Chemistry CP

Name:

Lab: Chemical Bonds

Section:

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 a 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 eight 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 eight solids.
- Determine the solubilities of the solids in water and in ethanol.
- Determine the conductivity of aqueous solutions of the soluble solids.
- Classify the compounds into groups of ionic and covalent compounds.
- Summarize the properties of each group.

Materials

microplate
calcium chloride
candle
citric acid
conductivity tester
ethanol
iron ring
ring stand
phenyl salicylate
potassium iodide
sodium chloride
sucrose
tin can lid
thin-stemmed pipets

Safety

When you use a candle, confine long hair and loose clothing. Use tongs or a hot mitt to handle heated glassware and other apparatus. Ethanol is flammable. Make sure there are no flames in the room before you use this chemical. Safety goggles must be worn at all times.

Procedure

1. Write a brief description of each of the six substances in your data table.
2. 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 a candle flame, as shown in Figure A. Light the candle for a moment to check that you have the correct height.
3. 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 B. Do not allow the samples of crystals to touch. Draw a diagram that shows the position of each compound.
4. 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 candle and observe. Note the substance that melts first by writing a 1 in the Data Table. Record the order of melting for the other substances.
5. After 2 minutes, record an *n* in your data table for each substance that did not melt. Extinguish the candle flame. Allow the tin can to cool while you complete the remainder of your experiment.
6. Put a *few* crystals of each of the white solids in the top row of your microwell plate. Repeat with the second row. Add 10 drops of water to each well in the top row. Record the solubility of each substance in your data table.

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7. Add 10 drops of ethanol to each well in the second row of the microwell plate. Record the solubility of each substance in your data table.
8. Test the conductivity of each aqueous solution by dipping both electrodes into the solution. 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 electricity. Record your results in the data table.
9. 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.

Data Table

Compound	Description	Melting Point	Solubility in water	Solubility in ethanol	Solution Conductivity
Calcium chloride					
Citric acid					
Phenyl salicylate					
Potassium iodide					
Sodium chloride					
Sucrose					

Analyze and Apply Questions

1. Group the white substances into two groups according to their properties.
2. List the properties of each group.
3. Use your textbook and your experimental data to determine which of the groups consists of ionic compounds and which consists of covalent compounds.
4. Carbon tetrachloride, CCl_4, is a non-polar covalent compound used for many years as a chemical solvent (until it was found to be carcinogenic). Predict which (if any) of the compounds investigated in this experiment should be soluble in carbon tetrachloride.

Analyze/Apply Questions

1. Based on your observations, classify the compounds you tested in Part I based on **similar behaviors.**
2. Which of the compounds tested in Part I would be considered to be ionic compounds? Discuss any patterns or similarities you notice in their chemical formulas.
3. Which of the compounds tested in Part I should be classified as covalent compounds?
4. Which of the compounds tested in Part II seem to have the weakest intermolecular attractions? The strongest? Justify your answer.
5. Based on your observations, is the evaporation of isopropanol (commonly known as rubbing alcohol) an endothermic or exothermic process? Explain your answer.
6. Carbon tetrachloride, CCl_4, is a non-polar compound used for many years as a chemical solvent (until it was found to be carcinogenic). Predict which (if any) of the compounds investigated in Part I of this experiment should be soluble in carbon tetrachloride.

**Don't forget to include an appropriate conclusion