LAB ACTIVITY: IONS AND ATOMS

Ionic compounds form when a **metal** reacts with a **non-metal**. The reaction creates oppositely charged **ions** that are chemically different from the original atoms.

Some elements are very reactive and form ionic compounds with a variety of elements. Chlorine is an example of a reactive element.

- As an element (atom), it is a yellowish-green gas that is extremely corrosive.
- It was used as a weapon by both sides of the First World War causing many deaths and casualties, yet the chloride ion is an essential part of nutrition.
- It is found as a safe and stable part of many important compounds.

The properties of an element's atoms are quite different from the properties of an element's ions.

In this Investigation, you will compare the properties of an atom and its ion.

Copper (II) chloride is corrosive and poisonous.

Take care to avoid drips and wipe up all spills promptly.
If any solution splashed on skin or in eyes, flush immediately with plenty of cold water and inform your teacher

Question: Are the properties of an ion different than the properties of an element?

Hypothesis: If aluminum metal is reacted with copper (II) chloride, it will become an aluminum ion, Al^{3+} and the copper ion, Cu^{2+}, will become copper metal (atoms).

Experimental Design:

In this experiment, you will react an ionic compound with a metal.

You will use your observations of the reaction to compare some of the properties of the metal ions.

Materials:

Safety goggles	Stirring Rod
Copper (II) chloride ($CuCl_2$)	Ring Stand
3 x 250-mL beakers	Ring Clamp
Water	Funnel
Graduated cylinder	Filter Paper
Aluminum foil	

Procedure:

1. Read the Procedure, and create a table to record your observations.

2. Put on your safety goggles.

3. Your teacher will supply you with a beaker that contains approximately 1.0 g of copper (II) chloride. Observe and record the properties of this compound.

4. Add approximately 100 mL of water and stir until the copper (II) chloride is completely dissolved. Observe and record the properties of the copper (II) chloride solution.

5. Observe and record the properties of the aluminum metal foil.

6. Crumple a foil square and place it in the copper (II) chloride solution and immediately begin to watch for any changes to the solution or the square of aluminum. Record your observations.

7. Use the stirring rod to ensure that all the foil is submerged. Continue to add small scraps of foil until the blue-green colour disappears from the solution.

8. Set up the ring stand with the funnel and filter paper, as demonstrated by your teacher.

9. Swirl the solution gently, and then pour it into the funnel, pouring along the stirring rod as shown in Figure 1. Touch the stirring rod to the spout of the beaker so that the liquid flows down the rod and into the filter cone.

10. When all the solution has been poured, add some water to rinse out the remaining solids.

11. Allow the filter paper to dry a little by putting it on top of several layers of paper towel. Pour any remaining solutions into the waste container designated by your teacher. Rinse the beaker, stirring rod, and funnel. Return the equipment to your lab basket ready for the next class (or put it away if you are the last block)

12. Observe the solid on the filter paper. Record your observations.

Analysis

1. What ions are present in a solution of copper (II) chloride? What colour do you think the copper (II) ions are? Explain.

2. What are the ***properties*** of aluminum that confirm it is a metal?

3. What ***observations*** convinced you that a chemical reaction was occurring between the aluminum foil and the copper (II) chloride solution?

4. What happened to the aluminum atoms in the foil? Explain.

5. What happened to the copper (II) ions in the solution? Explain.

6. What happened to the chloride ions in the solution? Explain.

7. Are the **ions** of a metal very different from the **atoms** of a metal? Give some important differences <u>in the properties you observed</u>.

8. Did the Investigation verify the prediction? Why or why not?

9. Some metal ions are serious pollutant if they get into rivers, lakes or oceans. Do you think this method would be a reasonable way to remove copper ions from waste water? Why or why not?