

Module 4; Ionic vs. Covalent Compounds

Introduction

In this experiment you will test properties (melting temperature, solubility in water, and electrical conductivity of water solution) of substances which contain ionic bonds and substances which contain covalent bonds. You will use the results of your tests to identify differences between ionic and covalent substances. First, read the following information from your textbook and complete the table below:

Chemical bonds

Chemical Bonds are the attractive forces that hold atoms together. There are three basic types of bonds. **Ionic bond** is the electrostatic attraction between ions, in ionic compounds, after losing or gaining electrons among atoms. These usually occur between a metal and a nonmetal. **Covalent bond** is the sharing of electrons among atoms and usually occurs between two non-metals. (The third kind of bond is a metallic bond which is not covered in CHEM 1405).

Ionic Compounds

An **ionic compound** contains positively charged cations, usually made from metals which tend to lose electrons, and negatively charged anions, usually made from nonmetals which tend to gain electrons. In some cases, ion charges can be determined by locating the element on a periodic table. Ionic compounds typically form when a metal atom **donates** an electron to become a cation and a non-metal atom **accepts** that electron to form an anion. The cation and the anion are held together *via* electrostatic attraction. The metal cation and non-metal anion must combine in a whole number ratio that results in a neutral compound.

Molecular Compounds

Compounds that exist as discrete molecules containing only non-metals are termed **molecular compounds**. Water (H₂O), carbon dioxide (CO₂), and ammonia (NH₃) are molecular compounds that are common in everyday life. These are very different from **ionic compounds** like sodium chloride (NaCl) and silver nitrate (AgNO₃). In a molecular compound, two atoms within the compound **share** electrons in the form of a **covalent bond**.

	IONIC COMPOUNDS	COVALENT COMPOUNDS (or MOLECULAR COMPOUNDS)
Two Examples		
Type of elements involved		
Type of bonding involved		
Description of bonding involved		

Procedure

You will observe three experiments in the assigned YouTube video. The link for the video is: <https://youtu.be/VGXvCyPkTS8> (There is no sound/speaking initially in this video for observations. You will just watch it. But then there is speaking when the three tests are run.) Also notice that you will need to use your cell phone timer to record melting times.

- 1) While you are watching the video, complete the data table on the following page.
- 2) Also, while you are watching the video, answer the following questions about the procedure used in the experiment:
 - a) In the solubility experiments, why does the scientist swirl the beaker?
 - b) In the solubility experiments, why does the scientist use the same amount of compound for each trial (0.05 moles) and the same amount of water (50 mL)? (Notice that in the melting point experiment he used 1.0 g for each trial).
 - c) Before the conductivity tests are run, what does the scientist show you is required to light the light bulb?
 - d) In the conductivity experiment, the scientist tests water by itself as a control. Why?
 - e) In the melting point experiments, what important tips did the scientist explain about using a Bunsen burner?
 - f) In the melting point experiment, the scientist defined the “end point” – the point at which you would stop the timer for each trial. How did he define the endpoint?

Data Table

In the first column, indicate whether the chemical being tested is ionic or covalent. Some acids are also tested. You will be studying acids in module 8. In the last four columns, record your data from the experiment.

Chemical	Ionic or Covalent (or acid)	Solubility in Water – observation Record what you observe (compound disappears, floats, sinks, or makes the solution cloudy.)	Solubility in Water – inference Record the inference as S for soluble or I for insoluble.	Conductivity-Inference Record your inference; is the conductivity strong, weak or none.	State of compound – observation Record the state as solid (S), liquid (L) or gas (G).	Melting – Observation Record the time in seconds it takes for melting to start.
Potassium Iodide, KI						
Potassium Chloride, KCl						
Glucose, C ₆ H ₁₂ O ₆						
Potassium Nitrate, KNO ₃						
PDCB, C ₆ H ₄ Cl ₂						
Benzoic Acid, C ₆ H ₅ COOH	ACID					
Acetic Acid, CH ₃ COOH	ACID					
Paraffin, C _n H _{n+2}						
Hydrochloric Acid, HCl	ACID					

Ionic vs. Covalent Bonds

Post Lab Questions

1. Looking at your data, what can you conclude in general about the water-solubility of covalent compounds versus ionic compounds?
2. Looking at your data, what can you conclude in general about the conductivity of covalent compounds versus ionic compounds?
3. Looking at your data, what can you conclude in general about the melting point of covalent compounds versus ionic compounds?
4. If a compound is soluble in water and conducts electricity when dissolved in water, is it likely a covalent or ionic compound? What is the key evidence for this?
5. What is the difference between melting and dissolving? Give an example of a time you melt sugar. Give an example of a time you dissolve sugar.(You can give examples from daily life or from the previous labs you did).
6. In module 8, you will be studying acids. Do they seem to behave more like covalent or ionic compounds based on your data?