

### Suggested Print Resources

- 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.
- Haslam, Andrew. *Machines (Make it Work! Science)*. Two-Can Publishing, Chanhasen, MN; 2000.
- Macaulay, David. *The New Way Things Work*. Houghton Mifflin, New York, NY; 1998.



## Pressure

### Grades 3-6

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#### TEACHER'S GUIDE

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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 *Pressure*, the Islanders work together to retrieve a wedding ring that has fallen down a sink drain. With the help of a visiting inventor, they discover what a straw, plunger, vacuum and jackhammer all have in common: they are all useful tools that operate by manipulating a force called pressure.

When you suck on a straw, you reduce the pressure in your mouth and the pressure of the air on the surface of the drink pushes it up the straw and into your mouth. When you put a plunger over a drain and push down sharply, the pressure inside the pipes is suddenly increased. This sudden increase in pressure forces the water along the pipe, dislodging anything that is stuck inside it.

A vacuum cleaner works by sucking air and dirt through the cleaning attachment and hose. Inside the vacuum cleaner is an electric motor, which drives a fan. This fan pumps air out of the vacuum cleaner and the hose, which reduces the air pressure. When this happens, the air pressure outside the vacuum cleaner forces more air up through the hose, carrying the dust and dirt with it.

Differences in air pressure are what cause wind. And the force of wind can cause objects to move — from a slight breeze, to the strongest gale! When it's compressed, air is said to be “under high pressure.” Some tools, like a jackhammer, use compressed air to make difficult work easier. The force of the air when released is incredibly strong and can even dig up roads!

Many machines use hydraulic pressure to get jobs done. Hydraulic pressure is another name for the pressure exerted by a liquid. A hydraulic machine uses cylinders filled with fluid. Pistons push down on this fluid and raise the pressure inside the cylinder. Powerful machines like excavators and bulldozers use hydraulic pressure. Thankfully, after learning about all these tools, the Islanders recover the missing diamond!

## Glossary

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

**air pressure** — The force exerted by the weight of tiny particles of air.

**effort** — The force applied to get work done.

**energy** — The ability to do work.

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

**hydraulic machine** — A device that gets its power from changing the pressure of a liquid, like water or oil.

**machine** — Any device that helps you do work. Machines don't increase the amount of force applied, they just use the force in a way to get the job done more easily.

**pneumatic machine** — A device that gets its power from changing air pressure.

**power** — A measure of how quickly work is done.

**pressure** — The force of molecules pushing on every surface area they come in contact with.

*(Continued)*

**wind** — The movement of air due to changes in pressure.

**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 define “force.” Explain that force is a push or a pull on an object. Use a small force to push open the classroom door, then illustrate that a larger force would push the door open even more. Ask students to come up with other examples of forces (pushes or pulls) that will move objects in the classroom.
- Ask students to define “work” and explain how work gets done. How do machines make work easier?
- What is pressure? What kinds of things exert pressure?
- What is energy? How do machines use energy?

## Follow-up Questions & Activities

- What causes wind?
- If you were on top of a mountain, would the weight of the air above you be greater than or less than the air if you were standing on a beach?
- Give each student a plastic cup half-filled with water and a drinking straw. Ask them to suck some water into the straws and cover the straws quickly with their fingers. Ask the students to try to explain the forces involved in doing this. Are forces balanced when the water is in the straw? Next, have each student lift his or her finger off the straw and explain what happens using the principle of air pressure.

## Suggested Internet Resources

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

- **[kids.earth.nasa.gov/archive/air\\_pressure/index.html](http://kids.earth.nasa.gov/archive/air_pressure/index.html)**  
This NASA Web site describes the force of air pressure and contains hands-on lessons designed for students to complete.
- **[www.howstuffworks.com/hydraulic.htm](http://www.howstuffworks.com/hydraulic.htm)**  
These pages from “How Stuff Works” explain how hydraulic machines work.
- **[www.exploratorium.edu/snacks/descartes\\_diver.html](http://www.exploratorium.edu/snacks/descartes_diver.html)**  
This “Science Snack” illustrates the power of changes in pressure and contains plans to build a simple Cartesian Diver.
- **[www.b4ubuild.com/kids/kidlinks.html](http://www.b4ubuild.com/kids/kidlinks.html)**  
This site has pictures and movies of dump trucks, bulldozers, hydraulic excavators and other heavy construction equipment.