

Chemical Bonding Lab

Chemical compounds are combinations of atoms held together by chemical bonds. These chemical bonds are of two basic types—ionic and covalent. Ionic bonds result when one or more electrons from one atom or group of atoms is transferred to another atom. Positive and negative ions are created through the transfer. In covalent compounds no electrons are transferred; instead electrons are shared by the bonded atoms.

The physical properties of a substance, such as melting point, solubility, and conductivity, can be used to predict the type of bond that binds the atoms of the compound. In this experiment, you will test six compounds to determine these properties. Your compiled data will enable you to classify the substances as either ionic or covalent compounds.

OBJECTIVES

Compare the melting points of six solids.

Determine the solubilities of the solids in water and in ethanol.

Determine the conductivity of water solutions of the soluble solids.

Classify the compounds into groups of ionic and covalent compounds.

Summarize the properties of each group.

MATERIALS

- Multi-well microplate
- Bunsen burner
- conductivity tester
- ethanol
- iron ring
- ring stand
- thermal gloves
- lab apron
- safety goggles
- aluminum foil square
- thin-stemmed pipets (2)
- SrCl_2 (Strontium chloride)
- KMnO_4 (Potassium Permanganate)
- CuO (copper oxide)
- $\text{C}_{13}\text{H}_{18}\text{O}_2$ (ibuprofen)
- $\text{C}_8\text{H}_9\text{NO}_2$ (acetaminophen)
- $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ (sucrose)



Always wear safety goggles, gloves, and a lab apron to protect your eyes and clothing. If you get a chemical in your eyes, immediately flush the chemical out at the eyewash station while calling to your teacher. Know the location of the emergency lab shower and eyewash station and the procedures for using them.



Do not touch any chemicals. If you get a chemical on your skin or clothing, wash the chemical off at the sink while calling to your teacher. Make sure you carefully read the labels and follow the precautions on all containers of chemicals that you use. If there are no precautions stated on the label, ask your teacher what precautions to follow. Do not taste any chemicals or items used in the laboratory. Never return leftovers to their original container; take only small amounts to avoid wasting supplies.



Do not heat glassware that is broken, chipped, or cracked. Use tongs or a hot mitt to handle heated glassware and other equipment because hot glassware does not always look hot.

When using a flame, confine long hair and loose clothing. If your clothing catches on fire, WALK to the emergency lab shower and use it to put out the fire.

Procedure

1. Put on safety goggles and a lab apron.
2. Before you begin, write a brief description of each of the six substances in **Table 1**.
3. Place a folded square of aluminum foil on an iron ring attached to a ring stand. Position the ring so that it is just above the tip of a Bunsen burner flame, as shown in **Figure 1**. Light the burner for a moment to check that you have the correct height.
4. Place a few crystals of sucrose, sodium chloride, acetaminophen, calcium chloride, ibuprofen, and potassium iodide in separate locations on the square of aluminum foil. Do not allow the samples of crystals to touch. Draw and label a diagram that shows the position of each compound.

Figure 1



5. For this experiment, it is not necessary to have exact values for the melting point. The foil will continue to get hotter as it is heated, so the order of melting will give relative melting points. Light the burner and observe. Note the substance that melts first by writing a *1* in **Table 1**. Record the order of melting for the other substances.
6. After 2 min, record an *n* in **Table 1** for each substance that did not melt. Extinguish the candle flame. Allow the can lid to cool while you complete the remainder of the experiment.
7. Put a *few* crystals of each of the white solids in the top row of your microplate. Repeat with the second row. Add 10 drops of water to each well in the top row. Do not stir. Record the solubility of each substance in **Table 1**.
8. Add 10 drops of ethanol to each well in the second row of the microplate. Do not stir. Record the solubility of each substance in **Table 1**.
9. Test the conductivity of each water solution in the top row by dipping both electrodes into each well of the microplate. Be sure to rinse the electrodes and dry them with a paper towel after each test. If the bulb of the conductivity apparatus lights up, the solution conducts electric current. Record your results in **Table 1**.
10. Clean the microplate by rinsing it with water into a pan provided by your teacher. If any wells are difficult to clean, use a cotton swab. Wash your hands thoroughly before you leave the lab and after all work is finished.

NAME: _____
DATE: _____ PERIOD: _____

TABLE 1 CHARACTERISTICS OF COMPOUNDS

Compound	Description	Melting point	Solubility in H₂O	Solubility in ethanol	Conductivity
Calcium chloride					
Ibuprofen					
Acetaminophen					
Potassium iodide					
Copper oxide					
Sucrose					

Analysis

- 1. Organizing Results** Group the substances into two groups according to their properties.

- 2. Organizing Results** List the properties of each group.

Conclusions

- 1. Inferring Conclusions** Use your textbook and your experimental data to determine which of the groups consists of ionic compounds and which consists of covalent compounds.

- 2. Relating Ideas** Write a statement to summarize the properties of ionic compounds and another statement to summarize the properties of covalent compounds.