

- www.sciencejoywagon.com/physicszone/lesson/00genral/density.html

This site contains a student lesson about density.

- www.titanicscience.com/TSci-ActivityGuideFinal.pdf

This excellent guide contains science and interdisciplinary lessons for all grade levels based on the tragedy of the Titanic.

Suggested Print Resources

- Allen, Pam. *Who Sank the Boat?* Paperstar, New York, NY; 1999.
- Brain, Marshall. *How Stuff Works*. John Wiley & Sons, Hoboken, NJ; 2001.
- Fleisher, Paul. *Liquids and Gases: Principles of Fluid Mechanics*. Lerner Publications, Minneapolis, MN; 2002.
- Macaulay, David. *The New Way Things Work*. Houghton Mifflin, New York, NY; 1998.
- Taylor, Barbara. *Sink or Swim! The Science of Water*. Random House, New York, NY; 2001.



Sinking

Grades 3-6

Journey to Mammoth Island, a whimsical place where investigating scientific principles is always an adventure. Olive, a young girl, assisted by the Island's mammoth population and a visiting inventor helps the locals discover why and how machines work. Science facts are clearly demonstrated, giving kids an opportunity to see how important everyday machines are linked together by the science that drives them. Students come to see that science is a way of organizing information about the world, explaining why things work the way they do and allowing us to predict what might happen in new situations.

This guide provides a brief synopsis of the program, background on the science concepts presented, discussion topics, additional activities, vocabulary and suggested print and Internet resources.

TEACHER'S GUIDE

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Teacher's Guides Included
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Program Summary

All the inhabitants of Mammoth Island are gathered to watch the maiden voyage of the Mammoth Ferry — the first ship to sail from Mammoth Island, carrying passengers, parcels and all kinds of other things. Unfortunately, a wave overtakes the ferry and all of the ship's cargo is swept overboard!

An enterprising young Islander, Troy, attempts to retrieve the sunken cargo but is unsuccessful. Watching from the shore, another Islander named Olive follows Troy's underwater progress and takes notice of the air bubbles rising to the surface. With the help of a visiting inventor, Olive designs a vehicle called a submersible that would allow them to sink to the ocean floor, retrieve the lost cargo and then rise back to the surface.

The inventor explains that it's not weight or mass that makes a thing sink, but something called density. An object's density is equal to its mass divided by its volume. If the object's density is greater than the density of water, it sinks, but if an object's density is less than that of water, it floats. So by blowing air — which is less dense than the water — into the submersible tanks, the submersible's density becomes less than the density of the water around it, causing the object to rise in the water.

Looking at some crabs scuttling on the beach, Olive decides to fit her submersible with claws to grab the sunken cargo. Before long, she retrieves all the lost parcels and truly saves the day! But she isn't finished yet — she next turns her hand to making the Mammoth Ferry a safer vessel. To make the ferry ride smoother and safer, she designs a stabilizer for the underside of the ship. As the stabilizer deflects the flow of the water downwards, the water pushes upwards on the fin, which stops the roll. And, if the ship is rolling in the opposite direction the fin tilts in the opposite direction, too. The water is deflected over the fin, causing a downward force, and stops the roll again!

Glossary

The following words are included for teacher reference and for use with students to extend the subject matter in the show.

buoyancy — The tendency of a body or object to float or rise when placed in a liquid.

buoyant force — The upward force exerted by a fluid on an object in it, giving the object the ability to float.

density — The amount of mass in a given volume.

displacement — The process that occurs when an object is placed in water and pushes some water aside. Every floating object displaces some water; some displace more than others.

energy — The ability to do work.

force — A push or a pull on an object that causes a change in motion.

float — To sit at or above the surface of a liquid. When buoyant force overcomes gravity, an object will float.

flotation — The act of resting on the surface of a liquid or being suspended in it.

force — A push or a pull on an object that causes a change in motion.

gravity — The fundamental force of attraction between all objects. The more mass an object has, the greater the force of its gravity.

machine — Any device that helps you do work.

power — A measure of how quickly work is done.

sink — To sit below the surface of a liquid or at the bottom of a liquid.

volume — The amount of space taken up by a given mass.

weight — The measurement of the force of gravity pulling down on an object.

work — To move or change something. Doing work takes energy. When you use force to make something move, you are doing work.

Pre-viewing Discussion

- Ask students to explain what air is made of.
- Why do some materials sink in water while others float? Ask students to describe the properties of those that sink.
- What does density have to do with sinking and floating?

Follow-up Questions & Activities

- Have students research aquatic creatures (like fish with swim bladders) and design their own, complete with organs that let them sink and rise in the water.
- Have students weigh a number of fruits and vegetables, measure their size and record the results on a chart. Then have them immerse the fruits and vegetables in a dishpan of water and record which objects float and which ones sink. If possible, provide a dishpan of saltwater as well.
- Alter or add to a floating object so that it will sink, and alter or add to a non-floating object so that it will float.
- Fill a glass or bottle halfway with carbonated water, and drop three or four raisins into it. Have students observe the raisins and come up with explanations for the way they move.
- Challenge small groups of students to modify a model watercraft to increase the load it will carry, and then to modify it to increase its stability in water.

Suggested Internet Resources

Periodically, Internet Resources are updated on our Web site at www.LibraryVideo.com

- www.exploratorium.edu/snacks/descartes_diver.html
This "Science Snack" contains plans to build a Cartesian Diver.

- www.aquaholic.com/gasses/archem.htm
Information on this Scuba Physics site is geared to older students and does an excellent job of explaining Archimedes' Principle. *(Continued)*

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