**Name** _____
**Chemistry Lab #3 Identifying Elements Using the Flame Test**
**Mrs. Rankin**

***Read the following:***

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 electrons in the metals ions, causing them to emit visible light. The characteristic emission spectra can be used to differentiate between some elements.

The flame test does have some limitations. The test cannot detect low concentrations of most ions. Also, the brightness of the signal varies from one sample to another. For example, the yellow emission from sodium is much brighter than the red emission from the same amount of lithium. Impurities or contaminants affect the test results. Sodium, in particular, is present in most compounds and will color the flame. Sometimes a cobalt (blue) glass is used to filter out the yellow of sodium. The flame test cannot differentiate between all elements. Several metals produce the same flame color. Some compounds do not change the color of the flame at all.

*Log into your computer. Click on "Start" → "Applications" → "Virtual Chem Lab".*
*Click on the workbook and select experiment 17-8: Identification of Cations in Solution.*

1. In your notebook, copy/complete the heading, purpose, and materials.

**Lab #3: Identifying Elements Using the Flame Test** **Today's Date**

**Purpose:** The purpose of this experiment is to identify individual elements based on the colors they give off when placed in a flame.

**Materials:** test tubes, Bunsen burner, $Ag^{+}$, $Ba^{2+}$, $Ca^{2+}$, $Co^{2+}$, $Cr^{3+}$, $Cu^{2+}$, $Fe^{2+}$, $Fe^{3+}$, $K^{+}$, $Mg^{2+}$, $Na^{+}$, $Ni^{2+}$, $Pb^{2+}$, $Sn^{4+}$, $Sr^{2+}$, $Zn^{2+}$

2. Move your mouse to the right side of the screen until the label "Stockroom" appears. Click on this label to enter the stockroom.

3. Inside the stockroom are bottle filled with solutions of different ions.

   (a) What subatomic particles are lost or gained to make an ion? _____

   (b) All of these ions are positive. Have they lost or gained particles? _____

4. Pick up a test tube from the box on the right and drag it to the test tube stand. Click on the bottle marked $Ag^{+}$. The test tube will fill with liquid. Press the box labeled "done" under the test tube to send it to the lab. Do the same with test tubes for $Ba^{2+}$, $Co^{2+}$, $Cr^{3+}$, $Cu^{2+}$, $Fe^{2+}$, and $Fe^{3+}$.

5. Click on the green "Return to Lab" arrow.

6. There is a handle above the Periodic Table. Click on it to pull down the help screen. This screen will tell you which ions are present in each tube as you mouse over them.

7. *In your notebook*, set up a chart with two columns for the ion and the color of the flame. Write the symbols for the ions in the ion column. We will record the colors of the flames as we test the ions.

8. Drag the test tube containing $Ag^{+}$ to the test tube stand. Click on the box at the bottom of the screen that has the flame. Watch the video and record the color on your chart. Be EXTREMELY DESCRIPTIVE with your colors. Once you record the color, drag the test tube to the red waste container on the bottom right of the screen.

9. Repeat the procedure with the remaining test tubes.

10. Go back into the stockroom. Pick up a test tube from the box on the right and drag it to the test tube stand. Click on the bottle marked $Mg^{2+}$. Press the box labeled "done" under the test tube to send it to the lab. Do the same with test tubes for $Ni^{2+}$, $Pb^{2+}$, $Sn^{4+}$, $Sr^{2+}$, and $Zn^{2+}$. Click on the green "Return to Lab" arrow.

11. Perform flame tests on each test tube, just as you did in step 8, and record the colors in your chart.

12. Enter the stockroom. Pick up a test tube from the box on the right and drag it to the test tube stand. Click on the bottle marked $Na^+$. Press the box labeled "done" under the test tube to send it to the lab. Do the same with $K^+$.

13. Pick up a third test tube and click on the bottle marked $Na^+$ AND on the bottle marked $K^+$. This will make a test tube that contains both ions. Press the box labeled "done" under the test tube to send it to the lab. Return to the lab.

14. Perform a flame test on the $Na^+$ tube, but do not discard the tube.

    (a) What color do you see? _____

15. Keep the $Na^+$ tube in the stand. Click on the box at the bottom of the screen that has a piece of cobalt glass in front of the flame.

    (a) How do your observations differ from the regular flame test for $Na^+$? _____

    _____

16. Discard the $Na^+$ tube and put the $K^+$ tube in the stand and perform a flame test.

    (a) What color do you see? _____

17. Keep the $K^+$ tube in the stand. Click on the box at the bottom of the screen that has a piece of cobalt glass in front of the flame.

    (a) How do your observations differ from the regular flame test for $K^+$? _____

    _____

18. Discard the $K^+$ tube and put the tube containing both ions in the stand. Perform a flame test.

    (a) What color do you see? _____

    (b) Which element does this color indicate? _____

19. Perform a flame test using cobalt glass on the $Na^+/K^+$ mixture.

    (a) What color do you see? _____

    (b) Which element does this color indicate? _____

*Use your observations and your knowledge of chemistry to answer the following questions. Use complete sentences.*

1. What inaccuracies may be involved in using flame tests for identification purposes?

_____

_____

_____

2. According to the chart in your notebook, which ions produce similar colors?

_____

_____

_____

3. Why must the ions be heated before they release light?

_____

_____

_____

4. Describe what happens to the electrons to cause the release of light.

_____

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_____

5. What was the purpose of the cobalt glass?

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6. Physicist Neils Bohr observed the different colors produced by flame tests and proposed the planetary model as a result. These observations led him to state that electrons traveled around the nucleus in different orbits, or shells. Bohr said that the gain or release of a quantum of energy allowed the electrons to move between shells. Use Google to define “quantum”.

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