

- [www.aquaholic.com/gasses/archem.htm](http://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.
- [www.sciencejoywagon.com/physicszone/lesson/00genral/density.html](http://www.sciencejoywagon.com/physicszone/lesson/00genral/density.html)  
This site contains a student lesson about density.
- [www.titanicscience.com/TSci-ActivityGuideFinal.pdf](http://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

- Bryant-Mole, Karen. *Floating and Sinking (Science All Around Me)*. Heineman Library, Crystal Lake, IL; 2002.
- Graham, Ian. *Boats*. Raintree Steck Vaughn, Austin, TX; 2002.
- Macaulay, David. *The New Way Things Work*. Houghton Mifflin, New York, NY; 1998.
- Pipe, Jim. *How Does a Ship Float? Projects about Sinking and Floating*. Copper Beech Press, Brookfield, CT; 2002.
- Wolke, Robert L. *What Einstein Didn't Know: Scientific Answers to Everyday Questions*. Delacorte Press, New York, NY; 1999.

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#### TEACHER'S GUIDE

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## Floating

### 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.



## Program Summary

In *Floating*, inhabitants of Mammoth Island are attempting to rescue an Islander and his mammoths from the middle of a lake. They have been stranded on a small island since a wooden bridge collapsed. Olive, a bright young Islander, notices that the wood from the broken bridge is floating on the surface of the lake, and comes up with a plan to build a wooden raft to save the day.

If you place any object such as a stone, a piece of wood, or a boat in water, then the water will try to support that object. In some cases the object will float, in other cases it will sink. Every object exerts a downward force on the water and the water pushes back with an upward force on the object. This principle is called buoyancy. When the buoyant force is greater than an object's weight, the object floats!

A scientist named Archimedes concluded that a floating object pushes aside, or displaces, an amount of liquid equal to its own weight and if the object weighs less than an equal volume of the fluid, the solid will float. Another way of explaining it is, if a solid has a lower density than a fluid, the solid will float in that fluid. Density is defined as the mass of a substance divided by its volume.

The Islanders also discover how boaters can use the power of the wind to go from place to place. When the wind is behind the boat, sailors simply let the sails out as far as they will go. The wind pushes on the sails and the boat's hull follows along. Sailboats can also travel when the wind is in front of them through a process called "tacking" which involves following a zig-zag route that keeps the sails at an angle to the wind.

## Glossary

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

**Archimedes' principle** — An object fully or partly immersed in a liquid is buoyed upward by a force equal to the weight of the liquid displaced by that object.

**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.

**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. *(Continued)*

**hull** — The frame or body of a ship.

**mass** — The amount of matter that is contained in an object. The more mass an object has, the greater its weight.

**rudder** — A flat piece of wood or metal attached to the back of a boat that is used to steer it.

**sail** — A piece of fabric used to gather wind and propel a boat.

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

**tacking** — To change the direction of a sailing ship by turning the bow to the wind and shifting the sails.

**tiller** — A lever that helps steer a sailboat.

**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

- What happens when objects are placed in water?
- Why do some things float and others do not?
- Discuss why you float if you are in a swimming pool and you stretch your body out flat, but you sink if you wrap your arms around your legs and curl up into a ball.
- What does density have to do with the ability to float?
- How do you steer a sailboat?

## Follow-up Questions & Activities

- Provide large containers of water and a variety of objects for students to immerse. First have them predict which objects will sink and which objects will float and record their predictions on a chart. Students can then immerse the objects and compare their predictions with their observations.
- Challenge small groups to use aluminum foil and tape to construct a vessel that will float on water and hold a load of pennies. The boat that holds the most pennies wins.
- Split a piece of clay into two identically-sized pieces. Roll one of the pieces into a ball. Fashion the other piece into a flat, boat-shaped object. Now place both pieces into a sink full of water. Which one floats and which one sinks?

## Suggested Internet Resources

Periodically, Internet Resources are updated on our Web site at [www.LibraryVideo.com](http://www.LibraryVideo.com)

- [plabpc.csustan.edu/energy&matter/Summer2000/Density/Buoyancy/Buoyancy.htm](http://plabpc.csustan.edu/energy&matter/Summer2000/Density/Buoyancy/Buoyancy.htm)

This site contains lessons and investigations designed for students studying the principles of density and buoyancy. *(Continued)*