

Purpose:

1. To emphasize the importance of looking at things through “Science Eyes”
2. To understand phenomena in the real world
3. Create a working model of **DENSITY**

Materials:

- 1 liter bottle of clear lemon lime soda (diet soda is much less sticky)
- 1 can dark soda (like cola, root beer, Dr. Pepper)
- 1 small box of raisins
- 3 jars with lids (Ziploc twist top containers work well and come in packs of 3. Mason jars also work)

Hypothesis (Claim)

Ask students what they think the bugs are. Make them give an answer and a reason for that answer.

Procedure:

1. Before students arrive set up the following containers:
 - a. Distribute the raisins evenly between all 3 containers.
 - b. Fill one container $\frac{3}{4}$ full of lemon lime soda. Screw lid on container immediately.
 - c. Fill another container $\frac{3}{4}$ full of cola. Screw lid on container immediately.
 - d. Fill the last container $\frac{3}{4}$ full of lemon lime soda. Add a splash of cola to change the color slightly. Screw lid on container immediately
2. When students arrive
 - a. Tell students that you have been doing environmental research. Working with Valero (or any refinery close to where you live) you have found organisms that appear to eat raw sewage.
 - b. Hold up container c from above. The raisins will be bobbing up and down. Tell your students that the dark liquid is raw sewage from a waste treatment plant. For younger students say, “Remember when you go to the bathroom and flush the toilet and the poop goes somewhere? I went to that somewhere and got a jar of it to show you how this experiment starts.” Tell students you put the bugs in the “poop water”, and they actually like being there; they are eating the sewage out of the water.
 - c. Hold up container d from above. Tell the students that the “bugs” have been in this container for about 2 months. Note how much clearer the water is and how active the bugs are. Make references to using the bugs to clean the environment.
 - d. Hold up container B from above. Tell students these bugs have been in the container for over 6 months and note how much cleaner the water appears to be.
 - e. Ask students if they would like to see one of the bugs. Take off the cap and pick up one raisin. Tell students the best part is you can eat the bugs; put the raisin in your mouth and eat it.
 - f. Tell students you can drink the water. Take a big sip of the soda from the container.
 - g. Now that you have their attention, point out that sometimes things are not as they seem.
 - h. Tell students you have a secret. Tell them you lied to them, but you lied for a very important reason. Tell them that you are the expert, so when you told them there were bugs in the containers they believed you. Tell them you can’t always trust the experts because sometimes they lie. Sometimes people don’t want you to know the truth; but more times than not it is just a case of not having our science eyes open wide enough.
 - i. Tell students they don’t need to rely on the experts. They can find an answer to everything in our world, including the bugs if they open their “Science Eyes” wide enough.
 - j. Ask student if they can describe what is happening with the bugs.
 - k. Explain what happens.

What's really happening:

The liquids are carbonated soda, which means they have carbon dioxide bubbles floating in them. The bugs are raisins, which have a lot of sugar in them.

Raisins are heavier, or **more dense** than the soda, so when I put them in the soda they sink to the bottom because everyone knows heavy things sink.

There is a chemical reaction between the carbon dioxide bubbles in the soda and the sugar in the raisins that causes the carbon dioxide bubbles to be attracted to, or stick to, the raisins, becoming part of the raisin system. These bubbles make the raisin lighter, or **less dense**, so light in fact that they are now lighter than the soda. Everyone knows light things float, so the raisins and their bubbles float to the top of the soda.

Have you ever popped a can of soda and chugged it? Do you remember the bubbles going up your nose? The same thing happens to the carbon dioxide bubbles holding onto the raisin. There is a pocket of air at the top of the container. When the bubbles get to the top of the container they release the raisin and go to the air pocket. The raisin is heavy again and sinks to the bottom of the container.

At the bottom of the container, the raisin picks up more bubbles and goes up to the top of the container. When it gets to the top, the raisin releases the bubbles and falls back to the bottom. It picks up more bubbles and goes to the top; gets rid of the bubbles and sinks to the bottom; picks up more bubbles and goes to the top... Since this is a closed system the event will last for days.

The point of this experiment, besides demonstrating density, is that there is a reason for everything that happens in your world. You can find those reasons if you are willing to open your "Science Eyes". You don't need to trust the experts. You can **be** the expert.

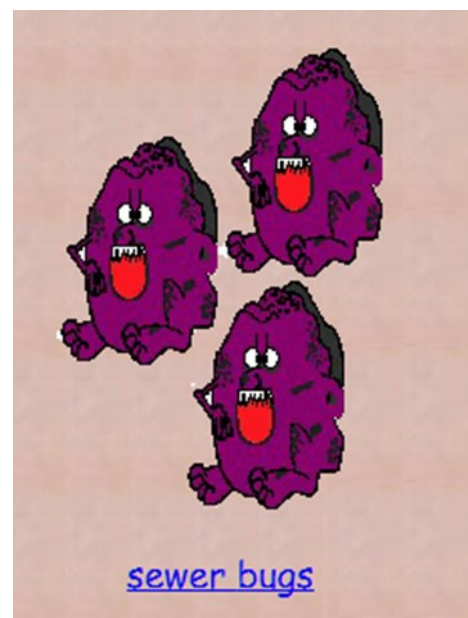
This is not a NGSS activity because the students are not actively participating.

I use this to make a point with my students about the power of scientific inquiry.

When I first started to use this activity, almost 35 years ago, this was a bold faced lie.

Today the fact is that most water treatment plants use bugs (microscopic organisms) to clean our water. They add the bugs to the fowled water and the bugs eat the garbage out of the water. As they eat they get heavy and sink to the bottom of the tank.

A fountain like device skims the clean water and moves it along to the next tank where the process happens over and over until the water is tested clean enough to be used by us again.



Linda D