

Introduction

The goal of this lab is for you to discover some of the properties of ionic compounds. The physical properties of a substance such as flame color, crystal structure, solubility, conductivity and melting point of a substance tell us a lot about the type of bonding in a compound. The electrostatic force that holds oppositely charged particles together in an ionic compound is referred to as an **ionic bond**.

- Ionic compounds are bonded together in a repeating 3-dimensional pattern called a **crystal lattice**.
- **Solubility** is the ability to dissolve in a solvent (typically water, but can include other liquids such as alcohols).
- **Conductivity** describes if the substance can carry an electric current.
- **Melting points** for ionic compounds are much higher than those of covalent compounds so we are unable to test for them safely in the lab.

Properties of compounds depend on the strength of the attractive forces between particles. The particles that compose an ionic compound (ions) are held together by ionic bonds. In this experiment, you will conduct tests on the physical properties of different compounds and compile data enabling you identify ionic compounds based on their properties.

Objective: Determine the general properties of ionic compounds and compare those properties to the properties of a covalent compound.

Safety: Goggles and hair ties are required for this lab. Keep paper and clothing away from the flame.

No personal electronic devices may be brought into the lab. Please keep them in a safe place during the lab.

Prelab questions (20pts):

procedure before answer the following questions:

1. What kinds of elements generally form ionic compounds?

2. What kinds of elements generally form covalent compounds?

3. Based on the type of elements involved, predict whether each of the following compounds is primarily ionic or primarily covalent.

· Sodium chloride

· Copper (II) sulfate

· Potassium iodide

· Magnesium sulfate

· Glucose (aka sugar) $C_6H_{12}O_6$

4. In your own words, what is an ionic bond?

5. Draw the crystal lattice for salt (you can refer to the chart).

6. In your own words, write the purpose of this experiment.

Materials:

Samples of compounds
Microscope
50mL graduated cylinder
Metal loop
Plastic minicups & tops
Distilled water
Conductivity testers
Petri dishes
Sugar
Bunsen burner

Four ionic compounds to test:

Sodium chloride
Copper (II) sulfate

Potassium iodide
Magnesium sulfate

Procedures:

Station 1: Crystalline structure

1. At the station, you will find 5 small petri dishes each with the different solids to investigate.
2. Place one Petri dish with a solid on the stage of the microscope and view the crystals.
3. Describe the color and crystalline shape on Data Table 1. Sketch a representative crystal as well. Identify the name of the crystalline shape as closely as possible. Review to the chart on the next page.
4. Repeat for the other solids.

Station 2: Flame test

1. Locate the five metal loops and corresponding solids to test
2. Turn on the switch to the burner and light carefully with a match
3. Dip one loop into small beaker containing HCl and then place into the corresponding solid (be sure to check the labels). Hold loop over the flame and observe the color of the flame above the loop.
4. Record color on Data Table 2
5. Turn the gas off.

Station 3: Solubility

1. Measure 1.0 grams of each sample into five small labeled mini-cups
2. Add 15 ml of distilled water to each.
3. Place on the top and slowly shake. Time how long it takes the substance to dissolve, using a stopwatch. Repeat for all substances.
Record the time in Data Table 3.
4. Record the solubility level as either: Completely / Partially / Insoluble in Data Table 3.
5. Bring mini-cups with you to station 5.

Examples of crystal lattice structures:

Crystal Systems and Examples / Kristallsysteme und Beispiele

cubic kubisch						
tetragonal						
hexagonal trigonal						
rhombic rhombisch						
monoclinic monoklin						
triclinic triklin						

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Data and Observations (30 pts):

Data Table 1: Observations and Crystalline structure

	Description	Crystal structure & Name
Sodium Chloride		
Potassium Iodide		
Copper (II) Sulfate		
Magnesium sulfate		
Sugar		

Data Table 2: Conductivity and Flame test color

	Solid Conductivity	Flame test color
Sodium Chloride		
Potassium Iodide		
Copper (II) Sulfate		
Magnesium sulfate		
Sugar		

Data Table 3: Solubility and Conductivity Observations of Ionic Compounds

	Time to Dissolve	Solubility	Conductivity
Distilled water (control)			None Low High
Sodium Chloride		Completely Partially Insoluble	None Low High
Potassium Iodide		Completely Partially Insoluble	None Low High
Copper (II) Sulfate		Completely Partially Insoluble	None Low High
Magnesium sulfate		Completely Partially Insoluble	None Low High
Sugar		Completely Partially Insoluble	None Low High

Analysis Questions (25 pts)

1. Review your observations of the appearance of the ionic compounds and their crystal structures.
 - a. Summarize similarities among the compounds
 - b. Summarize any observation that singles out a uniqueness of one or two of the compounds.

2. Review your observations on the solubility and conductivity of the ionic compounds.
 - a. Summarize similarities among the compounds
 - b. Summarize any observation that singles out a uniqueness of one or two of the compounds.

3. Look up the melting points for each of the five solids and record the values in the below table. Review the relative melting point of each of the compounds.

- Summarize similarities among the compounds
- Summarize any observation that singles out a uniqueness of one or two of the compounds.

Chemical Name	Chemical Formula	Melting point (°C)
Sodium chloride		
Potassium iodide		
Copper (II) sulfate		
Magnesium sulfate		
Sugar		

Conclusion Questions (25 pts):

- Look up each compound and record the following information for each of the five compounds you examined during this lab. How did your data compare?

Chemical Name	Chemical formula	Crystal structure	Flame test color	Solubility in water (g/L)	Aqueous Conductivity
Sodium Chloride					
Potassium iodide					
Copper (II) Sulfate					
Magnesium sulfate					
Sugar					

- Based upon your observations and analysis, generalize the properties of ionic compounds.

A. Appearance and Crystal Structure:

B. Solubility:

C. Conductivity (compare solid vs aqueous):

D. Melting point: