

## 5<sup>th</sup> Grade - Lesson 2.2

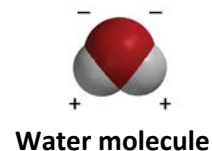
### Identifying an Unknown Liquid

#### Teacher Background

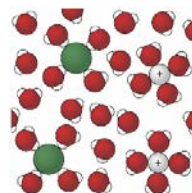
#### Polarity Makes a Difference

When placed on wax paper, water and salt water bead up but isopropyl alcohol and detergent spread out. The main difference between water and salt water, compared to alcohol and detergent, has to do with the polarity of water and salt water, and the relatively less polar detergent and alcohol.

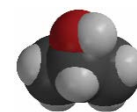
Water molecules are made up of two hydrogen atoms bonded to one oxygen atom. The bond between oxygen and hydrogen causes the area near the oxygen to be slightly negative and the area near the hydrogen to be slightly positive. This charge separation makes water a *polar* molecule. It's this polarity that causes water molecules to attract one another and that gives water a lot of its unique characteristics.



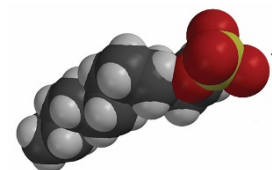
Salt water has positive sodium ions and negative chloride ions dissolved throughout the water. Water and salt water tend to bead up when placed on a surface because their molecules and ions attract each other and hold together.



But alcohol and detergent molecules are different. They have a large part of the molecule that is made up of carbon atoms bonded to hydrogen atoms. The bond between carbon and hydrogen is not very polar and does not result in areas of positive and negative charge like the oxygen-hydrogen bond in a water molecule. Alcohol and detergent molecules don't attract and hold together as well as water and salt water, so they act differently than water and salt water when placed on a surface. When placed on wax paper, detergent and alcohol spread out rather than bead up like water and salt water do.



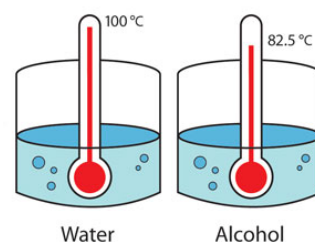
Alcohol molecule



Detergent molecule

#### Polarity Affects the Boiling Point

The difference in polarity between water and alcohol can also explain another property of these liquids. Since alcohol is less polar than water, alcohol evaporates faster than water and boils at a lower temperature. This makes sense since the water molecules have a greater attraction for one another, it takes more energy to make them move fast enough to break away from one another to become a gas.



Boiling point of water and alcohol