ScienceCube

Electrolytes and Nonelectrolytes

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1. **Distinguish between saltwater and sugar water as electrolytes and nonelectrolytes.**
2. **Understand and explain the principle of current flow in electrolyte solutions.**

Fundamental Concept

1. **Electrolytes and Nonelectrolytes**

   A. Conductors

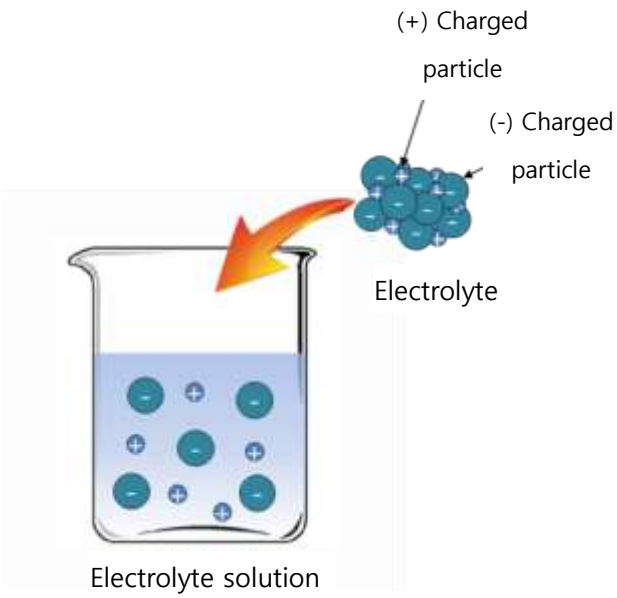
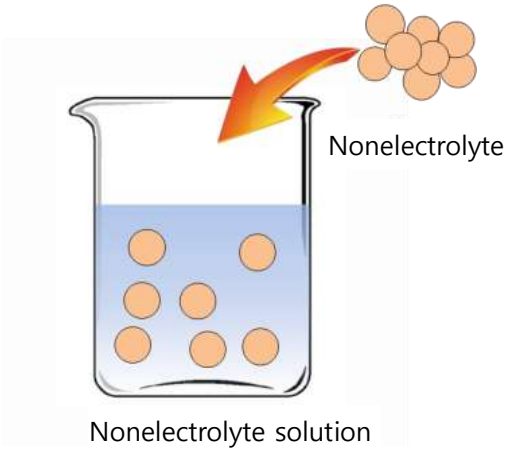
   i. Materials through which current flows well in a solid state.

   Most metals allow many free electrons to move, thus allowing current to flow.

   Examples: Silver, copper, iron, aluminum, graphite

   B. Insulators

   i. Materials through which current does not flow in a solid state.

Electrolytes	Nonelectrolytes
Substances that conduct current in an aqueous solution. For example, solid salt (NaCl) does not conduct electricity because Na+ and Cl- ions are strongly ionically bonded. However, in an aqueous solution, Na+ and Cl- ions separate and move toward the positive and negative electrodes, respectively, allowing current to flow. Examples: Sodium chloride, copper(II) chloride, potassium nitrate, acetic acid	Substances that do not conduct current in an aqueous solution. For example, when sugar dissolves in water, it breaks into sugar molecules dispersed evenly in the water. However, sugar molecules do not produce charged particles, so no current flows. Examples: Sugar, starch, glucose, ethanol, acetone
	

Experiment

Materials Needed

Interface, Science# Program, Conductivity Sensor, Distilled Water, Sugar, Salt, Measuring Spoon, Two 100 mL Beakers, Electronic Scale, Filter Paper (10)

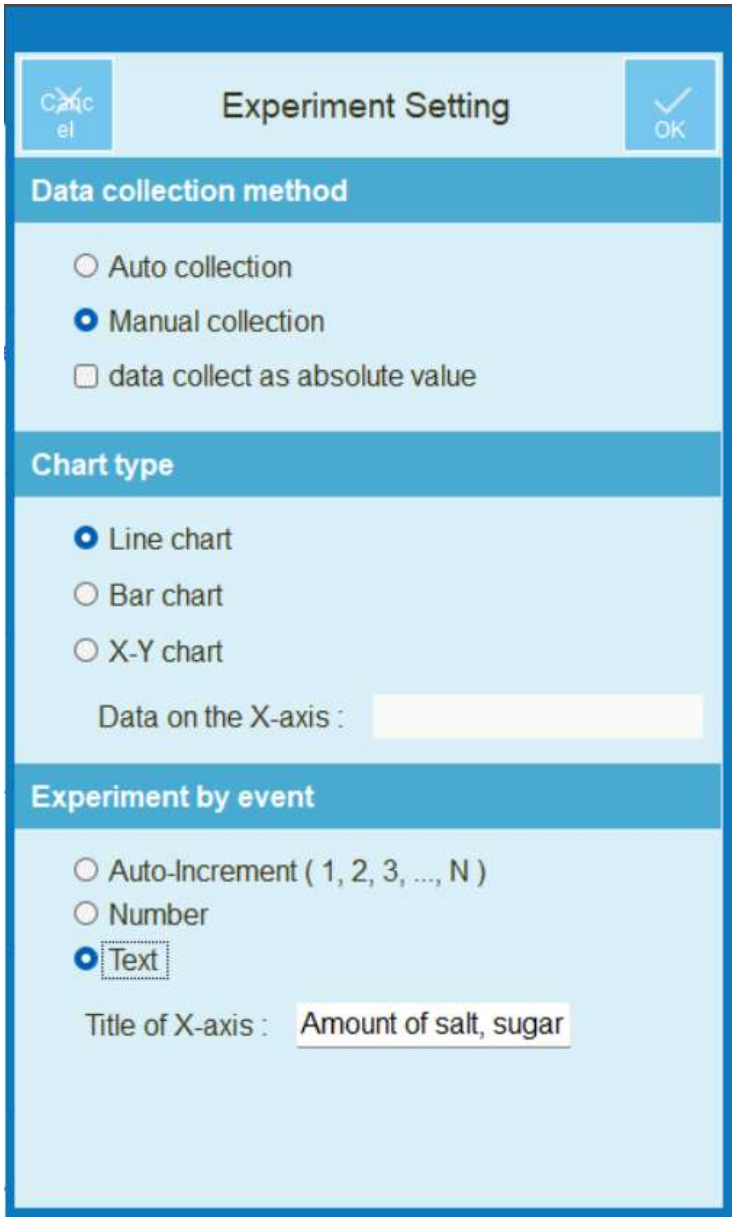
Preparation of Experimental Setup

1. Using an electronic scale, weigh 0.2 g each of salt and sugar, and place them on filter papers.

2. Fill two beakers with 100 mL of distilled water each, and label one for salt and the other for sugar.

Interface Setup

1. Launch the Science# program.
2. Connect the conductivity sensor to the interface.
3. Click to set up the experimental environment as shown below, or use the automatic setting option.



Automatic setup

Data Collection

1. Click to set the graph type to a bar graph.
2. Click to start data collection.
3. Place the conductivity sensor in the beaker.
4. Once the values stabilize, click and enter 'Salt 0.0g' in the text input window.
5. Add 0.2g of salt to the beaker, and once the values stabilize, click .
6. When the text input window appears, enter 'Salt 0.2g.'
7. Repeat the process, increasing the amount of salt by 0.2g increments up to 1g, and measure the conductivity for each concentration.

8. After completing the measurements, click  and repeat steps #1 to #7 using sugar instead of salt to measure the conductivity of the sugar solution.

Data Analysis

Recording Data

1. Measure the conductivity of saltwater while varying the amount of dissolved salt. Represent the conductivity as a bar graph based on the concentration of the salt solution.

2. Measure the conductivity of sugar water while varying the amount of dissolved sugar. Represent the conductivity as a bar graph based on the concentration of the sugar solution.

3. Based on the above graphs, classify saltwater and sugar water as electrolytes and nonelectrolytes and explain the reasons.

4. Compare how the conductivity changes with the concentration of saltwater and sugar water, and explain the reasons..

Data Application and Extension Activities

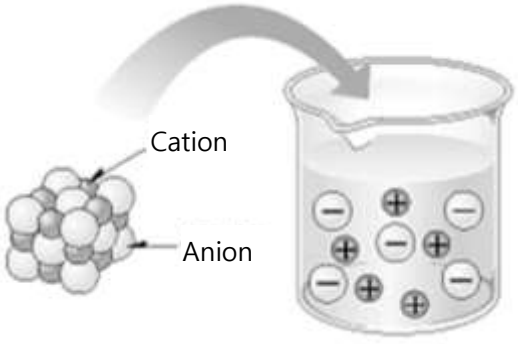
1. The following figures show the conductivity measurements of each solution using a conductivity sensor.

(a)	(b)	(c)
		
20	10.9	0

Based on the above figures, fill in the blanks with the appropriate symbols.

① ( ) has fewer ions than (b).
② ( ) has no ions.
③ ( ) has fewer charged particles than (a).
④ ( ) is distilled water, and ( ) corresponds to salt..

2. The following figure shows the model of saltwater when salt is dissolved in water. Select the incorrect statement based on the explanation.



① Salt does not conduct electricity in a solid state.

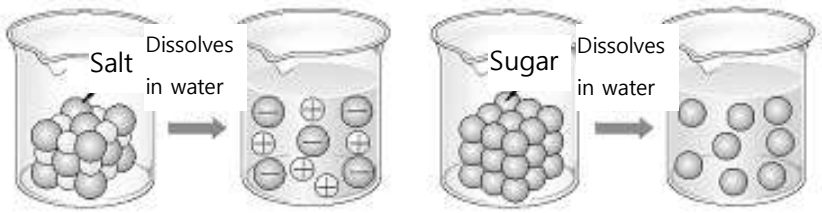
② Salt exists as ions in an aqueous solution.

③ Salt is bonded by electrostatic attraction between sodium ions and chloride ions.

④ When connected to a power source, sodium ions move to the (+) electrode, and chloride ions move to the (-) electrode, allowing current to flow.

⑤ The ionization equation of salt is NaCl → Na+ + Cl-.

3. The following figure shows the particles of salt and sugar dissolved in water.



(a) (b) (c) (d)

Choose the correct statements from the options below. (Note: + and - represent cations and anions, respectively.)

<Option>
① (a) is a conductor.
② When connected to a power source, cations move to the (-) electrode, and anions move to the (+) electrode in (b).
③ When not connected to a power source, particles freely move in (b) and (d).
④ Current flows in (b) and (d).

4. Measure the conductivity of various solutions and represent them as a bar graph. Classify the solutions into electrolytes and nonelectrolytes..

Electrolyte	Nonelectrolyte


Report
(For Teachers)
Report
(For Students)