TEACHER INFORMATION

Conducting Solutions

1. Editable Microsoft Word versions of the student pages and pre-configured TI-Nspire files can be found on the CD that accompanies this book. See *Appendix A* for more information.
2. Two or more sets of the solutions can be made available in small beakers or jars.
3. The solutions can be prepared (using distilled water) as follows:

0.05 M NaCl (2.93 g/liter)	0.05 M sucrose (17.1 g/liter)
0.05 M $AlC1_3$ (6.7 g/liter)	0.05 M $CaCl_2$ (5.55 g/liter)
0.05 M ethanol (2.3 g or 2.9 mL/liter)	0.05 M glucose (9.0 g/liter)

4. A variety of food suspensions may be used. Both plant and animal foods might be considered.
5. To prepare food suspensions, cut the food into small pieces and blend for 5 to 10 seconds, or until finely chopped. Strain the food through cheesecloth and collect the resulting filtrate for testing. This way, students will be testing the resulting dilute solution that will contain varying amounts of ions and molecules. Avoid foods that are high in oil or fat content, as they may leave residues on the electrodes of the Conductivity Probe (see the probe user's guide that was shipped with the probe for further information).
6. Several sources of water can be tested, including stream, tap, ocean, and lake water. Students may want to bring samples in from home to test.
7. The calibration that is stored within the data-collection software will work fine for a comparison of different solutions. For more accurate conductivity readings, you (or your students) can do a 2-point calibration for each Conductivity Probe using air (0 conductivity value) and the calibration solution that came with the Conductivity Probe (1000 µS/cm value).
8. If you make measurements of ocean water, you will need to dilute samples to 1/4 of their original concentration by adding 100 mL of the salt-water sample to 300 mL of distilled water. This diluted sample can then be measured using the Conductivity Probe at the high-range setting. Multiply the conductivity reading by 4 to obtain the actual conductivity.

SAMPLE RESULTS

Table 1		
Solution	Material	Conductivity (µS/cm)
1	Distilled water	0
2	Sodium chloride, NaCl	5214
3	Calcium chloride, $CaCl_2$	9362
4	Aluminum chloride, $AlCl_3$	11707
5	Ethanol, C_2H_6O	0
6	Sucrose, $C_{12}H_{22}O_{11}$	0
7	Glucose, $C_6H_{12}O_6$	0
8	Tap water	varies (20 – 1000)

ANSWERS TO QUESTIONS

1. The solutions containing mostly ions conduct best.

2. Distilled water does not conduct well because it contains few ions.

3. Tap water does conduct electricity. It contains Ca^{2+}, Mg^{2+}, Fe^{3+}, CO_3^{-2}, HCO_3^-, and other ions that dissolve into water as it flows through and over soil and rocks.

4. The conductivity increases from NaCl through $AlC1_3$ because of the increasing number of ions. A formula unit of NaCl contributes two ions, $CaCl_2$ three ions, and $AlCl_3$ four total ions.

5. Ocean water conducts much more than pond water. It has many more ions in it than pond water.

6. Answers may vary.

7. Any soluble ionic solid, and some soluble molecular substances, will give a conducting solution. Some common ionic solids that give conducting solutions include
   - The “no-salt” substitute, potassium chloride (KCl).
   - Salt peter, sodium nitrate ($NaNO_3$).
   - Ammonium chloride (NH_4Cl).
   - Epsom salts, magnesium sulfate ($MgSO_4$).
   - Drano®, sodium hydroxide (NaOH).
   - Muriatic acid, hydrochloric acid (HCl), is an example of a conducting solution made by dissolving a molecular substance.