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**Solution Conductivity Lab**

**Guiding question:** What factors influence the conductivity of a solution?

The conductivity of a solution is influenced by the molarity of that solution and the substances it is made out of.

**Evidence:**

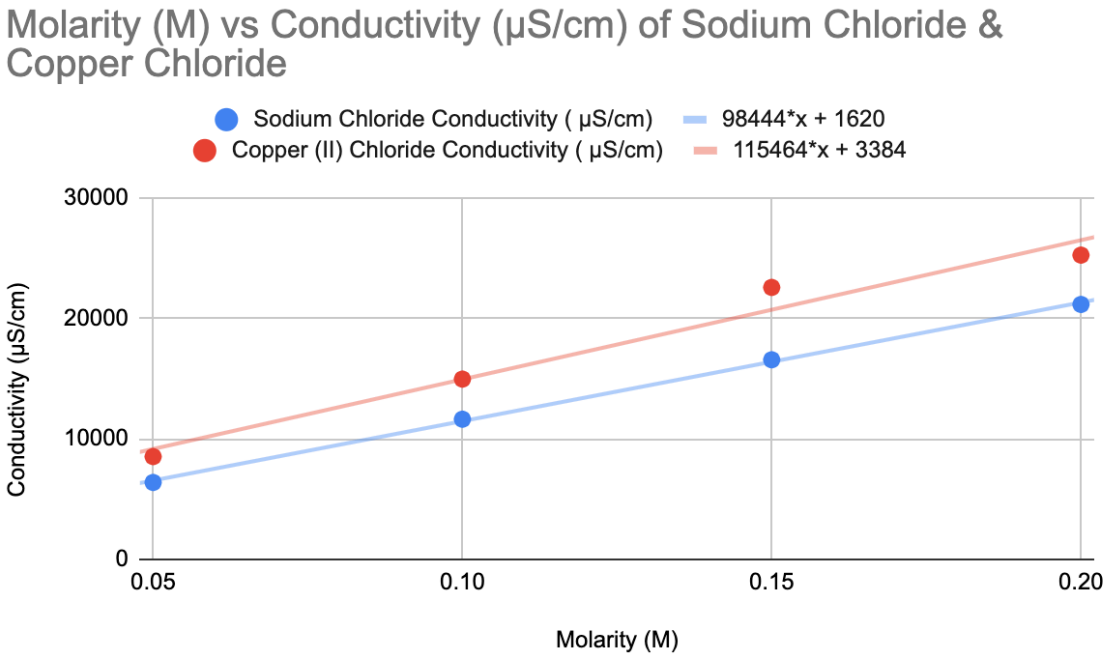
| **Molarity (M)** | **Sodium Chloride Conductivity ( μS/cm)** | **Copper (II) Chloride Conductivity ( μS/cm)** |
|---|---|---|
| 0.0500 | 6379 | 8525 |
| 0.100 | 11625 | 14951 |
| 0.150 | 16555 | 22556 |
| 0.200 | 21143 | 25234 |

During this lab, my group began by measuring 100mL of water in a graduated cylinder. Over the course of the first half of this procedure, we continued to add amounts of sodium chloride into the water. The amount we added corresponded to the amount of sodium chloride we calculated was necessary to make a 100mL solution of sodium chloride with different molarities. First, we added 0.292g of sodium chloride into the 100mL sample of water to create a 100mL sample of sodium chloride with a molarity of 0.0500M. (We measured the 0.292g by meticulously pouring out a sample of sodium chloride onto a thin piece of paper until the scale that we laid it on told us the correct value.) Next, we placed a conductivity probe into our solution that was hooked up to a computer and told us the conductivity of our sodium chloride solution. The conductivity value was 6379μS/cm.

For the next few steps, the value of molarity for the sodium chloride solution we were trying to make was simply increasing by 0.0500M. This meant that we just had to add another 0.292g of sodium chloride between each step. After each step, we again placed the conductivity probe into our solution. As seen in the graph, the 0.100M solution of sodium chloride had a conductivity of 11625µS/cm, the 0.150M solution had a conductivity of 16555µS/cm, and the 0.200M solution had a conductivity of 21143µS/cm.

During the second half of the procedure, we followed the same steps, just using copper chloride. In our prelab, we calculated that we needed 0.672g of copper chloride in order to create 100mL of a 0.05M solution of copper chloride. We first measured a new 100mL of water into a graduated cylinder and added 0.672g of copper chloride. We then used a conductivity probe to measure our 0.0500M solution and found that it had a conductivity of 8525µS/cm. Just like the sodium chloride solution, we continued to add 0.627g of copper chloride into our solution and measured the conductivity after each step. As you can see in the graph, the 0.100M solution of copper chloride had a conductivity of 14951µS/cm, the 0.150M solution had a conductivity of 22556µS/cm, and the 0.200M solution had a conductivity of 25234µS/cm.

The scatter graph below represents the table above and displays how the conductivity of a sample of sodium chloride or copper chloride is affected by its molarity.



**Reasoning:**

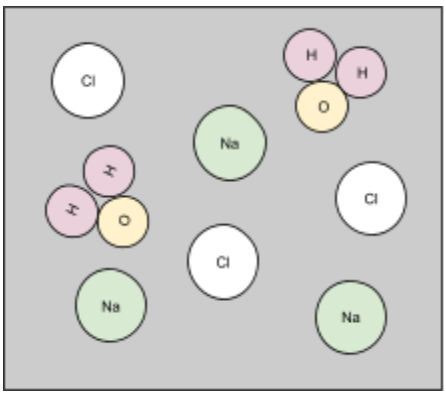
Why would different concentrations of solutions with the same solute have different conductivities?

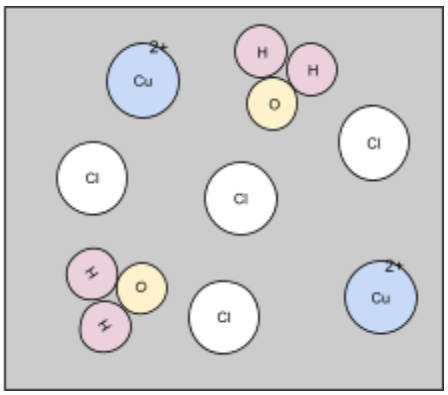
Conductivity is a solution's ability to conduct electricity, meaning that a greater amount of solution will be able to conduct more electricity. In the case of this lab, our solute (sodium chloride or copper chloride) is the solution conducting electricity. In the lab, our sample of a sodium chloride solution had the smallest conductivity of 6379μS/cm when it had the least amount of sodium chloride in it. As we continued to add more sodium chloride, the conductivity of the sodium chloride solution only increased. The same exact thing happened to the copper chloride solution as we added more copper chloride.

Why would equal concentrations of solutions with the different solutes have different conductivities?

When dissolved in water, different solutes will form different ions. Different ions have unique charges meaning that they will have different levels of electricity that they can conduct. Therefore, different solutes will have different conductivities. When dissolved in water, sodium chloride (NaCl) becomes $Na^+$ and $Cl^-$ while copper chloride becomes $Cu^{2+}$ and $Cl^-$. Because copper (Cu) has a greater charge of 2, this means that copper chloride has a greater conductivity than sodium chloride. This can be visualized in the data from this lab because the conductivity of the copper chloride for each amount of concentration is always greater than the conductivity of sodium chloride.

What would each solution look like on a particle level and how would that influence the conductivity? Draw particle diagrams that show how each solution compares to each other.



As explained in the answer to the last question, copper chloride will have a greater conductivity than sodium chloride when you use the same concentration of both because there's a greater amount of chloride ions conducting electricity in copper chloride.

Use the **trend line equations** from your graph to make a prediction of what the conductivity of each solution would be at a concentration of 0.500 M

Sodium Chloride Conductivity ( μS/cm) = 98444(0.500M) + 1620
Sodium Chloride Conductivity = 50842μS/cm

Copper (II) Chloride Conductivity ( μS/cm) = 115464(0.500M) + 3384
Copper (II) Chloride Conductivity = 61116μS/cm

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Clara Fuster-Bennett helped me figure out the second question of the reasoning section.