**Chemical Compounds Lab**

(Honors Chemistry)

**Purpose**

To distinguish between **ionic** and **molecular** compounds based on their physical properties.

**Introduction**

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 are transferred to another atom. The atoms form positive and negative ions which attract to each other. Ionic compounds are composed of large numbers of positive ions (cations) and negative ions (anions) so that the amount of positive charge equals the negative charge.

In covalent bonds the electrons are shared between two bonded atoms. A molecule is a group of atoms that are bonded together by covalent bonds. Molecular compounds are composed of these molecules.

The physical properties of a substance such as melting point, solubility in water, and conductivity of an aqueous solution tell us a lot about the type of particles in a compound. In this experiment, you will conduct tests on the physical properties of different compounds and compile data enabling you to classify the compounds as ionic or molecular.

**Relative Melting Point**

You will not measure the exact values for the melting point. The order in which the compounds melt will give relative melting points.

**Solubility in Water**

The phrase “like dissolves like” means that compounds will dissolve other compounds with similar bond types. Water, a polar molecule, will dissolve both ionic compounds and molecular compounds with polar molecules.

**Conductivity of Aqueous Solution**

If an aqueous solution contains ions, then it will conduct electricity, completing the circuit and lighting up the bulb. A strong electrolyte will light the bulb brightly; a weak electrolyte will light the bulb dimly. A solution containing nonpolar molecules will not conduct electricity.

**Pre Lab Questions**

1. What is an ionic bond?
2. What is a covalent bond?
3. Ionic compounds are composed of what particles?
4. Molecular compounds are composed of what particles?
5. What physical properties will be tested for each compound in this lab?
6. Explain what the term “Relative” means when performing an experiment.
7. What is the difference between soluble and insoluble substances?

**Materials & Equipment**

|  |  |  |
| --- | --- | --- |
| Aluminum foil | Ring stand | Iron Ring |
| Distilled water | Bunsen burner | Conductivity apparatus |
| Well plate | Toothpicks | Scoopula |
| sucrose | Sodium chloride | Lauric Acid |
| calcium chloride | citric acid | Paraffin wax |
| Matches or flint | Magnifier or hand lens | Heat gloves |

**Procedure**

**Relative Melting Point Determination**

1. Cut and label 6 pieces of paper. Write the names of the 6 chemicals on the paper. Obtain a small sample of each compound on the labeled papers. Using the magnifier, record a brief description of each substance in data table 1.
2. Cover the large iron ring with aluminum foil. Make sure the top and bottom of foil is smooth and even. Place the iron ring on the ring stand. Leave the ring high on the ring stand so it can be adjusted later.
3. Place a FEW crystals of sucrose, sodium chloride, citric acid, calcium chloride, lauric acid, and paraffin wax in separate locations on the foil. Do not allow the samples of crystals to touch. Make sure you are able to distinguish each compound from one another. *(Hint: make a key of some kind as you place the chemicals on the foil.)*
4. Light the Bunsen burner. Make sure the flame does not touch the foil, if necessary, use the heat gloves to adjust the height of the ring so the flame does not touch the foil. *(Hint: you are melting, not burning the chemicals.)*
5. Record the order of melting in your data table (1st, 2nd, etc.) After four minutes, record an “N” in your data table for each substance that did not melt. *(Note: If the compound does not melt, the temperature was not hot enough to reach the melting point, therefore, the melting point must be relatively high.)*
6. Extinguish the burner. Allow the foil to cool while you complete the remainder of the experiment.

**Solubility in Water**

1. Put a few crystals of each of the white solids in wells 1-6 in your well plate. Make sure you know the order of the compounds. *(Hint: make a key of some kind as you place the chemicals in the wells.)*
2. Add 10 drops of distilled water to each of the six compounds. Stir using a toothpick. It is necessary to observe the solids for several minutes to determine if they dissolve or not. Place an “S” in your data table by the substances that are soluble in water and an “I” next to the substances that are insoluble in water.

**Conductivity of Aqueous Solution**

1. Using the conductivity tester, test the conductivity of each solution by dipping both electrodes into the well. Be sure to rinse the electrodes with the bottle of distilled water between solutions. Using the scale on the back of the conductivity tester, record the conductivity of each sample.

**Disposal and Cleanup**

1. Excess compounds can be rinsed down sink. Clean the well plate by rinsing thoroughly with water. Use a paper towel to dry each well. Wrap the chemicals up in the Aluminum foil and dispose of in the trash.
2. Wipe your table down with a wet paper towel. Wash your hands, then return your aprons and safety goggles.

**Data Table 1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Compound** | **Description** | **Melting Point** | **Solubility**  **in water** | **Solution**  **Conductivity** |
| Calcium chloride |  |  |  |  |
| Citric acid |  |  |  |  |
| Paraffin Wax |  |  |  |  |
| Sodium Chloride |  |  |  |  |
| Sucrose |  |  |  |  |
| Lauric Acid |  |  |  |  |

**Analysis & Conclusion**

1. Group the compounds into two groups based on their properties. List the properties that are characteristic of each group. Include melting point (high or low), conductivity of an aqueous solution, and solubility in water.

|  |  |
| --- | --- |
| **Group A** | **Group B** |
|  |  |

1. Do all of the members of each group exhibit all of the same properties? Give specific examples from this experiment and explain your answer.
2. Which of the groups consists of ionic compounds and which consists of molecular compounds. Explain.
3. Make two lists that summarize the properties of ionic compounds and molecular compounds. Include physical state at room temperature, melting point, conductivity of an aqueous solution, and solubility in water.

|  |  |
| --- | --- |
| **Ionic Compounds** | **Molecular Compounds** |
|  |  |

1. Properties of compounds depend on the strength of the attractive forces between particles. Explain the difference between how ionic compounds and molecular compounds are held together.
2. Using evidence from the lab, determine whether ionic compounds or molecular compounds are held together by stronger forces.
3. Which compounds have higher melting points, ionic compounds or molecular compounds? Explain your data.
4. Which compounds had better conductivity, ionic compounds or molecular compounds? Explain your data.

**Real-World Science**

1. How are ionic compounds and molecular compounds used in our daily lives? Give two examples for each and explain why we need them and how we use them. Examples can include health benefits, industrial benefits, lifestyle benefits, etc. *(Hint: Do research if necessary…)*