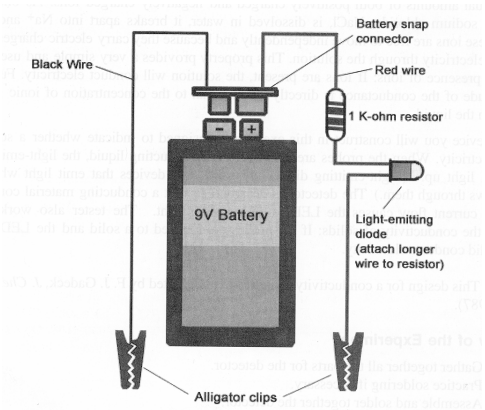
Name:_____

Conductivity Detector

I. Proceedures:

1. Your instructor will provide you with the parts to build a simple LED conductivity that is shown in the following circuit:



You will have to provide the nine volt battery

Your instructor will assist you with the soldering once you have your device assembled.

Once everything is soldered, connect the battery and carefully tape the components to the battery.

Your conductivity detector is now ready for use.

II. Using the Conductivity Detector to Test for Ions

If alligator clips are used, do not insert the metallic clips directly into the solutions. Instead, clip a short piece of wire (e.g., a partially unfolded paper clip) into each alligator clip. These wires can then be inserted into the solutions to be tested. Using wires in this fashion keeps the alligator clips out of the solutions and prevents the clips from becoming corroded.

To test a liquid sample, dip the wires attached to the alligator clips (or the wires themselves if no clips are used) into the liquid to be tested. The wires should dip in about a half an inch and should not touch each other. If the light goes on, it means that an electric current is flowing through the solution and that the solution contains ions. *It is important to rinse off the wires with pure water each time they are to be inserted into a new solution so as not to carry over contamination from one solution to the next.*

The tests that follow can be performed in small beakers, small test tubes, or in a plastic Fellplate. Be sure to record your observations on the data sheet as you proceed. For each test, record whether you observe no light, a bright light, or a dim light.

1. Test the conductivity of (a) pure water (distilled or de-ionized) and (b) tap water. What can you conclude about the presence of ions in each?

2. Next, test a sample of salt water (1 % solution of sodium chloride). Is the result what you expected?

3. Test a solution of sodium Bicarbonate (formula: $NaHCO_3$, Baking Soda). Does it contain ions?

4. Vinegar a water solution of Acetic Acid, (which, by itself, consists of CH3Ch2OH molecules). Test a solution of Vinegar. What do you conclude? How would a chemist describe what is present in Acetic acid solutions?

5. Test a 1 % solution of sugar in water. Does it contain ions?

6. Test a 10% solution of ethanol (ethyl alcohol) in water. Does it contain ions?

7. Using salt water, find out whether your conductivity tester is sensitive to the length of the wire that is immersed in the liquid being tested. Also find out whether the sensitivity of your detector is affected by the distance between the wires that are immersed in a liquid.

8. Devise and carry out an investigation to determine how sensitive your detector is to the presence of ions in solution. Record your method and the results.

III. Questions:

1. Which of the tested liquids contained ions? Which ones did not contain ions?

2. Did the brightness of the light vary from solution to solution? Cite specific examples. What does a dim light tell us about the number of ions in a solution?

3. If you wanted to make a solution of an unknown solid substance to test it for the presence of ions, would it matter whether you used pure water or tap water to make the solution? Explain briefly.

4. If you were able to test some commercial products, read the labels on the containers of these liquids and attempt to determine what substances were responsible for the liquid's conductivity, if any.

5. The purity of ultrapure water is often measured with conductivity detectors. Based on what you have observed, why is this a good test for water purity? In what way might it be incomplete?

6. Describe the results you got when you varied the length of wire immersed and the distance between wires. Offer explanations for the behavior you observed.

Note: This experiment was adapted from the Laboratory Manual, Chemistry in Context, Fourth edition