Sink or Float?

What makes something float? You might be tempted to say that whether or not something floats depends on how heavy it is. But, you'd only be partially right. Think about cruise ships—they can weigh tens of thousands of tons, but still float. That's because floating or sinking isn't just about how heavy something is. It's about how heavy something is compared to the same amount (volume) of water. This ratio of an object's mass to its volume is known as **density**. Density is what really determines whether something will sink or float.

In this activity, you will use an object called a density ball to explore how temperature can affect the density of different materials and affect whether an object will sink or float in water.

What You Need

- Hot tap water (125°-130° Fahrenheit)
- 2000 ml beaker
- 1 Density Ball
- Ice cubes
- Go Temp Probe

Vocabulary

- **density:** the ratio of mass to volume
- density = mass/volume.

- **volume:** the amount of 3-dimensional space occupied by an object

The Experiment

1. Fill the beaker with 1250 ml of hot (approximately 125˚F) tap water. Place the Go Temp probe in the water along the side of the beaker. Gently place the density ball in the water and let it settle. Does the ball sink or float?

2. Which is more dense, the water or the ball? What evidence did you use to support your answer?

3. Monitor the water temperature and the behavior of the density ball for 15 minutes.

4. Predict what will happen to the position of the ball if the water is significantly cooled. Do you think the ball will float higher, sink lower, or stay where it is? Give a reason for your prediction.

I think the density ball will _____.

Reason:

5. Place an ice cube in the beaker and monitor the temperature of the water and the position of the density ball. If the ice cube melts and the ball does not move place another ice cube in the water. Make sure to record the temperature when the density ball moves.

6. Record your observations of what happens to the ball as the water temperature cools. Pay close attention as the water temperature drops below 110 ˚F.

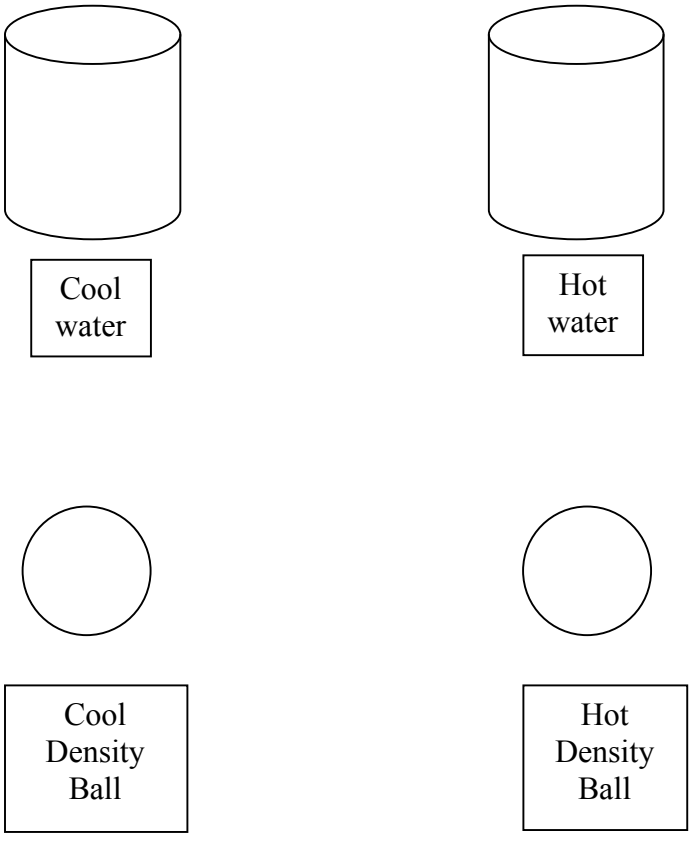
7. Compare your results to the other groups in your class. What is the range in temperature between the groups when the density ball moved?

8. What reasons would you give for the similarities or differences in the temperatures?

Analysis

1. Describe what the density ball did when you cooled the water. Was your prediction correct?

2. Explain why the ball behaved the way it did. **Describe and diagram in the space below** what you would see occurring in the water as it changed temperatures from cool to warm and what would you see occurring in the density ball, if you had the ability to see what was going on at the molecular level.



Real Life Connections

Clearly, the density ball is sensitive to changes in the surrounding temperature (you probably are too). Design an experiment using the density ball to test where the greatest temperature changes occur in your classroom during the day. Where do you think the temperature change will be the greatest? What are some possible reasons for these temperature changes? What could you do to help reduce these temperature changes throughout the day?

Connections to Capuano

What techniques does the Capuano School use to allow sunlight to enter the building and still maintain a comfortable school environment?