

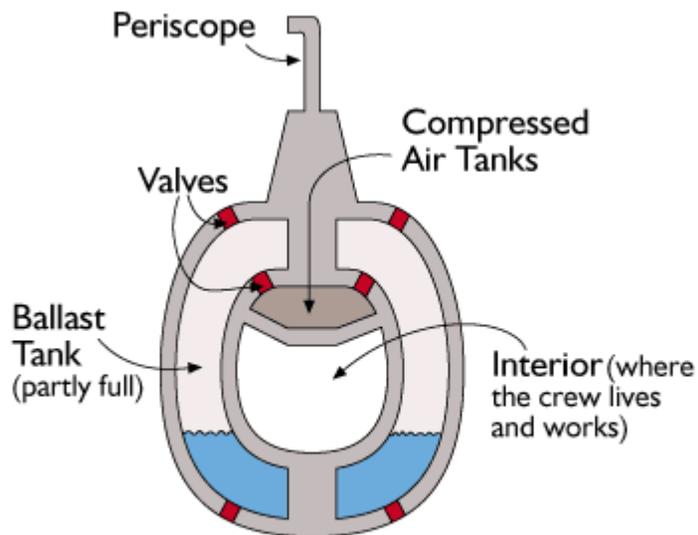
Your goal:

- To create a working model of a submarine that can dive, surface, and maintain a set depth.

Materials:

- 500mL water bottle
- Eyedropper
- Water

Use the following image to help you design your submarine



Submarine (cross section)

To descend (sink) water is added to the ballast tanks, making the sub heavier.

To ascend (rise) air is pumped into the ballast tanks, forcing the water out, making the sub lighter.

Problem: How could you create a condition of neutral buoyance with your submarine?

Hypothesis:

If we

then

Procedure:

Controlled Variables:

Manipulated Variable (Independent Variable):

Responding Variable (Dependent Variable):

Conclusion:

Draw and label diagrams on the left and answer the questions on the right. Look very closely at the air bubble inside your eyedropper when it is floating, compare the bubble to when the eyedropper has sank. You must draw and label the air bubble in your diagrams.

Diagram of Eyedropper while floating (at top)

How do you hold the bottle to make the eyedropper float?

Compared to when the eyedropper sinks, is the bubble inside larger or smaller? _____

Why does the eyedropper float? Use the word density to explain.

Diagram of completely descended Eyedropper (sunken)

How do you hold the bottle to make the eyedropper sink?

Why does the eyedropper sink?

When the eyedropper is on the bottom, which is greater: The force of gravity or buoyant force? How do you know?

Diagram of Eyedropper with neutral buoyancy

How do you hold the bottle to make the eyedropper float in the middle?

Compare the force of gravity pushing down on the bottle with the buoyant force pushing up when the eyedropper is suspended in the middle.

Analysis Questions

1. Use the particle model of matter to explain the difference in compressibility between liquids and gasses. Use two diagrams in your explanation.
2. Circle the material that would be easier to compress. Explain why for each.
 - a. Helium Balloon or Water Balloon
Because...
 - b. Solid rubber tire wheelbarrow tire, or inflated car tire
Because...
 - c. Plastic bubble wrap or liquid filled baby teething ring
Because...
 - d. Golf ball or Soccer Ball
Because...
3. Read page 51 in your science textbook (laptop). Explain what a Plimsoll Line is on the side of a boat. Why do some ship's have several Plimsoll Lines?
4. In what type of water would a submarine sink most easily? Why?
5. Watch the video in Teams. Why should deep sea free divers exhale as they ascend?