

## What Is Buoyancy?

Virginia SOLs: Middle School Science – 6.1, 6.8 (b) (i), PS.1 (k-m), PS.2 (e)

Background:

At Marshall Space Flight Center in Huntsville Alabama, there are numerous facilities to assist scientists and astronauts in preparing for space flight and experiments. Completed in 1968, the Neutral Buoyancy Simulator was the first dive tank created to simulate working in microgravity. The forty foot deep and seventy-five foot diameter tank provided enough underwater workspace to fabricate mockups of space craft components and scientific instruments. The tank's functionality depended on exploiting the human body's natural tendency to float (buoyancy). NBS developers attached weights to the air-tight space suits worn by astronauts such that, while working in water, the individual would neither float nor sink, a phenomenon called "neutral buoyancy."

This lesson will teach students about the concepts of the scientific method, buoyancy, and the practical application of scientific principles.

Materials:

Graduated plastic beakers (if unavailable, ask students to bring a clean milk jug from home, cut off the top and mark five levels, one inch apart, with a permanent marker)

Water

Ping pong balls

Solid rubber balls

Paperclips

Plastic bottle caps from milk jugs

Any solid plastic toys that have irregular shapes

Activity

Experiment can be conducted by the teacher with students asked to predict what will happen when each item is put in water, or students may divide in groups and record their hypothesis independently before testing at their station.

Phase 1

- 1) Working in teams, students create an experiment design. They will first describe how to test each object by placing it in a container of water and recording if the water level changes.
- 2) Ask students to create a hypothesis for how each object will act when placed in water
- 3) Allow students to carry out the experiment, or demonstrate with single teacher-run setup.
- 4) Ask students to record each result.
- 5) Discuss results and the definitions of buoyancy, density, and displacement in relationship to the objects tested. How did the classes' hypothesis differ from the experiment results?

Phase 2

- 1) Ask students how they would attempt to create neutral buoyancy by using objects that float and objects that sink. Students will create an experiment design using paperclips and milk jug caps.

- 2) Show images of the Neutral Buoyancy tank in operation and discuss history featured on the NBS page at NASA's CRGIS site.
- 3) Allow students to run experiment after hypothesizing how many paperclips it will take to make the milk cap sink.
- 4) Record results.

Terms:

Density

Buoyancy

Displacement

Comprehension Check:

Ask students to report their results to NASA scientists as if they were testing the feasibility of using the Neutral Buoyancy Simulator.

Other Resources

<http://www.nps.gov/nr/travel/aviation/neu.htm>

[http://www.nps.gov/history/history/online\\_books/butowsky4/space17.htm](http://www.nps.gov/history/history/online_books/butowsky4/space17.htm)