

### Introduction:

A compound is defined as a chemical combination of two or more elements. A chemical bond is the "glue" holding together atoms of different elements. Two types of bonds are *ionic* and *covalent*. **Ionic bonds generally occur between a metallic atom and a nonmetallic atom.** The bond results from the transfer of one or more 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 nonmetallic *ion*. Covalent bonding generally occurs between two or more nonmetallic atoms. **Covalent bonding involves the sharing of electrons.** Properties such as melting point, boiling point, solubility, electrical conductivity, color, and odor can help you distinguish ionic from covalent compounds. As in many areas of chemistry, the distinctions are not always clear, nor do the distinctions apply to all compounds. The salt and sugar on your kitchen table both dissolve easily in water, but the solutions they form have an important difference. One of those kinds of white crystals is an ionic compound, and when it dissolves, it *dissociates*, or breaks up into ions. The ions are free to move in the solution, and that solution, therefore, conducts electricity. The more ions in solution, the better it conducts electricity. If something produces a large amount of ions it is called a *strong electrolyte*. If something produces a small amount of ions, it is called a *weak electrolyte*. The other kind of crystal, however, is a molecular compound, and its molecules remain whole when they dissolve. With no ions, that solution does not conduct electricity. If something produces no ions, it is called a *nonelectrolyte*.

A **hydrogen bond** is the electrostatic attraction between polar molecules that occurs when a **hydrogen (H)** atom bound to a highly electronegative atom such as nitrogen (N), oxygen (O) or fluorine (F) experiences attraction to some other nearby highly electronegative atom.

### Pre-Lab Questions:

1. What is an ionic bond?
2. What is a covalent bond?
3. Do you think sugar or salt will melt at a higher temperature? Explain your answer.
4. What is a hydrogen bond? Give an example of hydrogen bonding.

### Part I - Nail Test (conduction) for Ionic/Covalent Bonding

5. Set up the apparatus using the salt solution.
  - a. **Record observations.**
6. Set up the apparatus using the sugar solution.
  - a. **Record observations**

### Part II - Melting test for Sugar and Salt (PUT ON GOGGLES FOR THIS)

7. Place a spatula full of sugar into a test tube and place it in a ring stand. Light a candle and position the test tube just above the flame.
  - a. **Record observations**
8. Place a spatula full of salt into a test tube and place it in a ring stand. Light a candle and position the test tube just above the flame.
  - a. **Record observations.**

### Part III – Hydrogen Bonding

#### 9. Observation of Hydrogen bonding

- Pour 100 mL of whole milk into a pie plate and let the milk settle for 1 minute.
- Add several drops of different food coloring close together, but separate, in the center of the pie plate.
- Dip a cotton swab in the liquid dish soap to the milk's surface near the drops of food coloring.
- Then, move the swab to different areas of the plate to initiate more reactions.
  - Record all observations.**

#### Post-Lab Questions:

- Why is distilled water used for this lab instead of just tap water? (hint: think about what is in tap water)
- What properties in general do Covalent-Bonded substances have? **Describe at least two properties** based on information from your experiment and your data table.
- What general properties do Ionic-Bonded substances have? **Describe at least two properties** based on information from your experiment and your data table.
- Which compound melted most easily SALT or SUGAR? Is this compound ionic or covalent?
- Using the periodic table explain how the position of the elements that make up sugar ( $C_{12}H_{22}O_6$ ) and Ethanol ( $C_2H_5OH$ ) can be used to tell if the bonds are ionic or covalent.
- Using the periodic table explain how the position of the elements that make up the salts ( $NaCl$ ,  $CaCl_2$ , and  $KCl$ ) can be used to tell if the bonds are ionic or covalent.

