**C1.1E, C2.4a, C2.4c, C2.4d: Flame Test** [**http://youtu.be/NEUbBAGw14k**](http://youtu.be/NEUbBAGw14k)

**Problem:** Can elements be identified by using a flame test?

Hypothesis:

Purpose:

Variables: (Dependent, Independent & Controls)

**Materials:** (per group)

* Nichrome wire
* Candle
* Dilute hydrochloric acid (2M HCl)
* Distilled water
* 2 small beakers
* 8 test tubes
* Test tube rack
* 8 chloride test solutions:
* 0.1M LiCl
* 0.1M CaCl2
* 0.1M KCl
* 0.1M CuCl2
* 0.1M SrCl2
* 0.1M NaCl
* 0.1M BaCl2
* Unknown solution
* Safety goggles

**Procedure:**

* 1. Label each of the test tubes with one of the following compounds: LiCl, CaCl2, KCl, CuCl2, SrCl2, NaCl, and BaBr2, unknown.
  2. Pour 5 mL of each test solution in the correctly labeled test tube. Be sure to put the correct solution in each labeled test tube.
  3. Clean the wire by dipping it into the dilute hydrochloric acid and then into the distilled water. Heat the wire in the blue flame of a candle until the wire is glowing and you no longer see colors in the burning flame.
  4. Dip the clean wire into the first test solution. Hold the wire at the tip of the inner cone of the burner flame. In the data table record the color given to the flame.
  5. Clean the wire by repeating step 4.
  6. Repeat step 5 & 6 for each of the other six known solutions. **Remember to clean the wire after testing each solution.**
  7. Obtain an unknown solution form your teacher. After cleaning the wire, repeat the flame test for this compound.

**Data Table:**

|  |  |  |
| --- | --- | --- |
| **Compound** | **Metal Ion** | **Color of Flame** |
| Lithium Chloride LiCl |  |  |
| Calcium Chloride CaCl2 |  |  |
| Potassium Chloride KCl |  |  |
| Copper Chloride CuCl2 |  |  |
| Strontium Chloride SrCl2 |  |  |
| Sodium Chloride NaCl |  |  |
| Barium Chloride BaCl2 |  |  |
| Unknown |  |  |

**Conclusion:**

1. Is the flame color a test for the metal or for the chloride in each compound? Explain your answer.

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1. Why is it necessary to carefully clean the wire before testing each solution?

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1. What metal is present in your unknown? How do you know?

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1. How can you identify a metal using a flame test?

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1. What do you think would happen if your test solution were a mixture of two metals?

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1. Could each metal be identified?

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**Analysis:** After you have finished your investigation record the following:

**CLAIM:** (The Claim is a testable statement or conclusion that answers the original question.)

**EVIDENCE:** (Support your claim based upon 2-3 pieces of evidence from your data; there is not any explaining here only the facts as seen from the data. Select only the data that is both appropriate and sufficient to support the claim.)

**REASONING: (**The reasoning ties the evidence to the claim. You want to explain how the evidence is connected to the claim using the science background knowledge (scientific principles) that allowed you to make that connection between claim and evidence.)

**Chemistry Priority Expectations are highlighted**

**C1.1D** Identify patterns in data and relate them to theoretical models.

**C1.1E** Describe a reason for a given conclusion using evidence from an investigation.

**C2.4a** Describe energy changes in flame tests of common elements in terms of the (characteristic) electron transitions.

**C2.4c** Explain why an atom can absorb only certain wavelengths of light.

**C2.4d** Compare various wavelengths of light (visible and non-visible) in terms of frequency and relative energy.

**C4.8e** Write the complete electron configuration of elements in the first four rows of the periodic table.

**C4.8f** Write kernel structures for main group elements.

**Big Idea-**Core Concepts:

Quantum theory provides a foundation for the atomic model and the understanding of electron behavior and arrangement.

* Electrons are arranged in main energy levels with sublevels that specify particular shapes and geometry.
* Evidence for the movement of electrons between different energy levels can be observed through absorption and emission spectra.

**Investigative Questions:**

1. How can you determine the cation of an unknown solution?
2. Some commercially available fireplace logs burn with a red and/or green flame. What elements could be responsible for these colored flames?
3. Aerial fireworks contain gunpowder and chemicals that produce colors. If you wanted a crimson red color which element might you use?