Macintosh HD:private:var:folders:tq:g7b5qchx4nz134dg4n5l152j_xwxcp:T:TemporaryItems:design stem logo final.pdfMacintosh HD:private:var:folders:tq:g7b5qchx4nz134dg4n5l152j_xwxcp:T:TemporaryItems:design stem logo final.pdf**Worksheet 3: What substances are in solutions that conduct electricity?**

Some compounds dissolve in water, and the solutions conduct electricity. Why do some compounds conduct electricity? What do the solutions look like at the submicroscopic level?

**Learning objectives:**

* Measure and compare the conductivity of different water solutions
* Explain the differences in the conductivity measurement from the submicroscopic perspective

**Materials**

* Sodium Chloride (NaCl)
* Sugar (C12H22O11)
* Baking Soda (NaHCO3)
* Deionized water
* Tap water
* 100 ml volumetric flasks
* Weigh boat
* 250 ml beakers
* Conductivity tester
* Conductivity probe and lab quest
* KimWipes

**Procedure**

1. Prepare 100 ml of 0.1 M solution of sodium chloride by weighing out an appropriate amount of material and transferring the solid to a 100-mL volumetric flask. Add enough deionized water to dissolve the solid. You may need to shake the solution to ensure dissolution. When everything is dissolved, add more deionized water to reach the 100-mL mark. Transfer the solution that you made to a 250-mL beaker. Label appropriately

Figure 1 Conductivity Indicator

1. Repeat Step 1 for sugar and baking soda.
2. Fill two more beakers with a) 100 mL deionized water and b) 100 mL tap water. Label them appropriately.
3. Classify conductivity of solutions and water samples as non-conducting, low-conductivity or high conductivity using the battery-operated conductivity indicator. Bring the conductivity indicator to each beaker to touch the metal ends of the indicator in each solution. When the conductivity of the solution is high, the the indicator light glows brighter and the beeping sound is louder.

Figure 2 Conductivity Probe

1. Measure the conductivity using the conductivity probe. Before the measurement, read the instruction in the Appendix and calibrate the conductivity probe. It should be set on the 0-20,000 μS/cm position. Measure conductivity of each solution and water sample. Avoid trapping any air bubbles in the probe opening. The conductivity value may drift for a few minutes. After the value stops changing, record the conductivity value in the table below. Between measurements, rinse the probe thoroughly with deionized water and dry the probe with KimWipes.

**Data**

|  |  |  |  |
| --- | --- | --- | --- |
| Sample | Observations (Conductivity Indicator) | Classification:  Non/Low/High conductivity | Conductivity Value (Conductivity Probe) |
| Sodium Chloride Solution |  |  |  |
| Sugar Solution |  |  |  |
| Baking Soda Solution |  |  |  |
| Tap Water |  |  |  |
| Deionized Solution |  |  |  |

**Data Analysis and Discussion**

1. Summarize the observation and measurements of conductivity values.
2. Draw a submicroscopic view of the solution and waters. How do they look different? Explain how the differences in the submicroscopic view explain your observation and measurement.

|  |  |
| --- | --- |
| Sodium Chloride | Sugar |
|  |  |
| Baking Soda | Tap Water |
|  |  |
| Deionized Water | How does this representation explain your observation and measurement? |
|  |

Appendix: Calibration of conductivity probe

|  |  |  |
| --- | --- | --- |
| **Measuring Conductivity** | We will measure the conductance of several solutions using a conductivity probe similar to that shown in the figure. When the probe is in a solution with ions, an electrical circuit is completed across the electrodes which are on either side of the hole in the probe. A voltage is applied to the two electrodes and the resulting current is proportional to the conductance of the solution. This conductance is displayed by LabQuest 2. | |
|  | |  |
| **Connecting the Equipment** | | You will use a LabQuest 2 interface and probe to measure conductivity of solutions. You will get the in LabQuest from your instructor and the probe will be in a holder beside the computer at your bench. Connect the probe to the interface at CH 1 port. Also, there is a toggle switch on the cord of the probe that must be set to a range of 0 – 20,000 µS. |
| **Calibrating the Conductivity Probe** | | On the reagent bench, you will find small jars of Conductivity Calibration Solution. This solution is a carefully prepared solution of known concentration that is used to calibrate the conductivity probe. To avoid spilling the jar of calibration solution; clamp and stabilize the conductiv­ity probe to a ring stand during the calibration process. The probe is immersed directly into the jar of solution to calibrate the probe. Do not transfer the calibration solution to another container. Return the jar of solution to reagent bench when you are finished.  1) Click the ***Sensors*** menu on the tool bar.  2) Choose **Calibrate** > **CH1: Conductivity 20000MICS**.  3) Click **Calibrate Now.**  4) Rinse the probe with deionized water and dry completely with KimWipes. Set **Value 1** to 0 µS/cm and click ***Keep***.  5) Now immerse the end of the probe into the 10,000 μS calibration solution making sure to completely cover the opening in the end of the probe. Be sure that no air bubbles are trapped in this opening. Enter 10,000 µS/cm as the calibration value for ***Known Value 2***. Click ***Keep***.  6) Click ***OK*** to accept your calibration values and return to the sensor window. |
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