Differences Between Ionic and Covalent Compounds

A compound is defined as the chemical combination of two or more elements. A chemical bond is the "glue" that holds atoms of different elements together. Bonds can be classified into two general types: ionic and covalent. Ionic bonds generally occur between a metallic atom and a nonmetallic atom. The ionic bond involves a transfer of electrons from the metallic atom to the nonmetallic atom, resulting in a charge difference. The positively charged metal ion is then attracted to the negatively charged nonmetal ion. Covalent bonding generally occurs between atoms that are nonmetallic and it involves the sharing of electrons.

Properties such as melting point, boiling point, solubility, electrical conductivity, color, and odor are some of the properties that can help you distinguish ionic from covalent compounds. In this experiment, you will observe several properties of some ionic and covalent compounds and attempt to recognize some patterns among the properties. It is important to understand that the patterns are generalizations that do not apply to all ionic and covalent compounds.

Purpose:
To observe properties of various compounds and identify those properties as either primarily ionic or primarily covalent.

Prelab:
1. Ionic compounds are generally made up of what kinds of elements?

2. Covalent compounds are generally made up of what kinds of elements?

3. Predict whether each of the following is primarily ionic or covalent.
   a. sodium bromide (NaBr)  
   b. methane (CH₄)
   c. calcium chloride (CaCl₂)
   d. ammonia (NH₃)

Procedure:
1. Obtain samples of the six compounds to be tested. Determine the type of bonding for each and record that information in the data table.
2. Begin heating approximately 150 mL of distilled water in a beaker on a hot plate.
3. Place a small scoop of solid into a well of the spot plate. Add 2 squirts of hot water. Stir with a stirring rod. If the solid dissolves, it is soluble. If some of it dissolves, it is slightly soluble. If it does not dissolve, it is insoluble. Repeat with the other solids using approximately the same amount of each solid. Record the results in the data table.
4. Test the conductivity of each solution with a conductivity tester. Record your results. Rinse out the spot plate.
5. Test the melting times of the compounds. Place a SMALL amount of each on the foil lined metal lid. Place the lid on the ring stand and begin heating it in the center. Rank them from fastest to slowest and record the results.
6. Put a small amount of each in solid in a well and add 2 squirts of alcohol. Observe the solubility of the compounds in alcohol. Record observations in the data table.
Data:

<table>
<thead>
<tr>
<th>Compound (formula)</th>
<th>Type of Bonding</th>
<th>Description</th>
<th>Solubility (warm)</th>
<th>Conductivity</th>
<th>Melting point (1= fastest, 6 = slowest)</th>
<th>Solubility (alcohol)</th>
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</thead>
<tbody>
<tr>
<td>KI</td>
<td></td>
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<tr>
<td>(C_{12}H_{22}O_{11})</td>
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<td>NaCl</td>
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Questions:
1. Look at the results carefully. Are there any patterns that you have observed in the property of solubility?

2. Similarly, look at the other properties. What can you say about each of the other properties in relation to the ionic or covalent character of the compounds?
   Melting Point:
   Conductivity:

3. Predict the following:
   Solubility of sodium iodide (NaI) in water__________________________
   Melting point of sodium iodide (high or low)________________________
   Conductivity of glucose \((C_6H_{12}O_6)\) solution_________________
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