



Virginia 4-H MAKING the Future

*18 U.S.C. 707

The Science of Flotation (4H-762NP)

The Science Behind it . . .

How do boats and ships float on water?

The Archimedes' principle, by the ancient Greek scientist Archimedes, is the physical law of buoyancy. It explains that when an object is placed in water, it displaces an equal amount of water to the weight of that object. An object will float if it is less dense (lighter) than the amount of water that it displaces.

Example: A rock will sink because although it may be heavy, it would displace little water related to its weight. A boat will float because it is large and will displace more water than its weight.

Large ships that are denser (heavier) than water will have a hollow hull, a space filled with air under the water, to make it less dense (lighter) than the water, and will therefore float.

Example: If you push a hollow ball down in water it will spring back up to the surface - this is called upthrust; a hollow ship's hull floats in the same way.

Upthrust - The upward force that a liquid exerts on a body floating in it.

Buoyancy – The quality that makes things float in water.

Density – The quantity of mass per unit volume.

Materials

- ⇒ Corks of various sizes (3-4 per youth)
- ⇒ Rubber bands of various sizes (1-2 per youth)
- ⇒ Toothpicks or small picks (1 per youth)
- ⇒ Paper for sail (1/4 sheet per youth)
- ⇒ Scissors (to share)
- ⇒ Water to fill 'lake'
- ⇒ Small tub or wading pool for 'lake'
- ⇒ Markers/stickers (optional)
- ⇒ Small plastic figures (optional)
- ⇒ Small water bottle fans (optional)

Sources

- ⇒ Encyclopedia Britannica:
<https://www.britannica.com/science/Archimedes-principle>
- ⇒ University of California:
<http://scienceline.ucsb.edu/getkey.php?key=2673>

Making and Exploring Further

Make activities encourage problem solving through trial and error, allowing for individual creativity and experimentation. Youth will ignite their curiosity and expand their critical thinking skills as they move from the planned and guided activity to an open exploration of different materials and methods.

- ⇒ Encourage youth to substitute different materials for the sail, such as foam or cardboard.
- ⇒ Encourage youth to substitute different materials for the boat such as twigs or aluminum foil.
- ⇒ Encourage youth to build different models and try floating different loads (plastic animals).
- ⇒ Encourage youth to experiment with different wind speeds (fan) and different designs.

This project also offers an opportunity to think about "metacentric stability" as well. How high can the center of gravity be without the vessel flipping over? Experiment: Raise a weight made of modeling clay (or something that can get wet and still adhere) up and down the vertical mast to raise and lower the center of gravity!

www.ext.vt.edu/topics/4h-youth/makers

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