Electrolytes and Nonelectrolytes
Exploring Bond Types Through Conductivity

Do you know why electrical devices caution against using them near water? If an electrical device falls into water in which you are standing, you could receive a severe or even fatal shock. Rain and tap water contain small amounts of dissolved ions that allow the solution to conduct electricity. A perfectly pure sample of water, containing only H_2O molecules, conducts only a very minute electric current and poses no harm. Only about 2 per billion water molecules spontaneously separate into H^+ ions and OH^- ions and therefore do not produce enough charged particles to carry a current that is measurable in most school science laboratories. When ionic substances dissolve in water, ions separate from each other. The charged particles released conduct an electric current through the water. If the substance ionizes almost completely in water, it is a good conductor of electricity and is classified as a ***strong electrolyte***. If a substance ionizes only partially, it is a poor conductor of electricity and is classified as a ***weak electrolyte***. Most of the solutes of both types of electrolytes are ionically bonded. Substances that dissolve in water without conducting an electric current are classified as ***nonelectrolytes***. Nonelectrolytes usually contain covalent bonds and do not dissociate into ions when they dissolve in water. We call these solutes *molecular* solutes.

PURPOSE
To use either the conductivity apparatus you have constructed or one provided by your teacher to classify the solute in a series of solutions as strong electrolytes, weak electrolytes, or nonelectrolytes. You will also relate the conductivity of these solutions to the bond type of the solute.

MATERIALS
- conductivity apparatus
- 24-well microplate
- NaCl solid
- sucrose solid
- solutions provided by your teacher

Safety Alert
1. Goggles and aprons must be worn at all times.
2. Use extreme caution when handling chemicals: Do not inhale any vapors during this laboratory and make sure there is adequate ventilation.
3. Clearly label all solutions.
4. Label the ethanol and kerosene CAUTION: Flammable.
5. Make sure there are no open flames or hot plates allowed in the lab room during this exercise.

PROCEDURE

1. Formulate a hypothesis in using the if-then format which relates a solute's conductivity to the type of bonding it exhibits.

2. Make a diagram of your 24-well microplate on your student answer page.

3. List the solutions to be tested in the data table on your student answer page.

4. Fill separate wells half-full with each solid to be tested. Clearly label the wells on your diagram.

5. Place 10 drops of each test solution into a separate well. Clearly label the wells on your diagram.

6. Insert both of the electrodes of the conductivity tester into the first well. The electrodes must NOT touch each other.

7. Note the relative conductivity of the solids and solutions by monitoring the brightness of the LED. Record your observations in the data table on your student answer page using the following code:
   - SE = strong electrolyte [LED glows bright]
   - WE = weak electrolyte [LED glows dim]
   - NE = nonelectrolytes [LED produces no light]

8. Predict the bond type for each substance tested and record you results in the data table on your student answer pages.

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HYPOTHESIS

DATA AND OBSERVATIONS

Make a diagram of your 24-well microplate in the space provided below:

ANALYSIS

Data Table		
Substance being tested	**Electrolyte Classification**	**Predicted Bonding**
NaCl solid		
Sucrose solid		
NaCl solution		
Sucrose solution		
distilled water		
tap water		

CONCLUSION QUESTIONS

1. What are the characteristics of a strong electrolyte solution?

2. For each strong or weak electrolyte write the symbols of the ions that are present in a solution of the substance.

3. Compare the conductivity of solid sodium chloride to a solution of sodium chloride. Explain any differences observed.

4. Compare and contrast the bonding of electrolytes and nonelectrolytes. Be sure and include the characteristics of each in your discussion.

