



Friction

Grades 3–6

TEACHER'S GUIDE

Paula J. Bense, M.Ed.

Curriculum Specialist, Schlessinger Media

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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.

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Program Summary

In *Friction*, young Islanders Olive and Troy are delivering mail with a mammoth-drawn wagon when they learn how important the force of friction is to everyday life. When two surfaces come into contact with one another — say a mammoth’s foot and the ground — molecular forces between the two attract one another. The more they’re pressed together, the greater the attraction. If you try to push one of the objects across the surface of the other, this attraction creates a force that pulls in the opposite direction. This force is called friction. This resistance between surfaces depends upon two factors: how much pressure is pushing them together and how uneven the surfaces of the objects are.

With the help of their dads, Olive and Troy create a new, improved wagon equipped with brakes. Their first model uses a device known as a “drum brake” that provides friction to their spinning wheel. An enclosed drum-shaped chamber is fixed to the vehicle’s wheel. Inside the drum are two curved blocks known as “brake shoes.” When the driver presses down on the brake pedal, the force pushes the brake shoes outwards — creating friction within the drum. This friction causes the wheel to slow down or stop.

Friction takes the energy out of a spinning wheel and translates it into two other forms of energy: sound and heat. However, heat build-up tends to reduce friction, thereby giving less braking power. The Islanders develop disc brakes for their wagon to solve some of the heat-related problems. In a disc brake, a steel disc is attached to the wheel, which the two brake pads squeeze like a pair of pincers. The heat can dissipate through the air and the wagon can slow down. Even with disc brakes, it does take some time to come to a stop, though. Young Troy and Olive find this out as they join their two delivery mammoths for an unscheduled bath after a foiled attempt to stop quickly!

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.

friction — The resisting force that opposes motion between two objects that are in contact with each other.

power — A measure of how quickly work is done.

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

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 is friction?

(Continued)

- What are some examples of friction occurring in everyday life? What causes friction?
- What are some ways you can reduce friction?
- Lead students through a discussion of how different their lives would be without the force of friction.
- Talk about the fact that when two things rub together, friction takes some energy of motion and converts it to heat. Explain how this can be a help and a hindrance.

Follow-up Questions & Activities

- Have students rub their dry hands together rapidly to create a lot of friction and observe the heat produced. Then have them put lotion on their hands and rub them together again, noting any differences. In small groups, have them research different machines, looking for ways that lubricants are used to reduce friction.
- Have students explain how a potter uses friction to push and pull on the surface of clay in order to shape a pot. Remind them that without friction, it would not be possible to walk, run or even pet a puppy.

Suggested Internet Resources

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

- home.houston.rr.com/molerat/hover.htm
The “Bizarre Stuff You Can Make In Your Kitchen” Web site lists two different plans for building hovercrafts — vehicles capable of almost frictionless flight.
- www.howstuffworks.com/
Students can use the topical index on this site to find many answers to their questions about uses of friction and different brakes and how they work.
- www.sci.mus.mn.us/sln/tf/f/friction/friction.html
This page from the Science Museum of Minnesota contains some plans for building spinning machines that take advantage of varying amounts of friction.

Suggested Print Resources

- Brain, Marshall. *How Stuff Works*. John Wiley & Sons, Hoboken, NJ; 2001.
- Eichelberger, Barbara. *Constructions for Children*. Dale Seymour Publications, Upper Saddle River, NJ; 2001.
- Lafferty, Peter. *Eyewitness Books: Force & Motion*. DK Publishing, New York, NY; 2000.
- Macaulay, David. *The New Way Things Work*. Houghton Mifflin, New York, NY; 1998.
- Oxlade, Chris. *Machines: Amazing Inventions That Made Life Easier (All About)*. Southwater Publishing, London, UK; 2003.