

## Suggested Print Resources

- 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.
- Tocci, Salvatore. *Experiments with Simple Machines*. Children's Press, New York, NY; 2003.
- Walker, Sally. *Pulleys*. Lerner Publishing, New York, NY; 2001.



## Pulleys

### 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

Most tools of today look different from those of the past, but they are just modifications and combinations of very ancient tools called simple machines. We are surrounded by simple machines that make our lives easier by helping to get a job done with less effort. Simple machines have very few moving parts, or no moving parts at all. They enable us to use less effort to push or pull an object, and they can be found almost anywhere work is being done. Machines do not increase the amount of force applied, they just use the force in a way that gets the job done more easily.

In *Pulleys*, inhabitants of Mammoth Island are trying to find the best method to lift their mammoths. Olive decides to use a simple machine called a pulley to get the job done. A pulley is a wheel that carries a rope, chain or cable on its rim and can be used to lift a heavy load. While a single pulley system does make it possible to lift a heavy mammoth, it does not take any less effort.

Luckily, pulleys can be used in many ways. More pulleys working together do lessen the effort it takes to do work. For example, a double pulley system would allow the Islanders to lift a mammoth with half the effort of a single pulley. A block and tackle is a pulley system with a number of pulleys working together; a ten-pulley system would require one tenth of the effort of a single pulley to lift a mammoth!

The use of chains and counterweights along with pulleys make machines like boom cranes, elevators and escalators possible. Tools like these make moving mammoths much easier!

## 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.

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

**machine** — Any device that helps you do work.

**load** — Something that is carried, lifted or supported.

**pulley** — A freely-turning wheel that has a groove around its edge through which a rope, chain or belt moves.

**block and tackle** — A pulley system that uses more than one pulley.

**crane** — A machine used to hoist heavy objects.

**elevator** — A platform or small room that can be raised or lowered in a vertical shaft to carry people or goods from one level to another.

**escalator** — A moving stairway that does work with a series of looped chains, pulleys and a set of tracks.

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

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

*(Continued)*

**simple machines** — Devices with few moving parts that can be used to reduce the amount of effort needed to do work. The six basic simple machines are the lever, the wheel and axle, the pulley, the inclined plane, the wedge and the screw.

**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.
- 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 pulleys?
- What happens to the effort applied if you double the number of pulleys in a system?
- What do you call the force that is applied to lift the load?

## Follow-up Questions & Activities

- What kinds of tasks involve the use of simple machines? Have the class make a list of all the pulleys that they encounter in the course of a week. After going over the list, have students write a story describing a day without the help of simple machines.
- Have students disassemble some common tools and list and describe or sketch all the different components in an “Inventor’s Journal.” How many components are simple machines? Have them chart their results, and then brainstorm with a partner to come up with a design for a new invention that would be comprised of some of the parts in the sketches.
- Provide small groups of students with inexpensive plastic pulleys, string, weights, a spring scale and plywood, and challenge them to create a block and tackle system that is capable of helping them lift the greatest load using a specific amount of effort (for example, 16 Newtons or 20 Newtons).

## Suggested Internet Resources

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

- [www.eduscapes.com/42explore/smplmac.htm](http://www.eduscapes.com/42explore/smplmac.htm)  
A list of many excellent resources dealing with simple machines.
- [www.fi.edu/qa97/spotlight3/spotlight3.html](http://www.fi.edu/qa97/spotlight3/spotlight3.html)  
The Franklin Institute Online presents information on simple machines.
- [www.mos.org/sln/Leonardo/InventorsWorkshop.html](http://www.mos.org/sln/Leonardo/InventorsWorkshop.html)  
This excellent Web site includes information about the simple machines that were in use during the lifetime of Leonardo da Vinci and also showcases the wonderful machines that this great inventor developed.