DIFFERENCES BETWEEN IONIC AND COVALENT COMPOUNDS

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 necessarily apply to all ionic and covalent compounds.

Materials

- sucrose \( (C_{12}H_{22}O_{11}) \)
- magnesium sulfate \( (\text{MgSO}_4) \)
- stearic acid \( (C_{18}H_{36}O_2) \)
- potassium iodide \( (\text{KI}) \)
- sodium nitrate \( (\text{NaNO}_3) \)
- lauric acid \( (C_{12}H_{30}O_2) \)
- 6 test tubes
- test tube rack
- hot plate
- 250 mL beaker
- 10 mL graduated cylinder
- conductivity apparatus
- aluminum foil pieces
- thermometer

Procedure

1. Begin heating approximately 150 ml of **tap water** in a 250 ml beaker on a hot plate. This will be used as a hot water bath to determine the solubility of each substance in Step 3 and melting point in Step 6. Two teams can use the same hot plate if necessary.
2. Wash your test tubes with soap and tap water. Then rinse them with a small amount of distilled water to remove any residue.
3. Examine the physical properties of each substance.
4. Place 5 ml of **distilled water** in each of six test tubes. Put 1/2 teaspoon (size of a pea) of each of the solids listed in the left hand column into a labeled test tube. Swirl the contents vigorously by tapping the bottom of the tube with your index finger while holding it tightly between the finger and thumb of the other hand. If the substance dissolves, it is soluble. If it does not, it is insoluble. Record the results. Remember, if there is less solid than what you put in the tube it is dissolving.
5. Warming sometimes increases solubility. Put any test tube containing a substance that did not dissolve in room temperature water into the beaker of hot water for two or three minutes. Again flick the bottom of each tube. Record the results. Remember, melting is not dissolving. Before moving on, set the hot plate to setting 2.
6. Pour a sample of each solution that you prepared in #2 or #3 into a spot on the spot plate. (Make sure it is clean.) Test the conductivity of the solution. How will you know if the compound conducts electricity? (You may see evidence of a chemical reaction if you look closely.) Clean the electrodes by dipping into distilled water after each use.
7. Rinse the test tubes. **Dry them.**
8. Put another small pea sized scoop of each sample on small, individual pieces of aluminum foil. Place the foil and samples on the hot plate. Record if the sample melts.
9. Dispose of liquid materials in the sink, solids in the waste basket. Use your boiling water to clean out your test tubes. It is easier than when the substance dries.

Data Table
<table>
<thead>
<tr>
<th>Substance</th>
<th>Solubility in:</th>
<th>Melting</th>
<th>Electrical conductivity of solution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Room temp Water</td>
<td></td>
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<tr>
<td></td>
<td>Hot water</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Formula</th>
<th>Physical Properties</th>
<th>Ionic/covalent Compound?</th>
</tr>
</thead>
<tbody>
<tr>
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Questions:
1. Create a table below comparing the characteristics of ionic and covalent compounds. Think about patterns in the two groups for the following when creating your table:
   a. solubility    b. melting point    c. electrical conductivity

2. Are there any exceptions to the patterns or characteristics you laid out in your table above? Explain.

3. Are there any additional distinctive physical properties for the two classes of compounds that you observed in lab? Describe them.

4. Which is more dense: lauric acid or water? Explain your reasoning.

5. You made several observations in this lab. Place each of these observations into one of the categories provided below:

<table>
<thead>
<tr>
<th>Physical Property</th>
<th>Chemical Property</th>
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</thead>
<tbody>
<tr>
<td>Physical Change</td>
<td>Chemical Change</td>
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</tbody>
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