Name _____ Date _____ Period _____

# LAB: Ionic and Covalent Properties

***Introduction:***

Ionic compounds (or salts) are formed when metals transfer electrons to nonmetals. The loss of electrons by the metal atom transforms it into a positive ion, or *cation*. The gain of electrons by the nonmetal atom transforms it into a negative ion, or *anion*. The cation and anion are attracted to each other because of their opposite charges. A salt is really a network of cations and anions that are stacked in a specific crystalline structure due to their mutual attractions.

In a covalent compound, atoms share electrons. Covalent bonds are usually formed between nonmetal atoms, which have more valence electrons than they are energetically capable of losing. Nonmetal atoms have reasonably high ionization energies, so it's hard to get an electron from one. When two nonmetal atoms meet they do not tend to completely transfer electrons; instead, they tend to share. One pair of electrons makes a covalent bond, and since both atoms "want" that pair of electrons, they stick together as long as the pair is shared.

Both types of chemical bonds exist because of atoms trying to satisfy the octet rule. The octet rule says that atoms gain, lose, or share electrons in an attempt to achieve the same electron configuration as one of the noble gases (which usually have 8 valence electrons – hence the word "octet").

***Purpose:*** In today's experiment, you will determine some properties of ionic and covalent bonds. You will compare their melting temperatures, ability to dissolve in water, and electrical conductivity in solutions. You will use the observed properties to make conclusions about unknown compounds.

***Materials:*** Aluminum foil, Hot Plate, Conductivity probe + GLX system, Distilled Water, Beaker, Spoon, Table Salt (NaCl), Table sugar ($C_{12}H_{22}O_{11}$), Unknown Compounds #1-4

***Safety Considerations:***

ALWAYS exercise caution when using hot plates.
The aluminum foil will be very hot after the first part of this experiment. Be extremely careful.

***Procedure:***

**PART ONE: RELATIVE MELTING POINT (SALT AND SUGAR)**

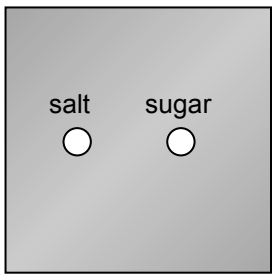


**Figure 1**.

1. Cut a square of aluminum foil that is about 5" by 5." It doesn't need to be perfect.
2. Label one section "salt" and one section "sugar" with a permanent marker.
3. Place the aluminum square in the center of your hot plate.
4. Obtain a small pea-sized sample of NaCl. Place the sample carefully on the aluminum foil, about 1 inch from the center of the square.
5. Obtain a small pea-sized sample of table sugar. Place the sample on the aluminum foil, about 1 inch from the center of the square, but in the opposite direction from the salt. Your aluminum foil should look like **figure 1**.
6. Turn the hot plate to medium-high.
7. Observe which compound melts first and record your observations in the data section.
8. Make predictions regarding the relative melting points of covalent and ionic compounds in your conclusions section.

**PART TWO: CONDUCTIVITY IN SOLUTION (SALT AND SUGAR)**

1. Obtain 200 mL of distilled water from your teacher.
2. Place a spoonful of salt into the beaker and stir for one minute. Record your observations under "dissolves in water" in the data section.

3. Turn on your GLX. If no numerical measurement is showing up, press the button with a house on it, scroll over to "digits," and then press the button with the checkmark.
4. Place the conductivity probe into the salt solution and record the value measured in the data section below.
5. Rinse the conductivity probe with DI water.
6. Repeat steps 1-4 with the table sugar.

*After completing the procedures above, you will repeat each experiment using several unknown substances to determine if each is ionic or covalent. For homework, you need to write the procedure you will follow to complete parts three and four. Use parts one and two above as a guide. A guide means you are modeling your writing after what's written above, not that you are copying it directly. These procedures should be written in your own words.*

**PART THREE: RELATIVE MELTING POINT (UNKNOWN COMPOUNDS)**
**PART FOUR: CONDUCTIVITY IN SOLUTION (UNKNOWN COMPOUNDS)**
(Complete on a separate sheet of paper, to be turned in with your conclusion questions)

***Data:***

| Substance | Relative Melting Point (Low/High) + observations | Dissolves in water (yes/no) + observations | Conducts Electricity When Dissolved (yes/no) + GLX measurement |
|---|---|---|---|
| Table Salt | | | |
| Table Sugar | | | |

Did the table salt or table sugar melt first?

Did the table salt or table sugar conduct a current when dissolved?

Record the properties you observed for the four unknowns in the table below:

| Unknown Number | Relative Melting Point (Low/High) + observations | Dissolves in Water (yes/no) + observations | Conducts Electricity When Dissolved (yes/no) + GLX measurement |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |

***Procedure:*** *Written in YOUR OWN WORDS for parts 3 and 4 of this experiment.*
***Conclusions:*** (Answer in complete sentences on a separate sheet of paper. You will turn this in.)
1. The formula for table salt is NaCl. Is table salt ionic or covalent? How do you know?
2. The formula for table sugar (also known as sucrose) is $C_{12}H_{22}O_{11}$. Is table sugar ionic or covalent? How do you know?
3. Based on your tests with salt and sugar, compare the melting points of ionic compounds with those of covalent compounds.
4. Based on your tests with salt and sugar, compare the ability to dissolve in water of ionic and covalent compounds.
5. Based on your tests with salt and sugar, compare the ability to conduct electricity in solution of ionic and covalent compounds.
6. A compound that conducts electricity when dissolved is called an ***electrolyte***. Write a short statement that identifies ionic and covalent compounds as electrolytes or non-electrolytes.
7. Identify each of the unknowns as ionic or covalent and explain using information from your lab.

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