Name Period Experiment No.

14

Conductivity and Ions

In this experiment, we will measure the conductivity of several different solutions. To understand conductivity, we must first define electric current. An electric current can be brought about by the motion of positive and negative particles. An electric current is a measure of the total number of positive and negative charges passing (in opposite directions) per second. In a solid, for example a wire, only the negative charges (free electrons) are able to move. Conductivity is a measure of the extent to which an electrical current can move in a substance.

Experimentation has shown that pure water is a very poor conductor of electricity. When solid sodium chloride, an ionic solid, is added to the water, a conducting solution is formed. The salt water solution is a good conductor because the NaCl releases Na^+ and Cl^- ions in solution. These ions migrate toward oppositely charged electrodes (+ and −). The moving ions complete the electrical circuit.

You can predict ionic properties in most solids by dissolving some of the solid in water and measuring the electrical conductivity of the resulting solution.

Objective

In this experiment, you are going to test a number of different substances for their ability to conduct an electric current and use this test to detect the presence of ions.

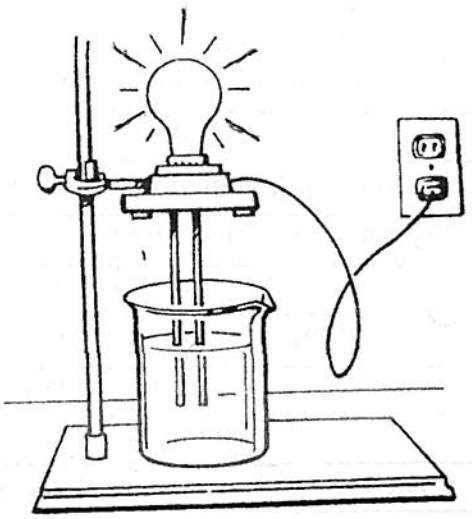
Equipment

conductivity apparatus
beakers (50 or 100 mL)

Procedure

1. Support the conductivity apparatus as shown in Figure 14-1. (Your teacher may not have available the same apparatus pictured here. Many others are available.)
2. As you test the solutions, list them and rate each as good, poor, or NDC (No Detectable Conductivity). Record any other notes, observations, or points emphasized by your teacher.
3. Prepare the following substances and solutions in 50 mL beakers and test each for conductivity. **CAUTION:** *Do not touch the electrodes as electrical shock can occur.* Rinse the electrodes with distilled water after each use.

Distilled water (30 mL in beaker)
Tap water (30 mL in beaker)
Granular NaCl (Beaker partially filled — Return most of this solid to a container provided by your teacher)
NaCl + water (Add a few crystals, test, then add more. About



Sucrose (sugar) granular (Same procedure as granular NaCl)
Sucrose + water (About one gram per 30 mL)
Sucrose + alcohol (About one gram per 30 mL)
$KClO_3$ (crystalline) (Same procedure as granular NaCl above)
$KClO_3$ + water (About one gram per 30 mL)
$KClO_3$, molten (Demonstration or as directed by your teacher)
HgI_2 (crystalline) (Same procedure as granular NaCl above)
HgI_2 + water (About one gram per 30 mL)
HgI_2, molten (Same procedure as molten $KClO_3$ above) **CAUTION:** *Test under fume hood. Mercury and its compounds should not come in contact with skin.*

Questions and Problems

1. On the basis of this experiment, what conclusions can you draw concerning the bonding in the four solids tested?
2. Explain the conductivity (or non-conductivity) of crystalline $KClO_3$.
3. What effect does concentration of a solution have on its conductivity?
4. Explain the conductivity (or non-conductivity) of HgI_2 + water.