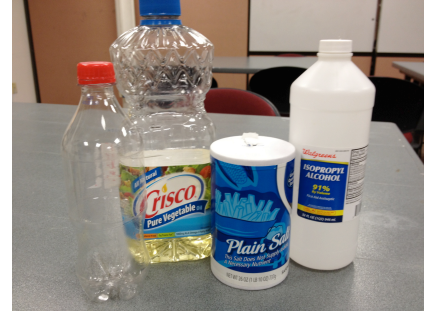


## Klutz-proof Density Column

Gravity doesn't care if you trip

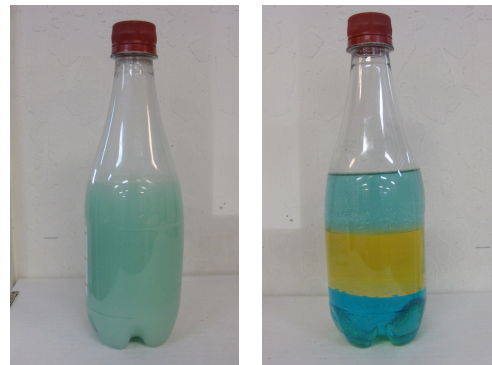
### Materials and Preparation

water  
vegetable oil  
isopropyl alcohol (70% or 91%)  
salt (non-iodized or kosher)  
empty bottle (smooth walled work best)  
food coloring



### To do and notice

1. Pour equal parts of water, vegetable oil, and alcohol into the bottle. If you're using 70% isopropanol, pour a little more alcohol and a little less water. How many layers does the mixture settle into?
2. Add enough salt until it does not dissolve anymore. How many layers are there now?
3. Add a drop or two of food coloring to make it easier to differentiate the layers. Shake the bottle so that everything mixes. Where does the color go? You may have to wait a few minutes for the column to settle.
4. (optional) If the excess salt on the bottom bothers you, you can decant the liquid into another container, wash out the salt, and replace the mixture.



### What's going on?

Density columns can be made by layering liquids of different densities. If neighboring layers are insoluble with each other, the column will stay in separate layers unless disturbed. The problem arises when the layers are mixed (ie. shaken or dropped) and exposed to layers with which they are soluble. The liquids will mix with these layers and usually end up settling into a hydrophilic (polar) watery layer and a hydrophobic (nonpolar) oily layer. In this activity, we use a phenomenon called "salting out", which separates the water and alcohol into different layers. When salt is added, the ions bond with water molecules and exclude the slightly less polar alcohol molecules from forming hydrogen bonds with water. Alcohol has a lower density than oil and ends up as its own layer on top of the column. Because the column has three insoluble liquids, it can be mixed as much as you like and will always settle into three layers.

### Going Further

If you would like to make a five-layer density column, check out Don Rathjen's activity at: [http://www.exo.net/~donr/activities/Five-Layer\\_Density\\_Column.pdf](http://www.exo.net/~donr/activities/Five-Layer_Density_Column.pdf)

Just don't drop it when you're done!