

How to Make a Density Column With Many Layers

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Here are the liquids used to make a 14 layer density column. Use food coloring to dye colorless layers.

A density column is a container of liquids stacked in layers. The layers stay separate because each substance has a different [density](#) from the others. In other words, heavy liquids have more mass or matter per unit of volume than lighter liquids. The simplest density column only has two layers. Oil and water are a good example. Oil is lighter than water and also [immiscible](#) (won't mix with it), so even if you shake a container of the two liquids, they will separate. Here are simple instructions to make a density column with many layers using common household ingredients. Usually, people make columns with seven layers, but you can make nine layers or even fourteen layers!

Density Column Materials

Use some or all of these liquids, depending on what you have available and how many layers you want. Also, you can use food coloring to tint any water-based or alcohol-based layers (indicated with a *). Keep in mind, adding food coloring slightly changes density, making heavy liquids a bit lighter and light liquids a bit more dense. Liquids are listed from most dense (bottom of the column) to least dense (top of the column):

1. Honey
2. Heavy corn syrup*
3. Chocolate syrup
4. Maple syrup*
5. Light corn syrup*
6. Whole milk*
7. Dish soap
8. Water*
9. Canola oil (or vegetable oil)
10. Extra-virgin olive oil
11. 70% alcohol (isopropyl alcohol, ethanol, or a mix)*
12. Baby oil (mineral oil)
13. 90% alcohol (ethanol, isopropyl alcohol, or mix)*
14. Lamp oil or kerosene

Some of these ingredients have density values close to each other. So, making a column with fewer than 14 layers results in better-defined stacks. Here are suggestions for five layer and seven layer columns. Of course, you're free to choose from the list of 14 liquids.

7 Layer Density Column

- Honey
- Corn syrup or pancake syrup or chocolate syrup
- Dishwashing liquid
- Dyed water
- Vegetable oil (any type)
- Dyed rubbing alcohol (any percent)
- Lamp oil or kerosene

5 Layer Density Column

The 5-layer density column has fewer layers and relies on [miscibility](#) differences to keep layers separate. It's the easiest to construct.

- Honey or any kind of syrup
- Dyed water

- Cooking oil (any kind)
- Dyed alcohol (any percent)
- Lamp oil or kerosene

If you are doing this project with young children, you may wish to omit the kerosene. You can use:

- Honey or any syrup
- Dishwashing liquid
- Dyed Water
- Any cooking oil
- Dyed alcohol

5 Layer Non-Toxic Density Column



You can color the layers of a density column using food coloring for water-based layers. (Anne Helmenstine)

Alternatively, make a completely safe density column using only cooking ingredients:

- Honey
- Dyed light corn syrup
- Milk
- Dyed water
- Cooking oil

Another option is to dye different [sugar water solutions to make a rainbow](#):

- 4 tablespoons sugar in 3 tablespoons water (dyed)
- 3 tablespoons sugar in 3 tablespoons water (dyed)
- 2 tablespoons sugar in 3 tablespoons water (dyed)
- 1 tablespoons sugar in 3 tablespoons water (dyed)
- Dyed water

Make the Density Column

Careful construction is the key to success. You will need:

- Narrow glass or graduated cylinder (or any clear glass)
 - Spoon or turkey baster or pipette
1. Prepare your liquids. Use food coloring to dye liquids, if desired. It's helpful to line up liquids in order before you start. You will pour from the top of the list (most dense) and work your way to the bottom of the list (least dense).
 2. Carefully pour the first liquid into the bottom of the container. Try to avoid touching the side of the glass. This first liquid is thick, so it's not easy to pour. One technique is to set a spoon in the container. Pour onto the spoon so the liquid flows down it, rather than down the side of the glass.
 3. Add the next liquid. Either pour it down the spoon, as before, or use a baster or pipette to slowly deliver the liquid to the top of the first layer. One tip is to rest the spoon or baster tip on the side of the glass just above the top of the layer. This helps prevent accidental mixing. Make sure each layer is fairly thick, so it will show up even if a little mixing occurs.
 4. Continue adding liquids in this manner until you're done. Now, you can admire your work or use it as a decoration. A well-constructed density column can maintain its layers for several hours or days.

How a Density Column Works

The first layer you pour stays at the bottom of the glass because it has the highest density or amount of mass per unit volume. The last layer you pour has the lowest density. Some liquids, like oil and water, don't mix because they repel each other. Other liquids, like honey and maple syrup, don't readily mix because they have different viscosity levels (thickness or ability to flow). However, over time, some liquids in the column will mix together.

Troubleshooting

Sometimes layers don't behave as you'd expect. Some layers mix more readily than others. For example, there's a strong possibility different types of syrups may mix with each other or different oils may mix. Aside from careful pouring, one way to reduce mixing is to chill chemicals before adding them to the column. Cooling usually increases viscosity. Molecules move more slowly, so it's harder for them to intermingle.

The other problem is that the density might be different than you thought. For example, one dishwashing liquid might be heavier than another, or different types of milk (skim, 2%, whole) have different densities, or brands of syrup might vary in density. Here, prevention is better than attempting a cure. Test liquids to see which is heavier before making the entire column.

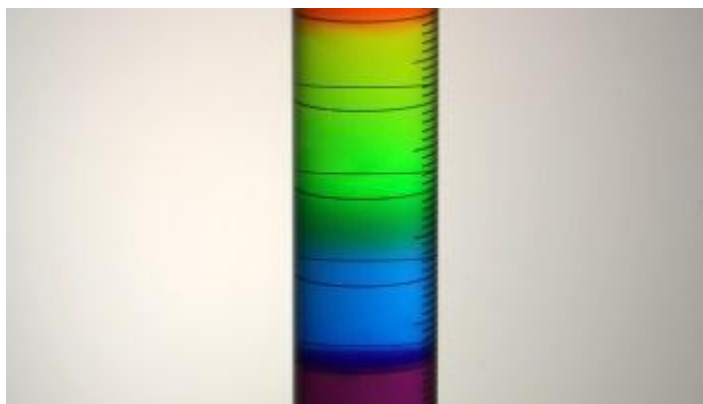
Here is a [table of density values](#), published by manufacturers. It's a good starting place for constructing a density column, but you'll see some liquids don't behave as expected. For example, lamp oil almost always floats on alcohol, even though its density value is reported to be higher.

Liquid	Density (g/mL)
Rubbing alcohol	0.79
Kerosene (lamp oil)	0.81
Baby oil (mineral oil)	0.83
Vegetable oil	0.92
Water	1.00
Milk	1.03
Dishwashing liquid (Dawn original)	1.06
Light corn syrup	1.33
Maple syrup	1.37
Honey	1.42
Mercury (not advised for density columns)	13.6

Safety

Don't drink the density column! However, there are layered cocktails you can make. A good example is a B-52, which is coffee liqueur, Irish cream, and Grand Marnier. Make non-alcoholic layered drinks by putting the component with the most sugar at the bottom of the glass and layering liquids with less sugar. Any syrup makes a good bottom layer. Next, add a juice or punch. Top it off with sparkling water or a sugar-free liquid (like Vitamin Water or G2).

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