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Per-1

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**Chemical Bonding Formal Lab Report**

**Title**: Classifying compounds as ionic or covalent

**Purpose**: In this lab, tests are conducted on the properties to classify different compounds as ionic or covalent. The objective of this lab is to compare the melting point of various compounds, determine the solubility of solid compounds in water and ethanol; and conductivity of water solutions of the soluble solids. Finally, classify the compounds as ionic or covalent compounds.

**Pre-Lab Questions**:

1. Define:

Ionic Bond- *The transfer and attraction of valence electrons between atoms.*

Covalent Bonds- *The sharing of valence electrons between atoms.*

Solubility- *The ability of a substance, the solute, to dissolve in a solvent.*

Conductivity- *A substance’s ability to conduct electricity.*

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

*Ionic bonds form when a nonmetal and a metal exchange electrons.*

1. Covalent compounds are generally made up of what kind of electron?

*Covalent bonds form when electrons are shared between two nonmetals.*

1. Classify the properties:

Description- *physical property*

Melting Point- *physical property*

Solubility- *physical property*

Electrical Conductivity- *physical property*

**Safety**:

* Safety Goggles- Always wear goggles during the whole lab to protect your eyes. If a chemical gets in one’s eyes, immediately flush the chemical out at the eyewash station while informing the teacher.
* Do not touch chemicals- If the chemicals get on one’s skin, wash the chemical off while informing the teacher. Carefully read the labels on all containers. Do not taste any chemicals and never return leftover chemicals back into the original container.
* Glassware- Do not heat glassware that is broken or chipped. Always use tongs or hot mitt while handling hot glassware. Do not wear loose clothes and tie long hair back around flames. Walk immediately to the lab shower if one’s clothes catch on fire.

**Materials**:

* Bunsen burner
* Conductivity tester
* Iron ring
* Ring stand
* 6 test tubes
* 3 small beakers
* Ethanol
* Deionized water
* Salt
* Sucrose
* Unknown A, B, C, D

**Procedure**:

Melting Point

1. Place a folded square aluminum on the iron ring and adjust the height of the ring so when the Bunsen burner is lit, the tip of the flame barely touches the aluminum.
2. Place different compounds around the aluminum, make sure that the compounds don’t touch. Draw a diagram of the setup.
3. Light the Bunsen burner and observe and record the order in which the substances melt by placing a 1, 2, 3…… in the data table.
4. After 2 minutes, place a ‘DNM’ for each substance that did not melt.

Solubility

1. Fill a test tube with ¾ water and place a scoop of the compound in it.
2. Cap the test tube and invert the test tube and observe for 30-45 seconds.
3. Record data as dissolved or did not dissolve, and rinse out test tube before testing another compound.
4. Repeat steps 1-3 for each compound.
5. For the solubility in ethanol repeat steps 1-3, but substitute ethanol for water.

Conductivity

1. Mix a scoop of the compound into 20 ml of water in a beaker.
2. Check if the conductivity tester is working by touch the end wires together and the bulb should light up.
3. Then place the tester into the beaker with the solution, and make sure the end wires are not touching.
4. If the bulb lights up then the solution can conduct electricity, if it does not then try adding another small scoop of the compound into the mixture.
5. Record data.

**Data:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Unknown A | unknown b | unknown c | unknown d | salt | sugar |
| Description | Different sized, round, solid, tiny, white balls. | Crushed, crystalline structure, solid white cubes. | White solid, sticky, easily breakable. | White, differently shaped, tiny substances. | White, crystalline solid, tiny cubes. | White cube, smaller cubes in it. |
| Melting Point Value | DNM | DNM | 1st | 3rd | DNM | 2nd |
| Solubility in Water | YES | YES | NO | YES | YES | YES |
| solubility in ethanol | NO | NO | NO | NO | NO | NO |
| CONDUCTIVITY | YES | YES | YES, BARELY | YES | YES | YES, BARELY |

**Post-Lab Questions:**

1. Group the substances into two groups according to their properties.

Ionic compound or covalent compound.

1. List the general properties of each group.

Ionic compounds have high melting points and conduct electricity. Covalent compounds have low melting points and do not conduct electricity.

1. Label the substances as either ionic or covalent compound.

Ionic Compounds: Unknown substances A, B, D and Salt.

Covalent Compounds: Unknown substances C, and Sugar.

1. Summarize the properties of ionic and covalent compounds.

Ionic Compounds have high melting points, they are soluble in water, they are sometimes soluble in ethanol, and they conduct electricity when dissolved in water.

Covalent Compounds have low melting points, some are soluble in water and some are not, they are not soluble in ethanol, and they do not conduct electricity.

1. How would sodium chloride and sugar compare in their melting points?

Sodium chloride(salt) is an ionic compound and requires high temperatures to melt, which is why salt did not melt. Sugar is a nonionic compound and does not require much heat to melt, so it melts easily.

1. What must be true if a solution conducts electricity? How can the conductivity be increased?

If a solution conducts electricity, then it must be an ionic solution. The conductivity can be increased by dissolving the compound in water or when they are melted.

1. Why can tap water conduct electricity and distilled water cannot?

Tap water consists of tiny salt particles dissolved in it, but pure water(distilled) has nothing in it to conduct electricity.

1. Why would you electrocute yourself if you took a bath with a hair dryer? Why are people good conductors of electricity?

Pure water does not conduct electricity but when a person is in the water the minerals on their skin gets in the water and make the water conductible and the hair dryer is a metal so it could be the reason for electrocuting. People are good conductors because the water in their body is made of different electrolytes and minerals that can conduct electricity.

1. What does “like dissolve like” mean?

Substances are more likely to dissolve in other substances with similar chemical properties. Oil will not dissolve in water because oil is nonpolar and water is polar and oil will not dissolve in ethanol because ethanol is very polar.

1. What is the relationship between electronegativity and bond type?

If the electronegativity difference is above 1.7 then it is an ionic bond, and if the electronegativity is below 1.7 then it is a covalent bond.

1. Physical properties:

Methane: high melting point, conducts electricity, and soluble in water.

Acetic Acid: high melting point, conducts electricity, and soluble in water.

Copper(ii) Sulfate: low melting point, does not conduct electricity, soluble in water.

1. Which property best separates compounds into ionic or molecular?

A melting point best separates compounds into ionic or molecular because there were only some compounds that melted at a specific heat and there were some that didn’t melt at all. This helps distinguish between ionic or covalent compounds.

1. Which property is least helpful in separates compounds into ionic or molecular?

The least helpful property would be the solubility in ethanol because neither of the compounds dissolved in ethanol and it would be hard to distinguish which is ionic or covalent just based on the solubility in ethanol.

**Conclusion:**

In this lab, experiments were done to see if a compound can be grouped into an ionic bond or a covalent bond. The first part of this lab was to find the melting point. The compounds were numbered from 1-6 in the order of which melted first and ‘DNM’ was placed next to substances that did not melt in the span of 2 minutes of the experiment. The changes made to this part of the experiment was instead of placing a Bunsen burner under an iron ring, we used a hot plate to melt the substances. The setting on the hot plate was set to 8 during the experiment. The second part was to find the solubility of each compound in water and in ethanol. Finally, the third was to test the conductivity of the compounds by dissolving each compound into deionized water and with the help of conductivity tester to see if the solution can conduct electricity. Based on the data, compounds that did not melt, conducted electricity, and are soluble in water ionic compounds. And the other compounds that melted in 2 minutes, that did not conduct electricity and mostly did not dissolve in water are the covalent compounds. One of the biggest error that could be made in this lab was not clean the test tube, beaker, or the scoopula before adding different substances in it to perform tests. The leftover residue from another compound can change the results.