

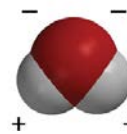
5th Grade - Lesson 1.2

Dissolving an M&M

Teacher Background

Water is a polar molecule

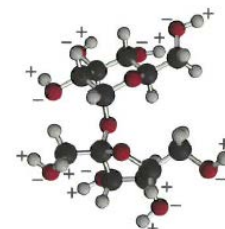
Water molecules are made up of two hydrogen atoms bonded to one oxygen atom. Each bond between oxygen and hydrogen causes the area near the oxygen to be slightly negative and the area near the hydrogen to be slightly positive. When a molecule has an area of positive and negative charge like this, it is called a *polar* molecule.



Water Molecule

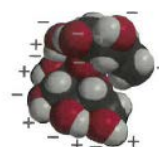
Sucrose molecules are also polar

The common sweetener sugar is a compound called *sucrose*. Sucrose is a pretty big molecule made up of two simpler sugars called *glucose* and *fructose*. The sucrose molecule is made up of carbon, hydrogen, and oxygen atoms and has the chemical formula C₁₂H₂₂O₁₁.



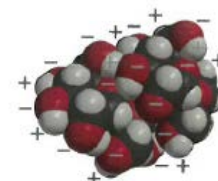
Sucrose Molecule
(Ball-and-Stick Model)

Like water, the sucrose molecule has bonds between the oxygen and hydrogen atoms. And like water, the area near the oxygen is slightly negative and the area near the hydrogen is slightly positive. This gives sucrose many areas of positive and negative charge and makes sucrose a polar molecule. The carbon atoms in the molecule don't contribute to sucrose's polarity.



Sucrose Molecule
(Space-filling Model)

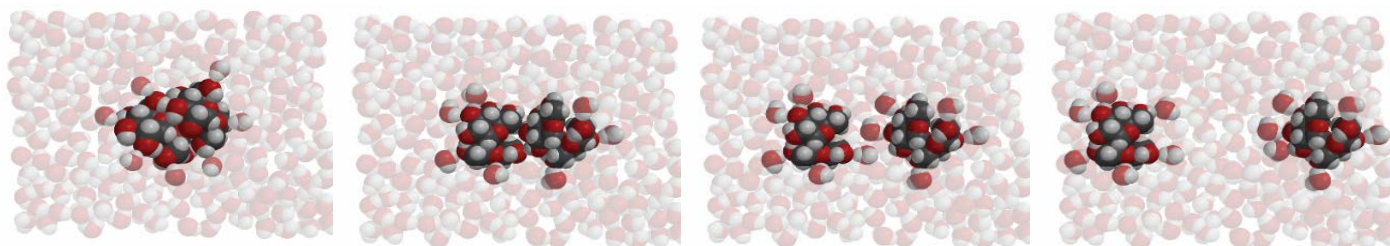
Another model of a sucrose molecule, called a space-filling model, looks like this: Entire sucrose molecules attract and connect to one another based on the attractions of opposite polar areas between the molecules. In fact, the attraction between these opposite charges is what holds one sucrose molecule to another in a granule of sugar. Here is a model of two sucrose molecules joined together.



Two Sucrose Molecules

How does water dissolve sugar?

When water dissolves sugar, the water molecules attract the sucrose molecules and pull them away from each other.



Notice how the positive areas of the water molecules (near the hydrogen atoms, white) are attracted to the negative area near the oxygen atoms (red) on the sucrose molecules. And the negatively charged areas of the water molecules (near the oxygen atoms (red) are attracted to the positive area near the hydrogen atoms (white) on the sucrose. The attractions the water molecules have for the sucrose molecules overcome the attraction the sucrose molecules have for each other and so they separate from one another. As the sucrose dissolves, the molecules become completely surrounded by water molecules and move throughout the water.

It is the polar nature of water as well as the polar nature of sucrose that explains why sugar dissolves in water.