



Cooling

Grades 3-6

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 *Cooling*, Olive, Troy and the inventor try to beat the heat on a hot summer day and wind up building some machines that are really cool! Their first thought is to cool off in the river, but the island's mammoth population has already beaten them to the water and there's no room left for the humans! Olive suggests that they build a machine to create a breeze, and after tinkering in the inventor's workshop for a time, they create a mammoth-powered automatic fan to help them stay cool. Before long, though, the poor mammoth is tired and overheated, and their fan is idle.

The inventor tells his young friends about an amazing machine that preserves food by keeping it cold — a refrigerator! Refrigerators keep food fresh by removing heat through evaporation. The compressor pumps a vapor called refrigerant through these pipes into a condenser at the back of the refrigerator, where the pressure makes the vapor condense into a liquid, giving off heat. The heat escapes into the room and the liquid cools. It then flows back inside the refrigerator through this expansion valve. Now the liquid refrigerant goes from a high-pressure area to a low-pressure area — the evaporator inside the refrigerator, where it expands and evaporates. When a liquid changes into a vapor it absorbs heat, cooling the inside of the refrigerator!

Based on what she learns about refrigerators, Olive decides to modify the design a bit to create a machine that will cool the air in a room: an air conditioner! An air conditioning unit works much the same as the refrigerator, except that the parts that release all the heat — the compressor and the condenser — are placed on the outside of the building, while the evaporator is on the inside, cooling the room down. In order to work properly, an air conditioning unit must do more than just cool the air immediately around it. A powerful fan circulates the air through the evaporator to cool the entire room effectively.

Glossary

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

atoms — Tiny particles that make up everything around us. These particles are constantly moving.

effort — The force applied to get work done.

energy — The ability to do work.

condenser — The part of the refrigerator that compresses the refrigerant gas. This raises the refrigerant's pressure and temperature.

compressor — A fan or a pump that squeezes air and pushes it forward to the combustion chamber.

contract — To get smaller. Most substances contract when they are cooled.

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

heat — The energy produced by the movement of the tiny atoms and molecules of an object. The more they move around, the more heat is produced.

machine — Any device that helps you do work.

(Continued)

power — A measure of how quickly work is done.

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

refrigerant — A liquid that evaporates at extremely low temperatures.

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 energy.
- What makes the inside of your refrigerator cold?

Follow-up Questions & Activities

- Ask student volunteers to put a small amount of water on their skin and describe how it makes their skin feel. (As the water evaporates, it absorbs heat and makes your skin feel cool.) Have them do the same with rubbing alcohol. (Rubbing alcohol feels even cooler because it evaporates faster.)
- Why does a refrigerator keep food fresh?

Suggested Internet Resources

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

- home.howstuffworks.com/refrigerator.htm
These pages from "How Stuff Works" include an experiment that can help students understand the properties of gases and their role in refrigeration.
- nesen.unl.edu/lessons/weather/pritemp.html
"Am I Hot or Am I Cold" is an elementary science unit about temperature and thermometers developed by the Nebraska Earth Science Education Network.
- www.miamisci.org/af/sln/mummy/
"The Atoms Family" Web site sponsored by the Miami Museum of Science contains two activities exploring heat and insulation called "Building a Better Pyramid" and "Cooling the Mummy's Tomb."

Suggested Print Resources

- Brain, Marshall. *How Stuff Works*. John Wiley & Sons, Hoboken, NJ; 2001.
- Challoner, Jack. *Hot and Cold*. Raintree Steck-Vaughn, Austin, TX; 1997.
- Lauw, Darlene. *Heat (Science Alive!)*. Crabtree Publishing, New York, NY; 2002.
- Macaulay, David. *The New Way Things Work*. Houghton Mifflin, New York, NY; 1998.
- Robinson, Tom. *The Everything Kids' Science Experiments Book: Boil Ice, Float Water, Measure Gravity—Challenge the World Around You!* Adams Media Corp, Avon, MA; 2001.