

the well with distilled water and collect the rinse water in the waste beaker.

- Put 10 drops of each metal ion solution listed in the materials list in a row in each well of the well strip. Put a row of 1.0 M HCl drops on a glass plate across from the metal ion solutions. Record the positions of all of the chemicals placed in the wells. The wire will need to be cleaned thoroughly between each test solution with HCl to avoid contamination from the previous test.

PROCEDURE

- Dip the wire into the CaCl_2 solution, and then hold it in the Bunsen burner flame. Observe the color of the flame, and record it in the data table. Repeat the procedure again, but this time look through the spectroscope to view the results. Record the wavelengths you see from the flame. Repeat each test three times. Clean the wire with the HCl as you did in Preparation step 2.
- Repeat step 1 with the K_2SO_4 and with each of the remaining solutions in the well strip.
- Test another drop of Na_2SO_4 , but this time view the flame through two pieces of cobalt glass. Clean the wire, and repeat the test. Record in your data table the colors and wavelengths of the flames as they appear when viewed through the cobalt glass. Clean the wire and the well strip, and rinse the well strip with distilled water. Pour the rinse water into the waste beaker.
- Put a drop of K_2SO_4 in a clean well. Add a drop of Na_2SO_4 . Perform a flame test for the mixture. Observe the flame without the cobalt glass. Repeat the test again, but this time observe the flame through the cobalt glass. Record in your data table the colors and wavelengths of the flames. Clean the wire, and rinse the well strip with distilled water. Pour the rinse water into the waste beaker.
- Obtain a sample of the unknown solution. Perform flame tests for it with and without the cobalt glass. Record your observations. Clean the wire, and rinse the well strip with distilled water. Pour the rinse water into the waste beaker.

CLEANUP AND DISPOSAL

- Dispose of the contents of the waste beaker in the container designated by your teacher. Wash your hands thoroughly after cleaning up the area and equipment.



ANALYSIS AND INTERPRETATION

- Organizing Data:** Examine your data table, and create a summary of the flame test for each metal ion.
- Analyzing Data:** Account for any differences in the individual trials for the flame tests for the metals ions.
- Organizing Ideas:** Explain how viewing the flame through cobalt glass can make it easier to analyze the ions being tested.
- Relating Ideas:** For three of the metal ions tested, explain how the flame color you saw relates to the lines of color you saw when you looked through the spectroscope.

CONCLUSIONS

- Inferring Conclusions:** What metal ions are in the unknown solution?
- Evaluating Methods:** How would you characterize the flame test with respect to its sensitivity? What difficulties could there be when identifying ions by the flame test?

EXTENSIONS

- Inferring Conclusions:** A student performed flame tests on several unknowns and observed that they all were shades of red. What should the student do to correctly identify these substances? Explain your answer.
- Applying Ideas:** During a flood, the labels from three bottles of chemicals were lost. The three unlabeled bottles of white solids were known to contain the following: strontium nitrate, ammonium carbonate, and potassium sulfate. Explain how you could easily test the substances and relabel the three bottles. (Hint: Ammonium ions do not provide a distinctive flame color.)