

Density and Polarity

Density measures how much space a substance takes up in its most compact state. The scientific equation is $\text{density} = \text{mass}/\text{volume}$. Water is heavier and denser than oil. That means water molecules are packed more tightly; a cup of water has more actual mass than a cup of oil. Therefore, when sharing a container, water will sink to the bottom while the oil sits on top.

Polarity keeps the oil and water from blending. Water molecules are "polar" due to having a lopsided electrical charge that attracts other atoms. One end of a water molecule has two hydrogen atoms and is positively charged. The other end, with the one oxygen atom, is negatively charged.

Similar to magnets, where opposite poles attract, the positive end of a polar molecule like water will connect with the negative end of other molecules.

On the other hand, oil molecules are non-polar and have neither a negative or positive charge, so instead of attracting each other, and mixing together, they are repelled by one another.

Commercial lava lamps also use polar and non-polar liquids however, a light is used to heat up the liquids. This makes the liquids expand and become less dense, causing them to interact, but not blend. As the liquids move farther from the heat, they cool and become denser until sinking back to the bottom and starting the cycle all over again.

Instead of a light, our homemade lava lamp uses Alka-seltzer tablets to produce carbon dioxide gas bubbles. These stick to the water molecules, making them less dense and producing a reaction much as heat does. When the lighter water rises to the top, the gas bubbles pop and the water sinks to the bottom