Season 1 Ep. 1 (#101)

Magic Ping-Pong Ball

Description:
Amaze your family and friends with this illusion.

Materials:
Large clear container with lid
Uncooked popcorn or rice
Metal ball bearing (about the size of a ping-pong ball)
Ping-pong ball

Procedure:
1) Fill the container with popcorn kernels so that there is at least 2 1/2 inches of space at the top
2) Before the demonstration, press the ping pong ball down in the center of the popcorn so that it is no longer visible
3) Place the ball bearing on top
4) Secure the lid on the container
5) Explain to viewers that you will make the ball change colors
6) Swirl the container in a horizontal motion
7) The ball bearing will disappear and the ping-pong ball will appear

My results:

Explanation:
Although the volumes of the two balls are similar, their masses are completely different. As a result, the ball bearing's density causes it to fall below the popcorn while the ping-pong ball rises to the top. Because the popcorn is more dense that the ping-pong ball, the popcorn falls and sinks below as well.

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Season 1 Ep. 1 (#101)

Invisible Soda

Description
See what happens when you mix liquids with different chemical properties.

Materials:
20-ounce bottle of cola
2% milk (enough to top off the soft drink)

Procedure:
1) Carefully open the bottle of Coke
2) Pour in enough 2% milk so that the bottle is entirely full
3) Seal the cap and do not disturb the bottle

My results:

Explanation:
Cola contains phosphoric acid, but when combined with milk has a chemical reaction. The phosphoric acid molecules bond together with the milk molecules, which increases the density of the molecules and they sink. The rest of the liquids clear and floats because those molecules are less dense.

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Season 1 Ep. 1 (#101)

Density Column

Description:

See what happens when you drop items with different densities into liquids with different densities.

Materials:

- Clear graduated cylinder (1,000 ml)
- 50-100 ml of the following liquids in this order:
  - Honey
  - Corn syrup
  - Maple syrup
  - Milk
  - Dish soap
  - Water
  - Vegetable oil
  - Rubbing alcohol
  - Lamp oil (3 oz)
- Items to drop:
  - Metal bolt
  - Die from game
  - Popcorn kernel
  - Grape tomato
  - Ping-pong ball
  - Top to a pop bottle
  - Plastic bead

Procedure:

1) Carefully pour each of the liquids into the center of the graduated cylinder in order
2) The liquids should settle into layers
3) Discuss the fact that each liquid has a different density
4) Carefully drop the other items into the cylinder and note where they stop

My results:

Explanation:

Although we used a similar volume of liquids (50 ml) for example, their mass was very different. Liquids that have molecules that are more tightly packed are more dense (density = mass/volume). This density column shows that the more a liquid sinks the heavier it is. By dropping in different items, it can be determined how their densities compare with one another and with the liquids.

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Season 1 Ep. 1 (#101)

Floating Eggs

Description:
You can change the density of water!

Materials:
2 jars or drinking glasses
Salt
Spoon
2 eggs (raw)

Procedure:
1) Fill one glass with tap water
2) Fill the second glass half full with water, then add 4 heaping tablespoons of salt and mix with a spoon
3) Fill the remainder of the salt solution with tap water
4) Carefully place an egg in the cup with water and note the result that it sinks
5) Add the egg to the salt solution and notice that this egg floats
6) Determine how little salt can be added to float the egg, as well as what other liquid solutions have a greater density than the egg

My results:

Explanation:
The raw egg will sink because the volume of water it displaces weighs less than the egg itself. The egg's volume is ore dense than the water's volume. By adding salt to the water, it increases the density of the water. As a result the mas of the volume of water is now greater than the egg's mass and the egg floats. Relating this to the Dead Sea is great fun as the slat level is so high that the water density will allow a person to float in a sitting or reclined position.

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The Curiosity Guide

Subject: Density

Investigation: 05

Season 1 Ep. 1 (#101)

Sinking Soda

Description:

Demonstrate how some things may look the same, but have different densities.

Materials:

Large clear tank, an aquarium (without fish!) works well
12 ounce soda cans (at least one must be a regular soda, and one must be a diet soda)
Balance

Procedure:

1) Fill tank with water
2) Predict whether or not the regular soft drink will sink or float
3) Place the can in the tank an notice that it sinks
4) Then place in a diet soda and notice that it floats
5) Experiment with other soft drinks to determine their densities as compared to water
6) Demonstrate the mass difference between the two cans
7) Examine the contents of the sugar in each can and compare

My results:

Explanation:

If the regular soda does not sink, gently rock the can in the water in case there is an air bubble underneath. The balance is useful to show that although the cans have the same volume (12 fluid ounces or 355 ml), the regular soda is more dense. When opening any soft drink can there is an air pocket (headspace) at the top, which will make the can float. The difference comes from the amount of sugar in each can. For example, if there is a total of 41 grams of sugar in the soda, the mass of the sugar adds to the total density of the can. This is especially true when compared to diet soda that uses artificial sweeteners instead of sugar. Aspartame is one sweetener that is often used. Because it is so much sweeter than sugar, not much is needed in a single can so it does not increase the density of the liquid as much as the sugar does.

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WKAR

The Curiosity Guide

Investigation: 06

Subject: Density

Season 1 Ep. 1 (#101)

Water Dance

Description:

Demonstrate the different densities of cold vs. hot water.

Materials:

4 baby food jars
2 square inch pieces of acetate or water resistant cards
Food coloring
Water
Trays (to catch spills)

Procedure:

1) Set out 2 trays to conduct the experiment and catch any spills
2) Completely fill 2 baby food jars with very cold water (without ice)
3) Add blue food coloring
4) In the remaining 2 jars, completely fill them with extremely hot water
5) Add yellow food coloring to those jars
6) Predict what would happen if you turned over the yellow hot jar on top of the cold jar
7) Cover the yellow jar with acetate and slowly turn it upside down so the air pressure holds the water in place
8) Place the jars on top of one another and slowly slide out the acetate
9) The water will stay where it is without the colors mixing
10) Repeat the experiment placing the cold water on top
11) Observe how the cold water begins to sink and the warm water rises

My results:

Explanation:

An object's density is related to its temperature as well. Because the molecules in hot water spread out more, it is less dense than the cold water where the molecules are closer together. Relate this to diving into deep water and the colder temperatures there.

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WKAR

Season 1 Ep. 1 (#101)

Dense Gas

Description:
Turn a liquid into a gas, and then pour the gas out.

Materials:
3 votive candles
Matches
White vinegar
Baking soda
Glass pitcher
Adult supervision

Procedure:
1) Place three unlit candles beside one another
2) Think about what carbon dioxide is (we exhale it, it's a gas, plants use it for photosynthesis, it makes soft drinks fizzy, etc.)
3) Depending on the container, combine 12 parts vinegar to 1 part baking soda (placing the baking soda in the container first)
4) Wait for the explosive foam to react
5) Once the reaction has subsided, light the candles with a match
6) Carefully tip the pitcher to pour out the gas (leaving the mixture in the container)
7) The carbon dioxide gas will extinguish the candle flames

My results:

Explanation:

Combining baking soda and water causes a chemical reaction in which hydrogen atoms from the vinegar (acetic acid) bond with the atoms in the baking soda. Baking soda (or sodium bicarbonate) is a base that can accept protons from an acid when mixed in a solvent. As a result, the bonds quickly change creating different molecules and freeing the carbon dioxide in a burst of released energy. The carbon dioxide gas is a heavy gas and fills up the top of the pitcher. It may be surprising to see that gas can be poured, but like a liquid, it takes the shape of its container and will flow in a similar fashion. Carefully pouring the heavy gas displaces the oxygen and eliminates the flame. Gases come in different densities as well.

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Making a Life Vest

Description:

Use various household items to make a can of soup buoyant.

Materials:

Soup can (1 for each group)
Large container of water
Miscellaneous materials:
- o Paper cups
- o Foam
- o Straws
- o Ping-pong balls
- o Plastic bags
- o Rubber bands
- o Tape
- o Cork
- o Paper towels
- o Paper clips
- o Wire
- o Aluminum foil
- o String
- o Small containers

Procedure:

1) Research what a life jacket or PFD is (personal floatation device) and where they may be worn or needed
2) Introduce the task that the students will work in teams to design and build a life vest for a soup can.
3) Examine the available materials and then draft a blueprint to work from (plans naturally change during the building and testing phases)
4) Rules: part of the can must be in the water during the trial tests, the can must remain floating for at least 25 seconds, the device must be attached to itself as one piece that can be taken on and off of the can
5) Build devices, test them periodically and redesign as necessary, and conduct final trail tests
6) Reflect on evolution of design

(more)

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What I used:

My results:

Explanation:

Problem solve and work through the engineering design process while discovering how to increase the buoyancy of a dense object. Buoyancy is the idea that something can float (in air or in water). In simplest terms, the object will displace an equal volume of fluid when immersed in it. If the objects volume is more dense, it will sink, if the fluid's volume is more dense, it will float. By adding volume to the can that is less dense, you can increase the buoyancy of the can.

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