Ionic and Covalent Compound Investigation
(7/2017)

**Teacher notes:**

This lab uses conductivity to investigate whether or not compounds are ionic or covalent. It is appropriate for ICP or first year chemistry. It is a qualitative investigation and would be appropriate to use before discussing the differences in ionic and covalent compounds.

The conductivity probe should not have to be calibrated, but should you need to do so, there is a sodium chloride solution included.

You can modify step 1 of the procedure to give specific directions based on the Vernier interface you have selected.

Experiment 14 in the Chemistry with Vernier is a good quantitative follow up to this experiment.

**State Standards:**

C.3.1 Investigate the observable characteristics of elements, ionic, and covalent compounds

C.3.4 Write chemical formulas for ionic compounds… given their names…

C.3.5 Use laboratory observations and data to compare and contrast ionic, covalent… substances with respect to… conductivity.

 **Science Express Equipment:**

Vernier Conductivity probe

Vernier Interface (LabQuest, LabQuest 2 or LabPro, LabQuest Mini and a laptop)

**Other Materials:**

Beakers (250, 250, 100)
Distilled water & wash bottle
0.5% Copper (II) Sulfate
1% sugar solution
0.5% Magnesium Sulfate

0.5% Potassium iodide

0.5% Sodium Chloride

70% Isopropyl Alcohol (whatever concentration is available is fine)

Expected Conductivity of Solutions[[1]](#footnote-1)

1% copper (II) sulfate 2900 µS/mL

1% sugar < 35 µS/mL

0.5% magnesium sulfate 4,100 µS/cm

0.5% potassium iodide 3,800 µS/cm

0.5% sodium chloride: 8,200 µS/cm

70% Isopropyl Alcohol < 6 µS/cm

0.5% acetic acid 300 µS/cm

Distilled water <1 µS/cm

Ionic and Covalent Compound Investigation

The purpose of this lab is to use conductivity to determine if a substance is ionic or covalent. Ionic compounds dissociate in water and the positive and negative ions are free to conduct electricity. In this experiment you will use a conductivity probe to determine whether or not ions are present in solution. Non-ionizing solutions will give readings of nearly zero conductivity. Ionizing molecular compounds will give conductivity values that are very low. Ionic compounds will give higher conductivity values.

Materials:

100 or 150 mL beaker

250 mL beaker (2) – label one for distilled water and one for waste.

Vernier Conductivity probe

Vernier interface

Stirring rod

Distilled water

Scoop

Chemicals:

 Copper (II) sulfate

Magnesium sulfate

Potassium iodide

Sodium chloride

Sugar solution

Isopropyl alcohol

Acetic acid

Procedure:

1. Plug in the probe to the interface. Follow your teacher’s directions for setting up your Vernier interface.
2. Pour about 30 mL of distilled water into the smaller beaker.
3. Place the probe in the distilled water. Make sure the entire hole near the end is submerged in the liquid. Take note of the liquid level required in order to submerge your probe. This is the amount of liquid you need for the remaining trials. Record the conductivity in the data table.
4. Pour the water into your waste beaker.
5. Add copper (II) sulfate solution to the beaker to the level determined in step 3.
6. Place the probe in the beaker and record the conductivity.
7. Pour the sample into your waste beaker. Clean the probe with your distilled water wash bottle.
8. Repeat steps 5-7 for each of the remaining chemicals.

Data:

|  |  |
| --- | --- |
| Substance | Conductivity Reading |
| Distilled Water |  |
| Copper (II) Sulfate |  |
| Magnesium Sulfate |  |
| Potassium Iodide |  |
| Sodium Chloride |  |
| Sugar  |  |
| Isopropyl alcohol |  |
| Acetic acid |  |

Conclusion:

|  |  |
| --- | --- |
| Substance | Non-ionizing covalent compound, Ionizing covalent compound, or ionic compound? |
| Distilled Water |  |
| Copper (II) Sulfate |  |
| Magnesium Sulfate |  |
| Potassium Iodide |  |
| Sodium Chloride |  |
| Sugar  |  |
| Isopropyl alcohol |  |
| Acetic acid |  |

1. <http://sites.chem.colostate.edu/diverdi/all_courses/CRC%20reference%20data/electrical%20conductivity%20of%20aqueous%20solutions.pdf> [↑](#footnote-ref-1)