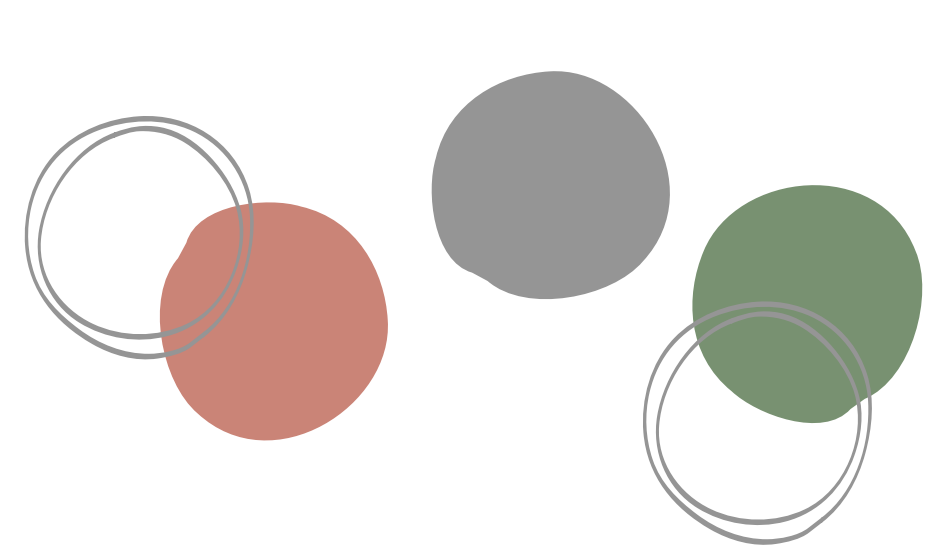


DIY Centrifuge

Raccoon Creek Explorers #33



Supplies:

- 2 small, clear plastic tubes or bottles with lids
- vegetable oil
- white vinegar
- mustard
- tape
- bicycle

Vocabulary:

centrifugal force- the force that acts on an object as it orbits a center, the result of inertia

centrifuge- a device used to separate substances based on density by spinning them at a high speed

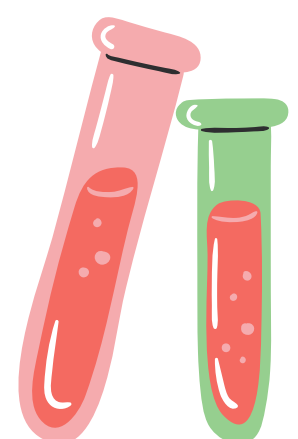
colloid- a mixture of substances with different densities that will not separate out over time without an outside influence.

inertia- the property of matter that causes an object to remain in place or in motion unless acted on by an outside force

mixture- a combination of two or more different chemical substances that are not chemically bonded

Background:

Have you ever heard of a centrifuge before? This is a piece of equipment that might be found in a scientist's lab, and it is used to separate mixtures by spinning them at very high speeds. The centrifugal force causes the more dense parts of the mixture to be pushed to the bottom of the test tube, leaving the less dense parts on top. In this experiment, we will make a simple kind of centrifuge at home using a bicycle tire and separate out the different parts of some home-made salad dressing.



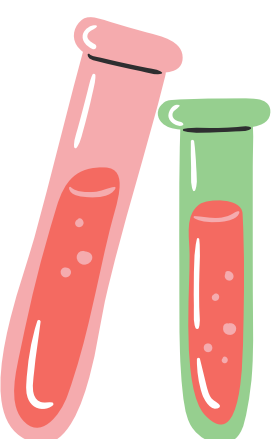


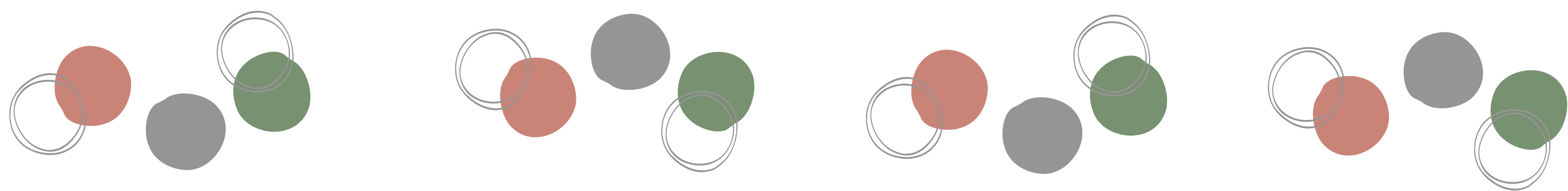
Let's Get Started:

- 1.) In each tube or bottle, mix $\frac{1}{3}$ vinegar and $\frac{2}{3}$ oil with just a little mustard. Close them tightly with their lids and shake to make sure they are well combined.
- 2) Set one tube or bottle to the side. This will be the control in our experiment and will show what happens to the mixture without the use of the centrifuge.
- 3) Turn your bicycle upside down so it is balanced on the seat and handlebars. Tape the other bottle to the spokes of one of the tires. Position it so it is close to the tire, not the center of the wheel. Be sure it is taped securely so it does not fly off!
- 4) Spin the tire as fast as you can for about 20 seconds. Try to stop the tire with the bottle or tube at the bottom, so it sits upright.
- 5) Remove the tape and look at the contents of the tube or bottle.

Reflect:

Did the oil and vinegar separate into different layers? Does the bottle or tube you spun on the bike tire look different from the control? If the experiment didn't work, try running it again but spin the tire as fast as you can for 30 or 40 seconds.





Apply:

Which substance ended up at the bottom of the container? Which was at the top? What does this tell you about the density of these substances? What happened in the control? Do you think the control will separate over time, without spinning?

Try this experiment with other mixtures around your house, like ketchup or milk, and see which ones you can separate.

Wrap Up:

If you let your control bottle sit long enough, it will eventually separate out on its own. This is because vinegar is mostly water, and oil and water don't mix. Oil is also less dense than vinegar, so oil molecules will rise to the top while the vinegar molecules settle to the bottom. However, not all mixtures will separate over time. These kinds of mixtures are called colloids, and one example is blood.

When you donate blood, doctors may need to separate it into different components like red blood cells and plasma. To do this, they put the blood in a centrifuge. The centrifugal force pulls then denser parts of the blood, like the red blood cells, towards the outside of the circle and the bottom of the test tube, leaving the less dense parts, like the plasma, at the top.

