



Which Mad Scientist Are You?

Only check one answer for each question.  
Developed by: Anne Marie Helmenstine, Ph.D.

1. Your lab is dominated by its:

- doomsday device
- lightning rod
- missiles
- computer
- operating table

2. You have been heard to say:

- Good news, everyone!
- It's alive!
- They can both pay for their mistake!
- You have cooties and you are stoopid!
- I've seen the Devil in my microscope and I have chained him.

3. You think the world would be better:

- if there were more doomsday machines and mutant aliens.
- if biological processes were as reversible as chemical reactions.
- if you were in charge.
- if you could stay up past your bedtime.
- if your cat could talk and clean its own litter box.

4. If you get bored, you might:

- create a mouse-elephant hybrid to see if the resulting creature would scare itself.
- Bored? I've got body parts to dig up and those don't get better with age.
- research venomous animals and maybe round up a henchman to help me test how poisonous they are.
- make a time travel machine and travel forward in time to hang out with your future self.
- Mess with the Sayer of the Law by coming up with complicated amendments.

5. You specialize in:

- Specialize? I'm great at all science!
- Human Physiology
- Defense Technology
- Computer Science and Robotics
- Veterinary Medicine

6. People recognize you by:

- skill at self-contradiction and tendency to enunciate any words containing 'wh'.
- the manic look in my eyes and emaciated frame.
- my obvious bionic body parts.
- my bright red hair.
- my white make-up.

7. You fear:

- being put in a retirement home.
- bringing my work home with me.
- the NRC, the UN, and the AEC.
- having family members in my lab.
- the light of day.

(continued on the next page)

Answers in next month's newsletter!



# ST[EMpower]

## Brilliant Layers

### Building Your Very Own Density Column!



#### BACKGROUND

**Density** means how tightly packed something is. If I have a pound of feathers and a pound of lead, they both weigh the same. Which takes more space? The feathers. A pound of lead weighs the same, but it takes up much less space. That is density.

#### ACTIVITY

##### Materials:

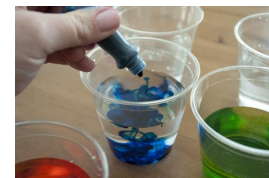
- Clear, clean 2 L bottle
- 7 nine ounce cups
- Food baster
- Assorted food coloring
- Scissors
- Honey
- Corn syrup (light)
- Dawn dish soap (blue)
- Milk
- Water
- Vegetable oil
- Rubbing alcohol
- Sharpie marker
- Popcorn kernel
- Cherry tomato
- Hex nut

##### Directions:

- Cut off the top of a two-liter pop bottle at the point it starts to curve up to the throat of the bottle. Wash, clean and dry it.
- With the sharpie marker, label each cup one of the following liquids: "HONEY," "CORN SYRUP," "DISH SOAP," "MILK," "WATER," "VEGETABLE OIL," "RUBBING ALCOHOL."



- Pour the liquid into the labeled cup (i.e. milk in the "MILK" cup, etc.) about 3/4 full. Be sure that there are equal amounts of each liquid in the 7 cups.
- Add different food coloring to the water, light corn syrup, and rubbing alcohol. In the picture above, the water has green food coloring added and light corn syrup has red food coloring added. The rubbing alcohol has not yet been colored.
- Watch how the food coloring disperses into each of the liquids. How long does it take for the food color to be evenly distributed? Is it the same for all three liquids? That is called **diffusion**, or how something spreads into another.
- Examine the chart to the right. It lists the **density** of each of the liquids we are using. The most dense (the highest **density** number) liquid will be the first added to our 2 liter bottle, and will be the base of our layers. The least dense will be the last liquid added



Liquid	Density
Honey	1.42 g/cm <sup>3</sup>
Corn syrup	1.33 g/cm <sup>3</sup>
Dawn dish soap	1.06 g/cm <sup>3</sup>
Milk	1.03 g/cm <sup>3</sup>
Water	1.00 g/cm <sup>3</sup>
Vegetable oil	0.92 g/cm <sup>3</sup>
Rubbing alcohol	0.79 g/cm <sup>3</sup>

to our 2-liter bottle, and it will be the top of our layers. For each of these liquids, take your time and pour carefully. The way you pour each layer changes, so be sure to read each step.

- Start with honey, which has the highest **density**. Carefully pour the honey from the cup into the bottom of the pop bottle, being very careful that the honey does not touch the sides of the bottle.
- Our next layer is the corn syrup. Slowly and evenly pour the corn syrup on top of the honey, being careful that the syrup does not touch the sides of the pop bottle.
- The third layer is the blue Dawn dish soap. Slowly and evenly pour the dish soap on top of the corn syrup, being careful that the dish soap does not touch the sides of the pop bottle.
- You need to use the turkey baster to add the remaining liquids. The fourth layer is milk. Suck up all the milk into the turkey baster (you may need to do this several times),



lower the baster into the pop bottle until the tip of the baster is just above the soap layer. Gently and carefully drip the milk to the top of the soap layer. Wash the turkey baster with soap and thoroughly rinse it.

- It is okay for the liquids to touch the sides of the pop bottle now. In fact, you need to do this for the remaining layers to remain separated. The liquids are **miscible**, meaning that they can be mixed together. We want to be sure that they remain separated. The fifth liquid to add is the water. Suck the water into the turkey baster and place the tip of the baster on the side of the pop bottle. Carefully and slowly squeeze the baster bulb, letting the water gently drip down the sides, and on top of the milk layer. Wash the turkey baster with soap and thoroughly rinse it.
- The sixth layer is vegetable oil. Suck the vegetable oil into the turkey baster and place the tip of the baster on the side of the pop bottle. Carefully and slowly squeeze the baster bulb, letting the vegetable oil gently drip down the sides, and on top of the water layer. Wash the turkey baster with soap and thoroughly rinse it.
- The last layer is rubbing alcohol. Suck the rubbing alcohol into the turkey baster and place the tip of the baster on the side of the pop bottle. Carefully and slowly squeeze the baster bulb, letting the rubbing alcohol gently drip down the sides, and on top of the vegetable oil layer. Wash the turkey baster with soap and thoroughly rinse it.
- Your Density Column is done! **AWESOME!**
- You have three solid objects: a cherry tomato (density average  $1.05 \text{ g/cm}^3$  — with a range  $0.7 \text{ g/cm}^3$  to  $1.4 \text{ g/cm}^3$ ), and a hex bolt (density  $8.05 \text{ g/cm}^3$ ), and a popcorn kernel (density mean  $1.264 \text{ g/cm}^3$  — with a range  $1.304 \text{ g/cm}^3$  to  $1.224 \text{ g/cm}^3$ ). Predict to which layer each will drop:

Object	Prediction	Actual
Cherry tomato:	_____ layer	_____ layer
Hex bolt:	_____ layer	_____ layer
Popcorn kernel:	_____ layer	_____ layer

- One at a time, place each object at the top of the rubbing alcohol, lightly touching it, and let go.
- Record to what layer it actually settled. Note that the cherry tomato and popcorn kernel has a range of density. That means your specific cherry tomato or popcorn kernel could be higher or lower density than the mean.

#### 8. When hatching an evil scheme you are most comfortable:

- wearing your pajamas.
- watching a thunderstorm. There's just something about lightning striking inanimate objects. Bug zappers are great, too.
- distractedly feeding your fish... henchmen.
- absent-mindedly pushing buttons on one of your many remotes.
- mingling with the creatures and taking in the sights of a beautiful tropical island.

#### 9. You're motivated by:

- Nothing. I'm just going through the motions.
- scientific curiosity and a desire to better mankind.
- revenge.
- ice cream and cookies.
- a desire to play God.

#### 10. You agree with this statement:

- Those who can, do. Those who can't, teach.
- If you can, then why not?
- It's only wrong if you get caught.
- Gym class should be optional, for extra credit.
- It's better to walk on two legs than four.

#### JOKE

- Q: Do you know what happened to the chemist who was reading a book about Helium?
- A: He just couldn't put it down!

#### POWER WORDS

**density:** Mass of an object divided by its volume. **Density** often has units of grams per cubic centimeter ( $\text{g/cm}^3$ ). Remember, grams is a mass and cubic centimeters is a volume (the same volume as 1 milliliter).

**diffusion:** The intermingling of substances by the natural movement of their particles.

**miscible:** Liquids form a homogeneous mixture (a mixture which has uniform composition and properties throughout) when added together.

#### JOKE

- Q: What is heavy forward but not backward?
- A: Ton!

#### CITATIONS

Sources for activity

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