Properties of Bonds

As you learned in Chapter 5, compounds differ in the physical property of conductivity depending on whether an ionic or covalent bond is present in the substance. Types of substances that dissolve to produce conducting solutions are called electrolytes. Electrolytes can either be strong or weak: a strong electrolyte is one that conducts electricity very well; a weak electrolyte is one that conducts electricity very poorly. In this investigation, you can see for yourself how well different liquids and compounds in solution are able to conduct electricity.

Question

What type of bond in a liquid or solution conducts electricity, and what type does not?

Prediction

Predict what substances in this investigation will conduct electricity, based on the bond type present.

Materials

computer system and interface
conductivity sensor
distilled water
tap water
ethyl alcohol (C_2H_5OH)
0.05 M solutions of sugar, table salt (NaCl), NaI, KCl, and KI.
8 beakers (100 mL)

Safety Precautions

- Ethyl alcohol is flammable — keep away from flames.
- Use caution with all solutions as some are caustic, poisonous, or will stain clothing.

Procedure

1. Copy the data table below into your notebook.

Trial #	Liquid or solution	Predicted type of bond	Conductivity (µS)	Type of bond
1.	Sugar			
2.	Table salt			
3.	NaI			
4.	KCl			
5.	KI			
6.	Distilled water			
7.	Tap water			
8.	Ethyl alcohol			

Predict the type of bond contained in each of the substances and record this in the appropriate column of the table.

2. Pour approximately 30 mL of sugar solution into a beaker. Label the beaker "sugar."

3. Repeat step 2 using salt, NaI, KCl, and KI solutions.

4. Prepare three beakers containing 30 mL of distilled water, tap water, and ethyl alcohol, and label them appropriately.

5. Set up the computer system with the conductivity sensor.

6. Calibrate the conductivity tester.

7. Display the conductivity tester with a digits and/or meter display.

8. Start the probeware data collection.

9. Completely submerge the end of the conductivity sensor into the beaker of sugar solution.

10. Once the reading has stabilized, record the measure of conductivity into the data table.

11. Remove the sensor from the beaker of sugar and completely rinse the sensor with distilled water. Dry the sensor with a tissue.

12. Repeat steps 9 to 11 with each of the different liquids and solutions.

13. Stop the data recording.

14. Discard the solutions as directed by your teacher. Do not pour anything down the drain. Clean all the equipment thoroughly and wash your hands thoroughly.

Analysis

1. Which solutions were strong electrolytes, and which solutions were weak or non-electrolytes?

2. Explain any differences in your results for distilled water and tap water.

Conclusions

3. In general, what types of bond conduct electricity?

4. In general, what types of bond do not conduct electricity?

Applications

5. How will the conductivity change if the amount of solute (one which has been shown to conduct electricity) dissolved into the solvent is increased to the point of saturation?

6. Electrolytes are conductors because a flow of electricity is caused by the charged ions in the solution. Cations (positive ions) move toward the negative electrode or cathode. Anions (negative ions) move toward the positive electrode or anode. This movement of ions toward the oppositely charged electrode in the solution causes the flow of electricity. Why do cations move toward the cathode and not the anode?

7. Collect tap water from your home and test it for conductivity. How does it compare to the tap water from school or from other students' homes?

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