

Name:

# Dazzling Density (Teacher Version)

## Recap: What's Density?

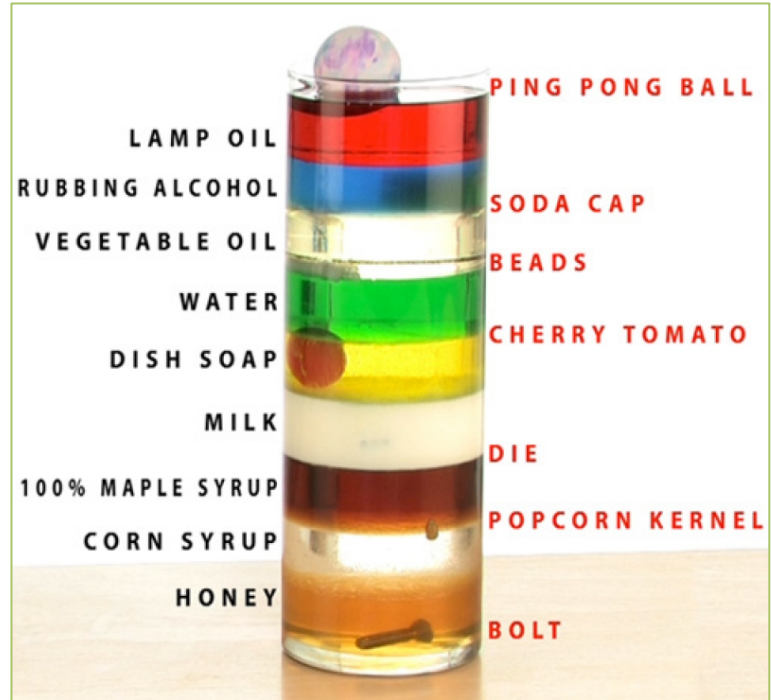
What do you know about density?  
*It's a measure of how compact an object's constituent particles are.*

Are the more-dense objects on top or bottom?

*The more compact fluids are heavier, meaning they will separate down to the bottom.*

Can a solid be as dense as a liquid or a gas?

*Yes, as long as the density=mass/volume ratio is satisfied.*



## A Cartesian Diver

### Materials:

- Straws
- Sticky Tack
- Empty Pop Bottle
- Glitter (Optional)

### Instructions:

1. Fill the bottle 2/3 full of water, and add some glitter.



2. Cut a straw in half. Take a piece and fold the sticky tack on one end to make a rounded weight. This is your "diver".



3. Place the diver in the bottle. Add or take away sticky tack until it floats.



### Try it Out:

Squeeze the bottle. What do you observe?



Name:

## Questions to Consider:

What does density have to do with this diver? *The diver, composed of a straw and sticky tack, has a small air bubble within it. Its density is slightly lower than that of water, causing it to float.*

What is the relationship between mass, volume, and density? *Density=mass/volume.*

What changes when the bottle is squeezed: mass or volume? *Volume. Mass stays constant here.*

Why does the diver sink when the bottle is squeezed? *Once the bottle is squeezed, the pressure on the air bubble is increased and therefore the volume is decreased. Since the mass stays constant, there is an increase in the density of the diver. When it overcomes the density of the surrounding water, it begins to sink. Once the bottle is released the pressure returned to normal causing the density to decrease and the diver to float to the top.*



## Other Ideas:

Try to make a Cartesian Diver with an eyedropper or ketchup package, since they have enough air in them to replicate the diver you made before.

Consider also changing the liquid inside! How would syrup work instead of water?



## Cartesian Corner

The Cartesian Diver is named after **Rene Descartes**, who is said to have invented the toy. Descartes was a famous French scientist, mathematician, and philosopher who did important work in geometry, algebra, buoyancy, and pressure. Ever heard of the Cartesian plane? That was his work as well! Pretty smart fella!



## Salty Situation

If you've ever swam in the ocean, you might have noticed that it's much easier to float.

Why do you think this is?

*Salt makes water more dense than if it had no salt, since the increase in mass outweighs the increase in volume. So when you're in the ocean, it's easier to float because the water is heavier and more difficult to displace.*



Name:

## **Image Sources:**

### **Recap: What's Density?**

- I. Steve Spangler Science:

<http://www.stevespanglerscience.com/lab/experiments/density-tower-magic-with-science>

### **A Cartesian Diver:**

- I. All images are property of Mason, Johanna.

### **Try it Out:**

- I. Scuba-Diving-Smiles: <http://www.scuba-diving-smiles.com/scuba-clipart.html>

### **Questions To Consider:**

- I. Mom Filter: <http://momfilter.com/kid-diy/cartesian-diver>

### **Other Ideas:**

- I. Steve Spangler Science:

<http://www.stevespanglerscience.com/lab/experiments/cartesian-diver-ketchup>

### **Cartesian Corner:**

- I. The Science Classroom:

[https://thescienceclassroom.wikispaces.com/René+Descartes](https://thescienceclassroom.wikispaces.com/Ren%C3%A9+Descartes)

### **Salty Situation:**

- I. NEES: [http://nees.oregonstate.edu/killer\\_wave/characteristics.htm](http://nees.oregonstate.edu/killer_wave/characteristics.htm)