Styrofoam® Life-Preserver
Teacher's Guide

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The Initial View (Introducing the Activity)

Any clear container works great for corralling the water. It's most important that the kids can see the activity from the side. An aquarium works well, but the fish might not like doing science. Use a large beaker to show water displacement and what's going on!

Take a Deeper View! (More Science)

You could see more and more water was being **Displaced** as the number of washers increased. The amount of water displaced shows how much **Mass** the entire **System** (washers, wire, and Styrofoam® ball) actually **Weighs**. As long as the mass of water displaced is greater than the mass of the system, floating happens. When the mass of the system gets too great, everything gets the "sinking" feeling!! This is an example of **Archimedes' Principle** in action! This is why a steel boat made from the same steel as your washer can float! The shape of the boat displaces more water than what the ship and contents weigh! Of course when too much water leaks in, the "down" force wins! Ask any submariner or a boat with a leak!

More and Bigger Views! (Additional Classroom Ideas)

1. Many of the victims of the *Titanic* disaster were found with their life-preservers working perfectly. What killed them? (**Hypothermia** from the super cold water.)

2. Research this Archimedes guy. It's a great story of greed, science, and a bathtub!

3. Put your fist in the water container, notice how the volume goes up and your hand feels lighter. That's **Buoyancy** you're feeling.

4. The **Volume** of a **Sphere** is calculated by this formula; $4/3\text{pir}^3$. (Use cm for the **Radius** (1/2 the **Diameter**). Another way of saying the formula is; 1.33 x 3.14 x the radius x the radius x the radius. (Take your pick.) Use a lab scale to measure the total mass of the system. (The ball, wire, and the number of washers which it could just barely float.) Divide this mass in grams by the volume in cubic centimeters. This is one way to express mathematically the **Buoyancy** of the Styrofoam®. Do this for both Styrofoam® balls, is there a difference?

5. Try the activity with other "floatable" materials. Calculate their buoyancies.

6. Learn how submarines sink, and more importantly, come up again!

7. Find out why it's more difficult to drown in the Dead Sea or the Great Salt Lake. Explain your answer based on what you learned in this activity.

8. Can the same ship carry more freight in the Great Lakes or the ocean. Why?

9. The ship can carry more freight in the ocean because the salt water is denser, more mass is displaced. Repeat the activity with very salty water. Recalculate buoyancies.

10. Explain how a fishing bobber works using what you've learned.

11. Some fish have a **Swim Bladder**, an air-filled structure inside their body. Research this structure and learn how this helps fish hover and swim!

12. Make a set of water safety posters; distribute them around the community or school.

13. Put a small wooden block in the water. Push the block under, notice you had to use force to get this done? As soon as you let go, the block floats right back up, that's buoyancy!

Answers

1. (it's not very dense, very buoyant) 2. (probably not, less air trapped, less buoyant)