Chemical Bonds 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.

PURPOSE

**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

* 12-well microplate
* calcium chloride
* Bunsen burner
* citric acid
* conductivity tester
* ethanol
* iron ring
* phenyl salicylate
* potassium iodide
* ring stand
* safety goggles
* sodium chloride
* sucrose
* tin can lid
* thin-stemmed pipets (2)

**Always wear safety goggles to protect your eyes and appropriate 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 to handle heated glassware and other equipment because hot



glassware does not always look hot.

**When using a Bunsen burner, 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 obtain appropriate materials.
2. Before you begin, write a brief description of each of the six substances in

## Table 1.

1. Place a can lid on an iron ring attached to a ring stand. Position the ring so that it is just above the tip of the flame from the Bunsen burner, as shown in **Figure 1.** Light the Bunsen burner for a moment to check that you have the correct height.
2. Place a few crystals of sucrose, sodium chloride, phenyl salicylate, calcium chloride, citric acid, and potassium iodide in separate locations on the lid, as shown in **Figure 2.** Do not allow the samples of crystals to touch. Draw and label a diagram that shows the position of each compound.

Figure 1

Figure 2

Sucrose

Sodium

chloride

Potassium

iodide

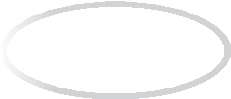
Phenyl

salicylate

Calcium

chloride

Citric acid



1. For this experiment, it is not necessary to have exact values for the melting point. The lid will continue to get hotter as it is heated, so the order of melting will give relative melting points. Light the Bunsen 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.
2. After 2 min, record an *n* in **Table 1** for each substance that did not melt. Extinguish the flame. Allow the can lid to cool while you complete the remainder of the experiment.
3. 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.**
4. 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.**
5. Clean the microplate by rinsing it with water into a pan provided by your teacher. Finishing washing all materials in the sink and dry completely with paper towels. Wash and dry your complete lab station. Wash your hands thoroughly before you leave the lab and after all work is finished.

TABLE 1 CHARACTERISTICS OF COMPOUNDS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Compound | Description | Melting point | Solubility in H2O | Solubility in ethanol |
| Calcium chloride |  |  |  |  |
| Citric acid |  |  |  |  |
| Phenyl salicylate |  |  |  |  |
| Potassium iodide |  |  |  |  |
| Sodium chloride |  |  |  |  |
| Sucrose |  |  |  |  |

# Analysis

1. Organize the six compounds into two groups according to their melting point. Explain the melting points of the compounds in each group.
2. Identify which of the groups from analysis #1 consist of ionic compounds and which consist of covalent compounds. Explain your reasoning.
3. Compare and contrast how a bond is formed in molecular vs. ionic compounds. (Hint: think about the behavior of the valence electrons)
4. Identify and explain the properties of each type of compound:
   1. Molecular compounds
   2. Ionic compounds
   3. Metallic compounds