Lava lamp

GLOBE		SDGs Associated	Type of Activity
Spheres	**Associated Protocols**		
Hydrosphere	Salinity Conductivity	13 (Climate action)	Exploratory

Overview
Participants will understand how density and polarity work.

Time
30 minutes

Prerequisites
None

School-level
Primary school students.

Purpose

This activity will help participants understand the concept of density and polarity and how water density can change with temperature.

Students outcomes

- Understand density and the impact of temperature on density;
- Understand polarity and how nonpolar and polar fluids interact with each other.

Background

Density is the 'lightness' or 'heaviness' of materials of the same size. It indicates how large the molecules are and how close they are to each other in a given substance. The larger and closer together the molecules are, the greater the density of the substance. Density is determined by how heavy something is compared to its volume. We say that a metal ball has a greater density than a wooden ball of the same size because the metal ball is heavier.

Polarity is the quality of having two oppositely charged poles. When atoms combine to form a molecule they either share or exchange electrons. True molecular compounds are formed when two or more atoms share electrons, resulting in what is called a **covalent bond**. These bonds are very strong and require a good deal of energy to break. Compounds formed with covalent bonds do not conduct electricity, do not have a positive or negative charge, and are referred to as

nonpolar because they are not very soluble in water. Oil molecules are nonpolar, this is why oil and water don't mix.

Polar molecules, on the other hand, are readily soluble in water. They are formed when atoms exchange an electron to form a bond called an **ionic bond**. These bonds are strong because the atoms have become more stable due to either losing or gaining an electron (called ionization). Molecules formed from ionic bonds are not true molecules because the electrons are not shared but exchanged. Water molecules are "polar" because they have a lopsided electrical charge that attracts other atoms. The end of the molecule with the two hydrogen atoms is positively charged. The other end, with the oxygen, is negatively charged. Just like in a magnet, where the north poles are attracted to the south poles ("opposites attract"), the positive end of the water molecule will connect with the negative end of other molecules.

Whenever we have an oil spill in the environment, we can see it float on the water. An oil spill refers to the accidental release of oil into the environment, typically occurring in bodies of water such as oceans, rivers, or lakes. Oil spills have significant environmental and ecological consequences. Because oil has nonpolar molecules and a lower density, it forms a thick layer on the surface of the water. This prevents sufficient amounts of sunlight from entering the surface, and also reduces the level of dissolved oxygen in the water, causing harm to marine life.

Guiding Research Questions

- *What happens when you mix the oil and food coloring with the water?*
- *What happens when you put effervescent tablets in the water?*

Scientific concepts

- Density
- Polarity

Material:

- A clean plastic bottle, try to use one with smooth sides
- Water
- Vegetable oil (or you can use mineral or baby oil instead, and also use discarded vegetable oil that is filtered)
- Effervescent tablets (such as Alka Seltzer)
- Food coloring

What to do and how to do it

Beginning

Pose the guiding questions and then explain the scientific concepts necessary to begin the activity.

Development

1. Fill the bottle approximately 1/4th (1 quart) with water.

2. Pour the vegetable oil into the bottle until it is almost full. You may want to use a measuring cup with a spout or a funnel. You may have to wait a few minutes for the oil and water to separate.
3. Add a few drops of your favorite food coloring. Watch the color sink through the oil. Did the drops of dye mix immediately with the water or did they float for a few minutes?
4. Break your effervescent tablet in half and drop some of it into the bottle.
5. You can take a flashlight, turn off the lights and drop another half tablet into the bottle. Shine your flashlight through the bottle, now you have your own lava lamp.

Closing
Discussion/ Reflection

1. Why does the oil float on the water (hint: there are 2 reasons for this)?
2. Why does the food color mix with the water but not with the oil?
3. When you add the tablet, it sinks to the bottom and begins to dissolve. As it dissolves, it makes gas, carbon dioxide. Why do the bubbles float to the top (hint: think of the density of water in different states)? The air bubbles bring up some colored water. When the air comes out of the colored water bubble, the water sinks. Why do you think this happens?
4. Real lava lamps use a polar and non-polar liquid but instead of effervescent tablets, it uses a lamp to make the denser liquid rise. How does the lamp help the denser liquid rise? What happens when it gets to the top?

Additional experiments

- What happens when you put the cap on the bottle after dropping the effervescent tablet in?
- What if you drop a whole tablet in it?
- When it stops bubbling, sprinkle some salt into your lava lamp. What is happening?

While mixing oil and water in lava lamps is cool, what would happen if oil spilt into a waterbody that is used by animals, plants and or humans? If you are curious about oil spills in the environment, please look at the oil spill experiment!

How to properly dispose of used oil?
Don't throw used oil down the drain or toilet as it will cause all kinds of issues. Instead, put the oil in an old or used nonrecyclable container with a lid (such as a cardboard milk or juice carton or a similar wax- or plastic lined paper container) and dispose of it in the garbage.

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