Name: ____ Date: ________

Facts do not cease to exist because they are ignored. --Aldous Huxley

Title – Ionic or Molecular?

An element may be described as a substance in which all of the atoms are alike. Elements are the "stuff" of chemistry, but not the only stuff. If that were true, chemistry would be a lot simpler since there are currently known only 112 elements. When elements combine chemically then they can form compounds. A compound is a substance in which not all of the atoms are alike. In a compound elements are combined in some fixed ratio (by mass) and they cannot be separated by physical means (e.g., using a microscope and tweezers...). It will take more chemical action if we want to separate them again. Compounds are responsible for most of the material and biological diversity that surrounds us. Some compounds are good like aspirin. Others we could be better without like sulfur dioxide and nitrogen dioxide which contribute to acid rain.

Before you begin, here are a few things to keep in mind:

1. The properties of compounds are often not similar to the elements that compose them:

e.g., sodium metal reacts violently with water and chlorine is a poisonous gas, but sodium chloride is—to most people—relatively harmless.

2. There are two very large categories of compounds which are based on properties that you can observe:

These compounds are known as ionic or molecular compounds. Ionic compounds generally consist of metal and non-metal elements, molecular compounds consist of non-metal elements only.

3. There are a lot of compounds and it is impossible to fit every one into neat generalizations

In this activity you will make a few tests and observations on six compounds:

1. general appearance
2. melting point
3. electrical conductivity of water solutions

The six compounds that you will study are**: sodium chloride (NaCl); potassium iodide (KI); Copper(II sulfate ($CuSO_4$), glucose ($C_6H_{12}O_6$); salicylic acid ($C_7H_6O_4$); camphor ($C_{10}H_{16}O$).**

Materials

CBL System	H_2O (distilled)
TI-83 Graphing Calculator	Bunsen Burner (wide mouth if available) and Goggles
Vernier Conductivity Probe	Plastic drinking cups
Wash bottle with distilled water	5 50 mL test tubes per group (some will never be clean again and will need to be thrown away.

Procedures

Please be sure to prepare a data table to collect the data. Read the procedures to decide on headings and number of columns and rows.

Part A

1. To start with you will make general observations of each of the compounds: color, appearance of crystal etc.

Part B

2. You will then make a water solution of each of the crystals (about 0.25 g of each compound in 50 mL of ***distilled*** water. Make each solution in the small drinking cups provided.

3. You will then test each of these solutions for conductivity. Your teacher will describe the procedures available for you. A solution that contains ions has the ability to conduct electricity. The size of the conductivity value depends on the ability of the aqueous solution to conduct electricity. Strong electrolytes (substances that conduct electricity when dissolved in water) produce large numbers of ions, which results in high conductivity values. Weak electrolytes result in low conductivity, and non-electrolytes should result in no conductivity.

Part C

4. The last test is to compare melting points. In this case you are not trying to get exact determinations, but simply whether the compound melts easily, partially, or not at all when heated for about one minute with a Bunsen burner. Measure one spatula of compound and heat in a test tube.
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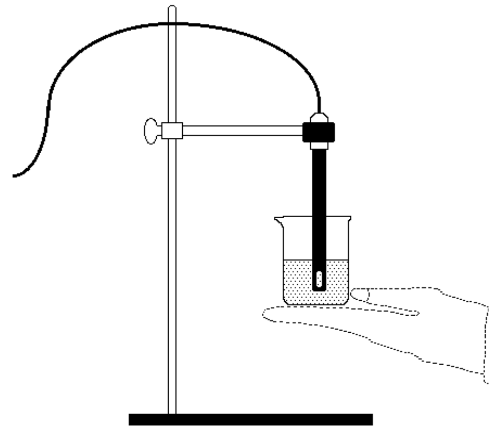
Data Analysis

Divide the six compounds into two categories based on similarities of the results from your lab. Add their formulas to the data and decide if they are molecular compounds or ionic compounds. Based on your observations in this activity try to come up with generalizations about each category of compounds. For example, do molecular compounds generally have a high melting point? Do their solutions conduct electricity well? Write a complete summary below:

Directions for using the Conductivity Probe:



- Plug the conductivity probe into the adapter
- cable in Channel 1 of the CBL.
- Set the selection switch on the amplifier box of
- the probe to the 0-20,000 μS range.
- Use the link cable to connect the CBL System
- to the TI Graphing Calculator. Firmly press in
- the cable ends.

Turn on the CBL unit and the calculator. Start the CHEMBIO program and proceed to the MAIN MENU.

Set up the calculator and CBL for a conductivity probe and a calibration of 0 to 20,000 μS .

- Select SET UP PROBES from the MAIN MENU.
- Enter "1" as the number of probes.
- Select CONDUCTIVITY from the SELECT PROBE menu.
- Enter "1" as the channel number.
- Select PERFORM NEW from the CALIBRATION menu. Follow the instructions for the **Zero Calibration Point**. Simply use air as the zero reference, press TRIGGER when the voltage has stabilized and enter "0" μS as the corresponding reference value. Follow the instructions for the **Standard Solution Calibration Point.** Place the probe in the standard sodium chloride solution that has been supplied with your probe. Be sure the entire elongated hole with the electrode surfaces is submerged in the solution. Wait for the displayed voltage to stabilize, press TRIGGER, then enter 1000 μS as the value of the standard solution.
- Select H 0-20000 MICS from the CONDUCTIVITY menu.

Set up the calculator and CBL for data collection.

- Select COLLECT DATA from the MAIN MENU.
- Select MONITOR INPUT from the DATA COLLECTION menu.
- Follow the directions on the calculator screen to allow the system to warm up, then press [ENTER]. The conductivity reading (in μS) is displayed on the screen of the TI calculator. No readings are stored when using the MONITOR INPUT mode.

8. Measure the conductivity of each of the solutions.

- Carefully raise each plastic cup and its contents up around the conductivity probe until the hole near the probe end is completely submerged in the solution being tested. **Important:** Since the two electrodes are positioned on either side of the hole, this part of the probe must be completely submerged as shown in Figure 1.
- Briefly swirl the cup's contents. Monitor the reading on the calculator screen for 6-8 seconds, then record the conductivity value in your data table (round to the nearest 1 μS).
- Before testing the next solution, clean the electrodes by surrounding them with a 250-mL beaker and rinse them with distilled water from a wash bottle. Blot the outside of the probe end dry using a tissue. It is *not* necessary to dry the *inside* of the hole near the probe end.
- You should also test ***tap water*** and ***distilled water*** by themselves just to have some kind of comparison.

When you have finished collecting data, press [+] to quit MONITOR INPUT.