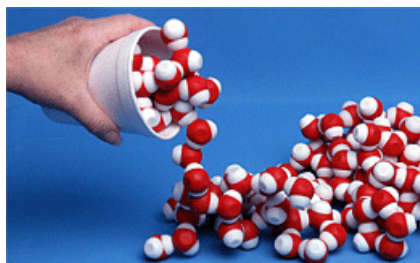


# Proteins Fold in an Aqueous Environment

## SMART Teams

Exploring the  
Molecular World



### Water Cup Contents

- 12 water molecules
- 1 sodium atom
- 1 chloride atom
- 1 two-carbon ethane core with 5 non-magnetic hydrogens
- 1 non-magnetic hydrogen cap and grey plug
- 1 hydroxyl group

### Activity

1. Pass out one water molecule to each student. Give the chemical formula of water and identify the atoms in a molecule of water.  $H_2O$ . *Hydrogen is white and oxygen is red.*
2. Using two molecules of water, identify which regions can interact and which regions do not interact. *The hydrogen binds oxygen. Hydrogen does not bind hydrogen, oxygen does not bind oxygen.*
  - a. Give a reason why the regions are able to interact. *Because the electrons are unequally shared between the hydrogen and the oxygen, water is a polar molecule. The two hydrogen atoms have a slightly positive charge and the oxygen atom has a slightly negative charge.*
  - b. What is the name of this type of interaction? *Hydrogen bond.*
3. Predict what types of molecules will interact with water and what types of molecules will not interact with water. *Polar or charged molecules are able to interact with water.*
  - a. Sodium chloride? *Yes, the positively-charged  $Na^+$  will interact with the oxygen in water. The negatively-charged  $Cl^-$  will interact with the hydrogen in water.*
  - b. Ethane? *No. Ethane is a non-polar molecule.*
  - c. Ethanol? *Yes, the hydroxyl group in ethanol is polar and will interact with water.*
4. Test predictions with the sodium, chloride, ethane, and ethanol models in the water cup.
5. Develop a general statement describing the types of molecules that are able to interact with water and types of molecules that are not able to interact with water. *Molecules that are polar or charged will be able to interact with water.*
6. The cells in our body are mostly made of water. What prediction would you make about the proteins in the cell that are surrounded by water? *The outside portion of a protein in an aqueous environment will be polar and the inside portion of a protein will be hydrophobic.*

Additional lesson plans available from the Water Kit® Basic Lesson Plans available on the 3D Molecular Designs website: <http://www.3dmoleculardesigns.com/water1.php>