

- www.fi.edu/

The Franklin Institute Online presents information on the human heart and how it acts as a pump.

Suggested Print Resources

- Brain, Marshall. *How Stuff Works*. John Wiley & Sons, Hoboken, NJ; 2001.
- Colman, Penny. *Toilets, Bathtubs, Sinks, and Sewers*. Atheneum Press, New York, NY; 1999.
- Lauber, Patricia. *What You Never Knew About Tubs, Toilets, & Showers (Around-The-House History)*. Simon Schuster, New York, NY; 2001.
- Macaulay, David. *The New Way Things Work*. Houghton Mifflin, New York, NY; 1998.
- Nankivell-Aston, Sally. *Science Experiments with Simple Machines*. Scholastic Library Publishing, New York, NY; 2000.
- Sproule, Anna. *James Watt: Master of the Steam Engine (Giants of Science)*. Blackbirch Press, Woodbridge, CT; 2001.



Pumps

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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Program Summary

In *Pumps*, inhabitants of Mammoth Island are enjoying a beautiful day when suddenly they smell smoke — Brenda's baking shed has caught fire! Soon the Mammoth Island Fire Brigade arrives and the inventor observes an unusual method of firefighting. The fire brigade attempts to use mammoths filled with water to put the fire out! While young Olive appreciates the theory behind the old method, she is sure that a machine might make it easier to get water to a fire. Looking at her bicycle pump, she wonders if it might be possible to create a device for pumping water.

Pumps work by raising or lowering the pressure of a fluid. A fluid can actually be a gas, like air, or a liquid, like water. All fluids, just like everything else, are made up of tiny particles called molecules and the amount of pressure they're under depends upon whether they are packed tightly together or if they have loads of room to move around.

When a pump's piston is pulled back, it gives the molecules within the pump's chamber extra room. This reduces the pressure inside the pump. Then, because there's a hole at the other end of the chamber, more molecules rush into the chamber to take up the extra space. When the piston is pushed in, the molecules inside the pump are pressed tightly together, which increases the pressure inside the chamber. If it can, a fluid will always move from a place where the pressure is high, to one where the pressure is low. Because the pressure inside the pump is so great, the fluid rushes out of the pump in a powerful stream.

With the help of the inventor and other Islanders, Olive builds a water pump that is soon put to the test at a barbecue blaze. When the handle is pumped, water is sucked up inside the pump and then pushed out along a hose. Her pump saves the day!

Glossary

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

effort — The force applied to get work done.

energy — The ability to do work.

fluid — A liquid or a gas.

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

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

mechanical advantage — The number of times a simple machine multiplies the effort force.

power — A measure of how quickly work is done.

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

pump — A device that converts mechanical force and motion into hydraulic fluid power.

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reciprocating pump — A pump that uses a piston that moves back and forth.

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 “work” and explain how work gets done. How do machines make work easier?
- 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.
- What are some uses for pumps?
- What is pressure? What kinds of things exert pressure? Have students describe pressure in terms of atoms and molecules.

Follow-up Questions & Activities

- Have students research and report on the use of windmills in 19th-century America to pump water.
- Introduce students to a number of pumps in the classroom. Some examples are a bicycle tire pump, an Archimedes' screw, an aquarium with air pump and a small submersible fountain pump. Then have students design and build their own pumps.
- On a warm day, take students outside to perform a hands-on investigation of different types of water pistols. After some analysis, have them dissect a number of different models to see how they work.
- Have students research the human heart and discover how it acts like a pump. Have them draw “alien blood pumps” for imaginary visitors from other planets.
- Have students research and report on one of the many inventors involved in the design and improvement of steam engines, first used as pumps. Some possible subjects include Hero of Alexandria, James Watt, Elijah McCoy, Thomas Newcomen, and Robert Fulton. A good Web resource for younger students interested in inventors is www.enchantedlearning.com/inventors.

Suggested Internet Resources

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

- www.animatedsoftware.com/pumpglos/ram_pump.htm
“All About Pumps” contains a glossary of pumps with animated explanations of how many different pumps work.
- www.howstuffworks.com/
Students can use the topical index on this site to find many answers to their questions about pumps and how they work.

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