

BOTTLE CAP BOATS

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Science Activity 1

Materials

Per student

- metal bottle caps
- about 15 small steel balls (BB's)
- science journal

Per table group

- tank 1 – tap water
- tank 2 – salt water

Per class

- tank of tap water with 1 can of Coke and 1 can of Diet Coke

Getting Ready

Do the Coke/Diet Coke activity “Floating Cans” in Taylor, B., Poth, J., and Portman, D. *Teaching Physics with TOYS*; Terrific Science Press: Middletown, OH, 1995.

Mix a salt solution the day before so that it is clear. Use a ratio of approximately 1 part kosher salt to 4 parts water.

Procedure

1. Remind students that in the Coke/Diet Coke investigation they found out that liquids can have different densities just as solids can.
2. Show students tank 1 and tank 2 and tell them that the two tanks are filled with different clear liquids. The liquids have different densities. Ask students whether they have any predictions on what those liquids might be? Some answers might include water, sugar water, salt water, or oil. Distribute one of each tank to each table group and ask students to conclude what the liquids are.
3. Show the students the bottle caps and tell them that the density of the cap and steel balls are the variables that they will not change. This time, they will be investigating floating systems of the same density in fluids of different density.
4. As in the Coke/Diet Coke investigation they are testing an entire system. In the Coke/Diet Coke investigation they tested the can combined with the liquid and gas in the can. With the bottle cap boats they are testing the cap, any air in the cap, and the steel balls in the cap. A real world example of the investigation would be whether the same boat could carry more or less cargo in fresh or salt water.
5. Ask students to float a bottle cap in tank 1 and carefully add the steel balls one at a time until the bottle cap boat and cargo sinks. Each student should have at least one individual opportunity to complete this step. It may take some practice. Ask students to record the highest number of balls that their bottle cap boat can hold in tank 1

before it sinks. Answers will vary. Ask students to share results and look for any consistency or patterns. In general, students should be able to float a range of 4–6 balls. Students may also have a variety of ways of loading the cargo that they would like to share.

6. Repeat the above step in tank 2. In general, students should be able to float a range of 7–10 balls. Note: students may need to dry their bottle caps off. If the cap is holding water from the first experiment, it may not be able to hold as many steel balls as in the first test because of the added water.
7. Discuss the results and possible causes for variations in results.

Assessment

Teacher observation, science journal

Science Activity 2

Materials

Per class

- Coke/Diet Coke cans in tap water tank as used in previous activity
- Bottle cap boats and steel balls in tanks of tap water and salt water as in previous activity

Procedure

After time has passed and students are no longer working with density on a daily basis, show students the two setups and ask them to describe what they observe, what variable is changed/not changed in each setup, and what science concepts and vocabulary they have learned that is useful in describing the setup and how it works.

Assessment

Teacher observation

“Science on the Spot” questions

Which of the following is an example of a simple physical change? A) a nail rusting, B) putting sugar in Kool Aid, C) leaves burning, D) apples rotting.

Making salt water is an example of a physical change. Describe another physical change involving water that can occur in nature.