flame.
5. Record the flame color in your table below. **Be as SPECIFIC as possible when recording the flame color, it will help when trying to identify your unknowns.**
6. Repeat this procedure until you have completed your data table.
7. Once Data Table 1 is complete, complete Data Table 2 on the next page for your unknown salt

Table 1: Known Solutions

Solid Salt	Metallic Cation	Flame Color
NaCl	Na ⁺	
LiCl		
KCl		
CaCl ₂		
SrCl ₂		
BaCl ₂		
BaCO ₃		
CuCl ₂		

For the unknown station... The unknown is one of the solids you examined above. Based on the color imparted to the flame, identify the metals present in each of the unknown solutions. Make a prediction first and then after record the identity of the unknowns after comparing flame colors

Table 2: Unknown Solution

Substance	Flame Color	Solid Salt Prediction
Unknown #1		

Questions: Answer on separate paper in COMPLETE SENTENCES!! **MUST BE HANDWRITTEN.**

1. Explain, thoroughly, how the colors of the flame test are produced (in terms of atoms). Use appropriate vocabulary from this unit.
2. You have just returned from the moon with a handful of crystals. Describe how you could use flame tests to identify some elements that might be in these crystals.
3. If a pan of milk boils over on a gas stove, the flame turns orange/red. Explain why.
4. What is a spectroscope? What is observed if each flame test is viewed through a spectroscope?
5. In your own words, explain the following terms: (a) quantum (b) ground state (c) excited state
6. What are some drawbacks for using flame tests for identification purposes?

Conclusion: Connect your claim (from pre-lab) and your evidence (from the lab experiment) using the following format...**MUST BE HANDWRITTEN.**

- The evidence from the Flame test shows...
- I know (from our notes...Bohr Model, Excited vs. Ground State Electrons)...
- I can apply (the big ideas...Bright Line Spectra/Emission spectra)...
- Therefore, I can conclude that...