

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.



Heat

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

One freezing winter day on Mammoth Island, a visiting inventor discovers how useful the Island's mammoth population is in keeping things warm! The warm-blooded creatures help heat water, press clothes, warm beds and keep the village sauna hot and steamy. While the inventor is quite amazed at the ingenious uses the villagers have for mammoths, he is less than impressed with the way the big hairy beasts smell!

The inventor explains that heat is energy that comes from the movement of the atoms and molecules that make up everything around us. The faster that atoms move, the more heat energy is produced. Heat can travel from place to place in three ways: conduction, convection and radiation.

Radiation is the way that heat travels in a straight line from a hot object. Hot things like the sun radiate heat rays which move through the air and even through the vacuum of space. When heat rays hit cooler objects, they warm up those objects. This form of heat transfer is known as thermal radiation.

Another method of heating is known as convection. In liquids and gases, the molecules move about a lot. When heated, liquids and gases expand and rise, while cooler liquids and gases contract and sink. This causes the matter to swirl in a circular motion, transferring heat energy.

Conduction is the third method of heating. When the surfaces of two objects are touching, like an egg on a hot frying pan, heat travels through conduction from the hotter object to the cooler one.

Heat energy travels quickly through some objects, known as conductors, and does not travel easily through other objects, which are called insulators. A vacuum flask is useful to keep soup hot for a long time. Inside the flask is a double-walled container made from glass or steel. The walls are silvered on the inside to reflect the heat rays so they can't leave the flask through radiation. Between the container walls is an empty space called a vacuum that keeps heat from entering or leaving by conduction and convection. The support and stopper are made of an insulating material which also helps reduce heat loss through conduction.

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.

conduction — The way in which heat energy is passed directly through matter that is touching. Molecules vibrate faster and strike other molecules, which also vibrate faster, thus spreading the heat.

conductor — A substance that allows heat to flow through it easily. Metals are good conductors of heat.

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

convection — The movement of liquids and gases from a warm spot to a cooler spot. An example of convection is the wind that forms when cold air sinks and warm air rises.

(Continued)

effort — The force applied to get work done.

energy — The ability to do work.

expand — To get bigger. Most substances expand when heated.

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.

insulator — A substance that does not allow heat to flow through it easily. Air, wood and plastic are examples of insulators.

machine — Any device that helps you do work.

matter — Any substance that takes up space. Matter is made of small particles called atoms and can be in the form of a solid, liquid or gas.

radiation — The movement of energy in a direct line away from its source. The sun radiates energy through space; even though we do not touch the sun, we can still feel its heat.

work — To move or change something. Doing work takes energy.

Pre-viewing Discussion

- What is energy? Where does it come from?
- How does heat travel from one thing to another?
- Describe heat energy in terms of atoms and molecules.
- What types of energy can be used to do work?

Follow-up Questions & Activities

- Have students look for objects in the classroom that seem to give off heat and those that do not. Discuss the apparent differences between the two groups of objects.
- Compare the movement of atoms in cold water and hot water.
- Brainstorm a list of more ingenious ways that the warm-blooded mammoths could help the Islanders on a cold winter day.

Suggested Internet Resources

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

- 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."
- www.howstuffworks.com/engine.htm
Students can use the topical index on this site to find many answers to their questions about different engines and how they work.
- nesen.unl.edu/lessons/weather/pritemp.html
"Am I Hot or Am I Cold?" is an elementary science unit about heat and temperature developed by the Nebraska Earth Science Education Network.