10 ELECTRON CONFIGURATIONS OF ATOMS AND IONS

OBJECTIVES

- Observe colors of various chemical solutions
- Write electron configurations for various metals, nonmetals, cations, and anions
- Relate the presence of color in an ionic solution as a characteristic of electron configurations

PURPOSE

In this experiment, you will observe a variety of chemical solutions containing common cations and anions. You will write electron configurations for many of the ions contained in the solutions. You will observe the colored solutions and draw conclusions about the electron configurations of the metal ions in the colored solutions.

EXPERIMENTAL PAGE

1. Place one drop of each of the indicated solutions on the acetate sheet. Record the color of each solution

NaCl	$MgSO_4$	$AlCl_3$
$FeCl_3$	$CaCl_2$	$NiSO_4$
$CuSO_4$	$ZnCl_2$	$AgNO_3$

2. A precipitate is a solid that separates upon mixing solutions. Predict which of the metal cations in this experiment will form colored precipitates upon the addition of NaOH. **That prediction is based on reading the introduction.** Add one drop of NaOH to find out. Record your results.

NaCl	$MgSO_4$	$AlCl_3$
$FeCl_3$	$CaCl_2$	$NiSO_4$
$CuSO_4$	$ZnCl_2$	$AgNO_3$

QUESTIONS FOR ANYALYSIS

Use what you learned in this experiment to answer the following questions.

1. Write the noble gas configurations of

   Na

   Mg

   Al

2. Metal ions form when metal atoms lose valence electrons-the number of electrons lost equals the ion's charge. Write the noble gas configurations of

   Na^{+}

   Mg^{2+}

   Al^{3+}

3. Write the noble gas configuration of

   Cl

   Cl^{-}

4. Transition-metal ions with partially filled d orbitals usually have a color. Based on your observations, which solutions contain transition-metal ions with partically filled d orbitals?

5. Transition metal usually lose s orbital electrons first, then d electrons when they produce ions. Write nobel gas configuration for

   Fe

   Fe^{3+}

   Ni

   Ni^{2+}

6. Copper and silver both have exceptional electron configurations because they both have full d orbitals at the expense of an s orbital. That means that the d is filled, and the s is partially filled. Write the noble gas configurations of

   Cu

   Ag

7. Write the electron configuration for

   Cu^{+2}

   Ag^{+}

8. Is each electron configuration consistent with the color you observed for each cation? Explain.

9. The solution Zn^{2+} ions is not colored. What does this suggest about its electron configuration?

10. Write the electron configuration of Zn^{2+}.

11. Predict which of the following transition-metal ions has a color. Explain your answers.

    Cr^{3+}

    Cd^{2+}

    Hg^{2+}

    V^{2+}

12. Do the colored precipitates all contain transition-metal ions with partially filled d orbitals? Explain.