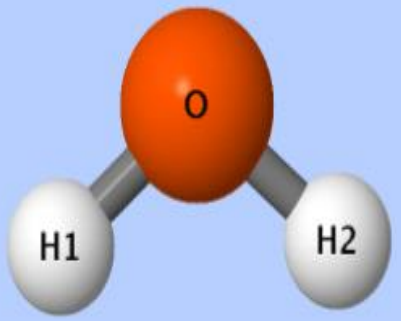
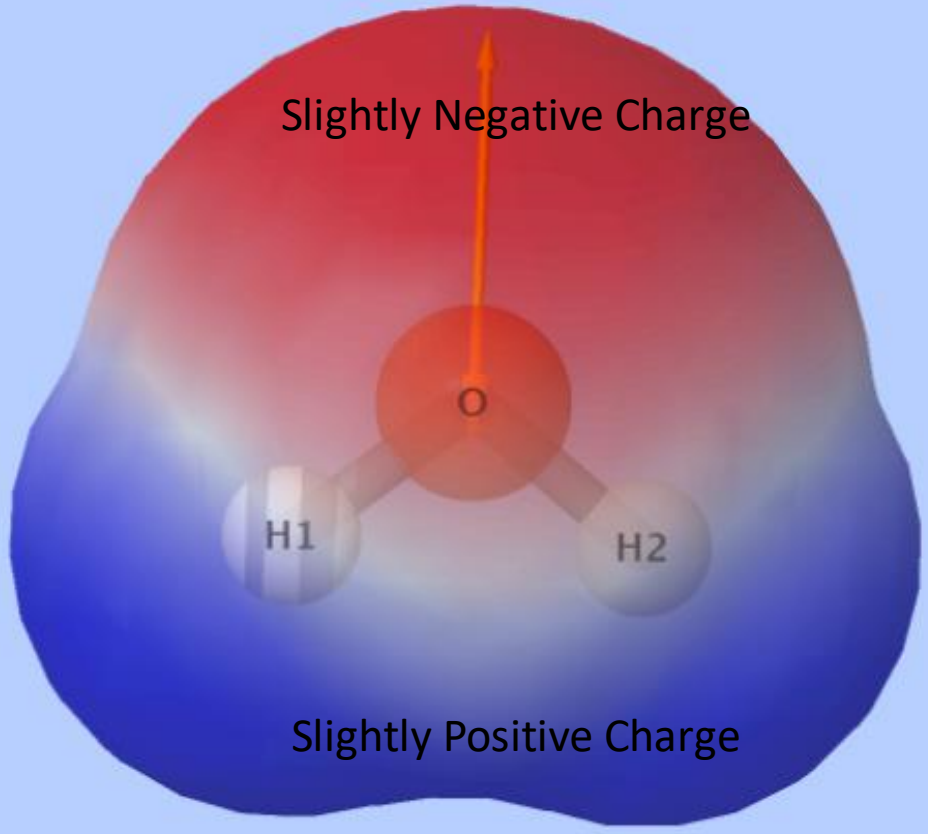
Properties of Water

ROSEDALE ACADEMY

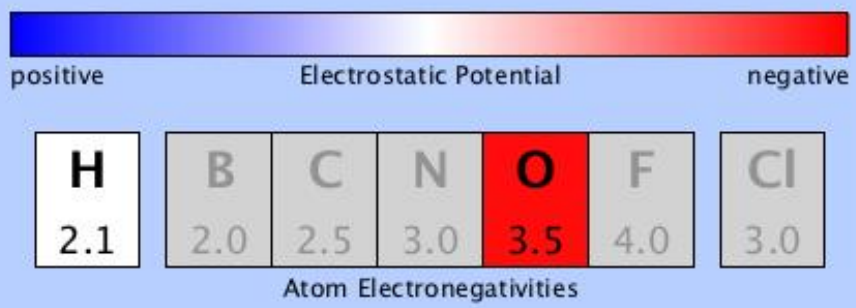
Solutions can be made by mixing certain solids in water. When a solid dissolves, the bonds between ions or molecules that comprise the solid are disrupted, causing the solid to break apart and disperse evenly throughout the liquid to create a homogeneous mixture. In the animation below, ionic bonds between sodium and chloride ions are broken, causing the ionic compound to break up and the individual Na+ and Cl- ions to disperse throughout the water, creating an aqueous solution.

Water (H_2O) is a polar molecule. This is due to differences in the way that oxygen and hydrogen atoms attract the shared electrons that make up the covalent bonds between oxygen and hydrogen atoms.





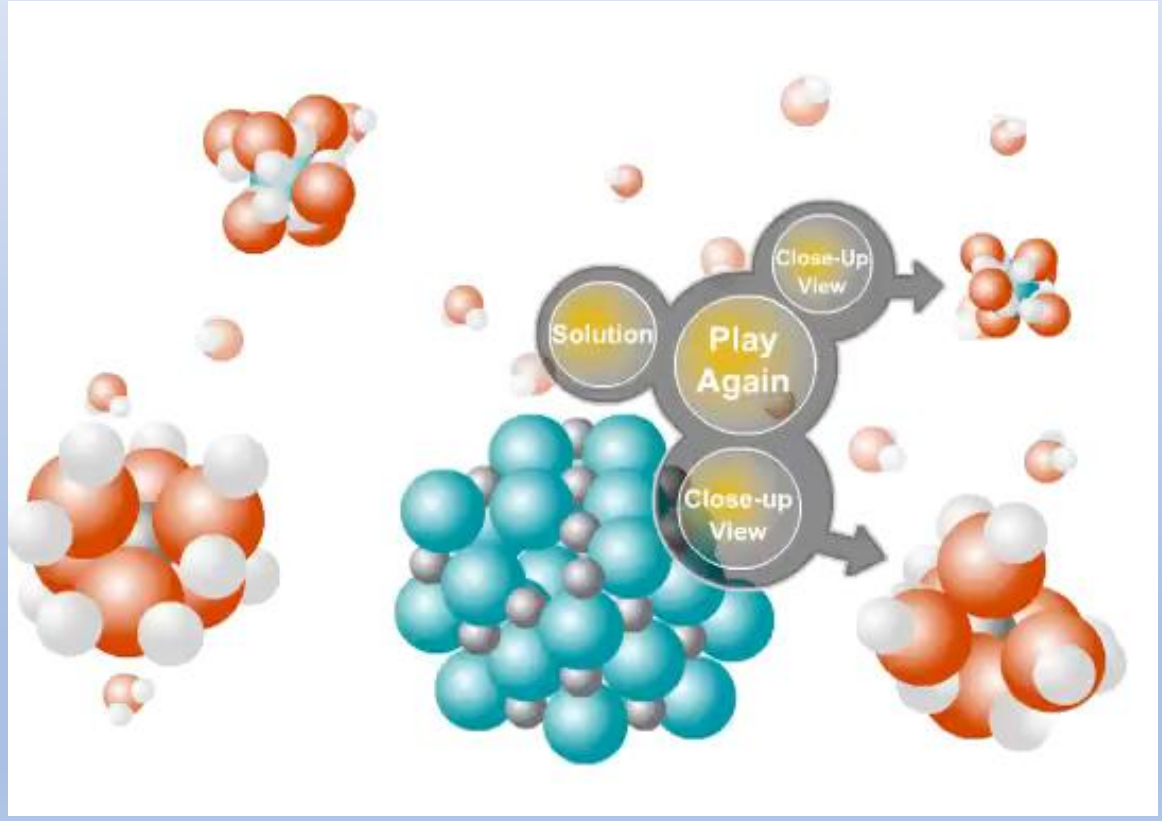
The ability to attract shared electrons is called electronegativity. Oxygen has a higher electronegativity value and as a result the oxygen end of a water molecule tends to have a slight negative charge while the hydrogen atoms tend to have a slight positive charge. This difference in electronegativity makes water molecules slightly polar.



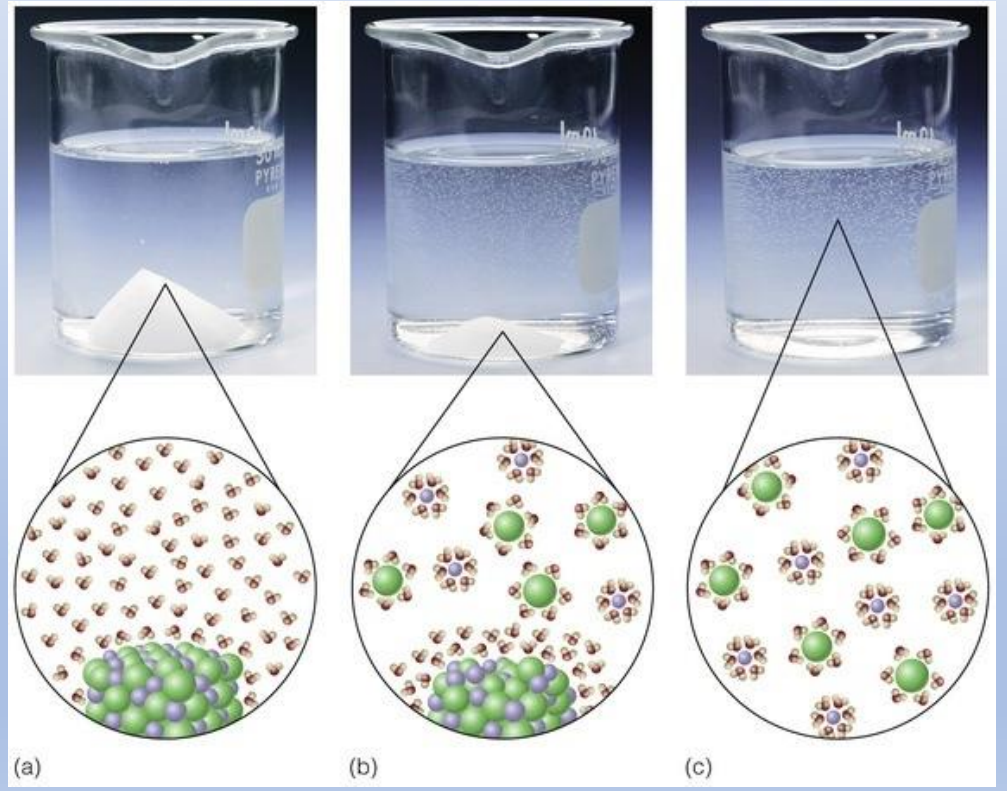
Dissolving Ionic Compounds

The video below demonstrates how the polar nature of water molecules helps to breakdown and disperse ionic compounds to create a solution when solute (ionic compound) and solvent (water) are mixed.

*Hover over the video and click the play button to start the video.



When an ionic compound dissolves, polar water molecules surround ions causing the dissociation of the ionic compound which leads to the dissolving of the solid. Surrounded ions are then dispersed evenly throughout the solvent, creating a uniform solution.



Dissociation

Dissociation is the process where ions dissociate from ionic crystals to become individual ions (ie. Na^+, Cl^-). Dissociation can be represented by a chemical equation, for example, the dissociation of solid sodium chloride (table salt) can be represented as follows:

$$NaCl\ (s) \rightarrow Na^+\ (aq) + Cl^-\ (aq)$$

Dissolving Molecular Compounds

Water also has the ability to break down and disperse certain molecular compounds to form solutions. The polar nature of water molecules allow them to disrupt the intermolecular bonds that hold together molecular compounds that also have a polar nature. Polar water molecules are then able to surround the polar molecular compounds and disperse them throughout the solution, creating a homogenous mixture. Click the link below to visualize how aqueous solutions can form between a mixture of water and polar molecular compounds.

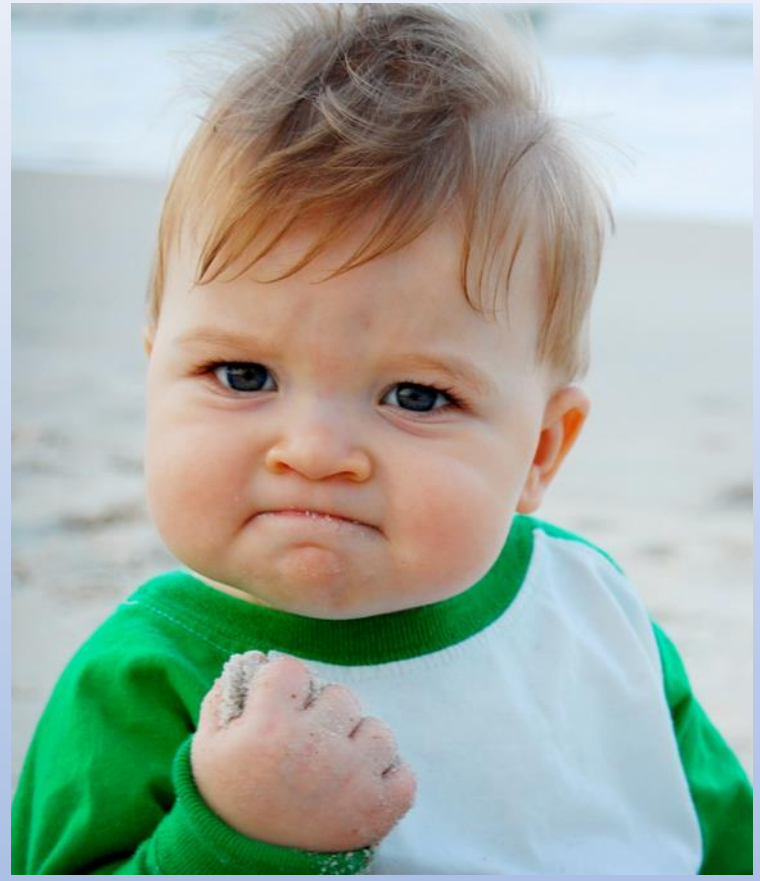
http://www.mhhe.com/physsci/chemistry/animations/chang_7e_esp/clm2s3_4.swf

Like Dissolves Like

Water has the ability to dissolve polar solutes due to its polar nature. However, non-polar solutes like crude oil do not dissolve in water. This is because the polar nature of water molecules cannot disrupt the bonds between molecules of a non-polar solute. However, non-polar solvents are able to dissolve non-polar solutes.

Success!

You have reached the end of this learning activity. You will know that you have achieved the goals for this lesson when you can describe how water is able to dissolve and form aqueous solutions with ionic and polar compounds and explain how the saying “like dissolves like” applies to the formation of polar and non-polar solutions.



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