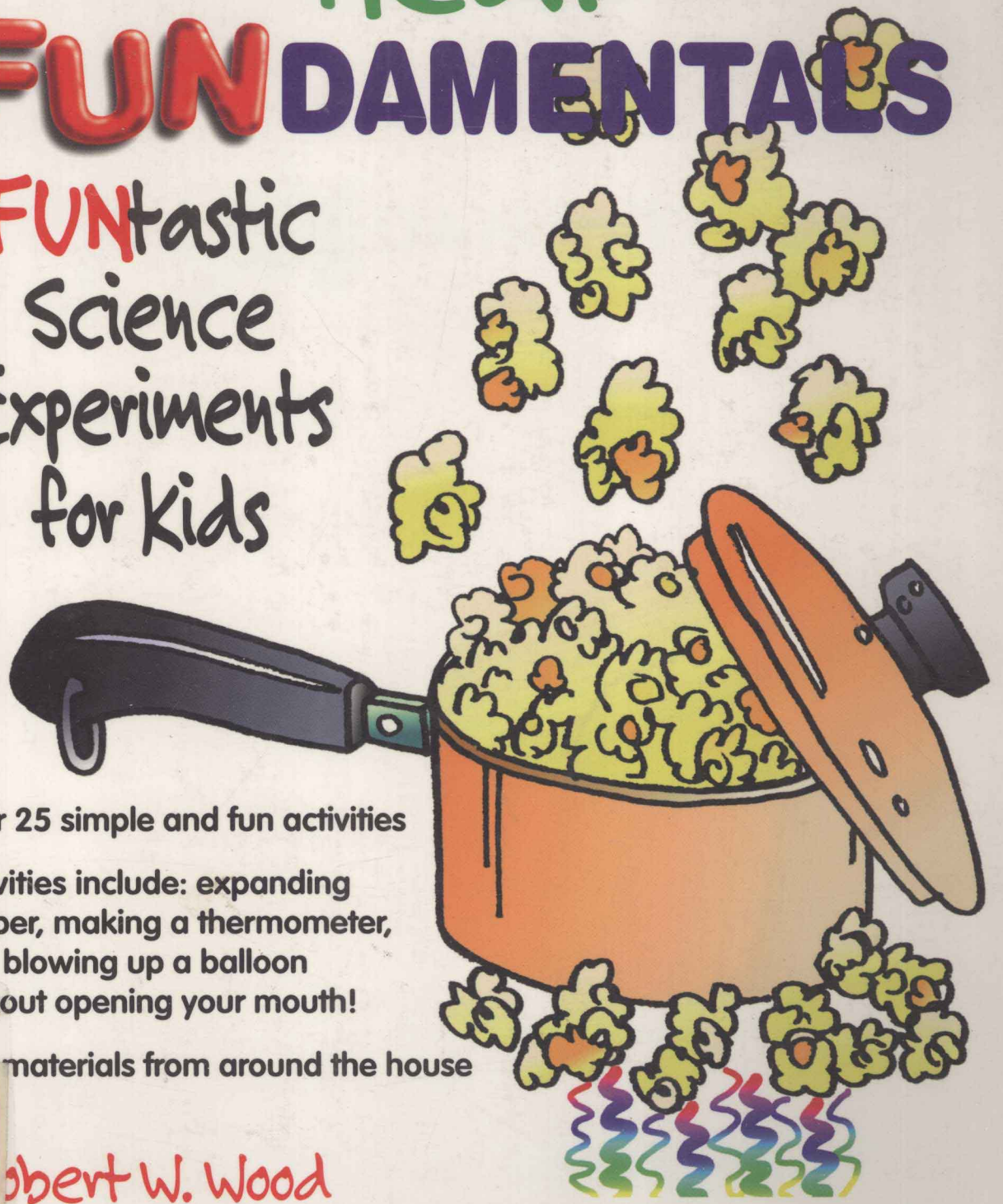
Heat FUNDAMENTALS

FUNtastic Science Experiments for Kids



- Over 25 simple and fun activities
- Activities include: expanding copper, making a thermometer, and blowing up a balloon without opening your mouth!
- Use materials from around the house

Robert W. Wood

HEAT FUNDAMENTALS

FUNtastic Science Activities for Kids

Robert W. Wood

Illustrated by Rick Brown

LEARNING TRIANGLE PRESS

Connecting kids, parents, and teachers through learning

An imprint of McGraw-Hill

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pbk 1 2 3 4 5 6 7 8 9 FGR/FGR 9 0 2 1 0 9 8 7 6
hc 1 2 3 4 5 6 7 8 9 FGR/FGR 9 0 2 1 0 9 8 7 6

Library of Congress Cataloging-in-Publication Data applied for

ISBN 0-07-071803-2

CIP

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INTRO

This book explores the fascinating world of heat. Although we take heat for granted, it's vital to all living things. *Heat* is the combined energy of all the moving molecules of something. *Molecules* are tiny particles that make up all materials, such as iron, glass, and wood. You can't see them or feel them, but these molecules are in constant motion.

We know that a body in motion has *kinetic energy*. The faster something moves, the more kinetic energy it has. And the more kinetic energy something has, the more heat it has, too.

Because all objects have moving molecules, they all contain heat. Even though cold water feels cool to the touch, we know that it is warmer than ice. But even ice contains heat. Ice forms in fresh water at 0°C, or 32°F. (This is warmer than the temperature of your freezer, which is about −13°C, or 8°F.) An object becomes colder when part of its heat is removed and the molecules are slowed down.

You don't need fancy equipment or complicated experiments to observe the behavior of heat. Though the activities in this book are easy to perform, they illustrate important principles about the world around us. Each activity begins with a challenge, followed by a materials list and

a step-by-step procedure. Results are given to explain what is being demonstrated, as well as a few questions to discuss further. The experiments conclude with fun facts.

Where measurements are used, they are given in both the English and metric systems as numbers that will make the activities easy to perform. Use whichever system you like, but realize that the numbers might not be exact equivalents.

Be sure to read Safety Stuff before you begin any experiment. It recommends safety precautions you should take. It also tells you whether you should have a teacher or another adult help you. Keep safety in mind, and you will have a fun-filled experience.

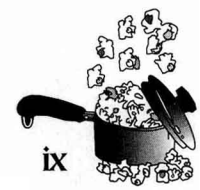
Safety Stuff

Science experiments can be fun and exciting, but safety should always be considered. Parents and teachers are encouraged to participate with their children and students.

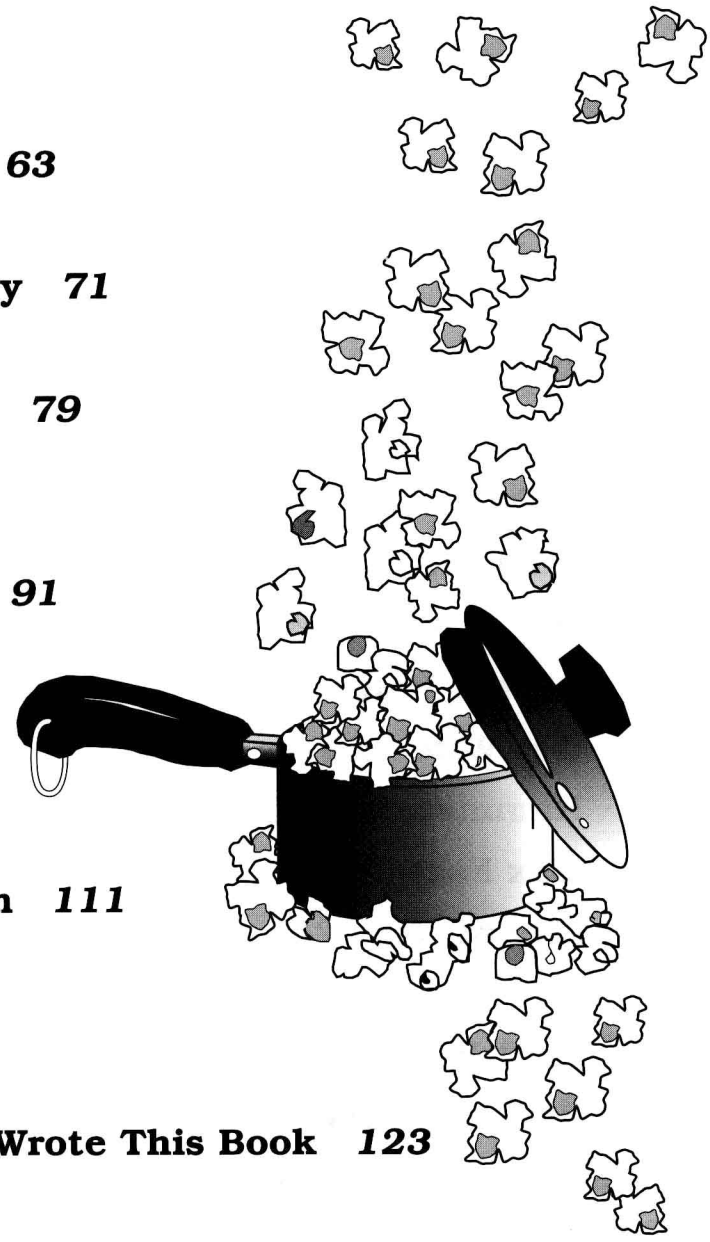
Look over the steps before beginning any experiment. You will notice that some steps are preceded by a caution symbol like the one next to this paragraph. This symbol means that you should use extra safety precautions or that the experiment requires adult supervision.

Materials or tools used in some experiments could be dangerous in young hands. Adult supervision is recommended whenever the caution symbol appears. Children need to be taught about the care and handling of sharp tools or combustible or toxic materials and how to protect surfaces. Also, extreme caution must be exercised around any open flame.

Use common sense and make safety the priority, and you will have a safe and fun experience!



Contents



Here's a chance to get in hot water—
and get away with it!

Heat Sink

Your Challenge

To discover the difference between heat and temperature.

You Need

Very warm tap water

Glass coffee cup

Large glass bowl

Thermometer

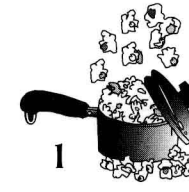
Do This

1 Run some very warm water from the faucet. Fill both the cup and the bowl with water. (Figure 1-1)

Fill the cup and the bowl with water.

Make sure the water isn't hot enough to scald yourself!

Figure 1-1



2 Place the thermometer in the cup and measure the temperature. (Figure 1-2)

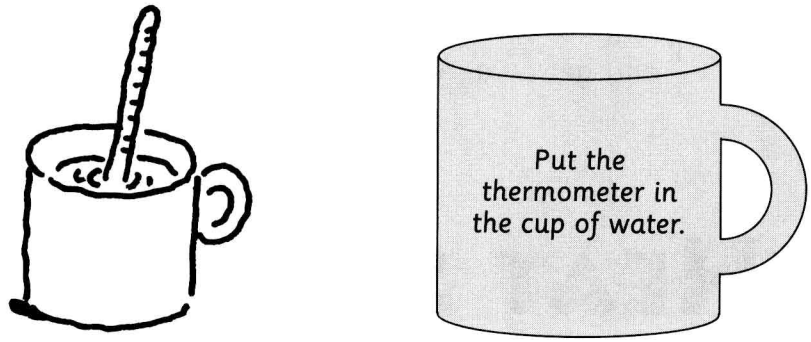


Figure 1-2

3 Now measure the temperature of the water in the bowl. (Figure 1-3)

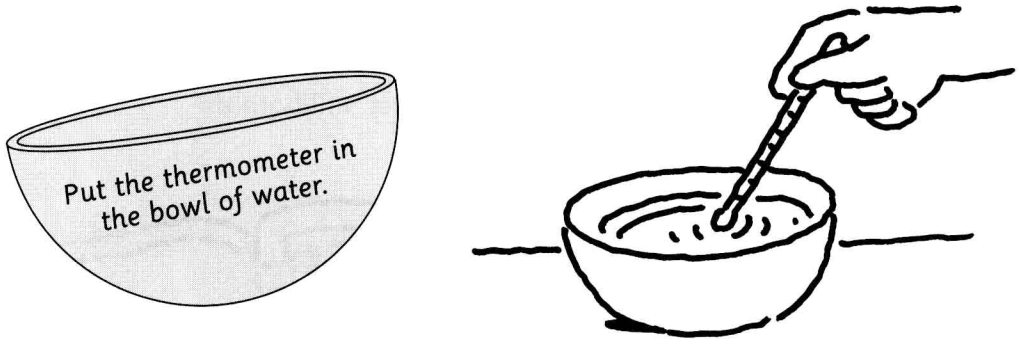
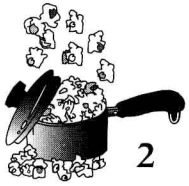


Figure 1-3

4 Compare the temperatures. What do you see?



What Happened?

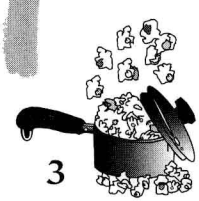
Heat is a form of energy. It is the combined energy of all of the moving molecules of something. *Temperature* is simply the measure of the average energy of individual molecules of the object. Two objects can be at the same temperature, but if they are different sizes they will contain different amounts of heat.

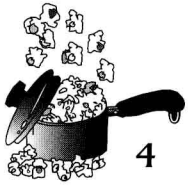
Because the water came from the same source, both temperatures should have been about the same. Which container has the most heat? Can you think of a way you could use this information to design a method to store heat for later use?

If the molecules stopped moving and there was no heat in the object, the object would be at absolute zero. Absolute zero is equal to −273.15°C (−459.67°F).

Guess What?

- *It's impossible to reach absolute zero; however, temperatures very close to it have been achieved.*
- Cryogenics *is the study of matter at extremely low temperatures. At these temperatures, air becomes a liquid and living tissues freeze instantly. At extremely low cryogenic temperatures, matter behaves even more strangely: liquids run uphill and electric currents flow forever!*
- *Heat energy occurs naturally within the earth and represents a potentially inexhaustible source of energy.*
- *About 65 percent of the homes in Iceland are warmed by water heated inside the earth.*





This is one hot experiment!

Hot Hands

Your Challenge

To use your sense of touch to detect temperature.

You Need

Three large bowls

Tap water (very warm, room temperature, and very cold)

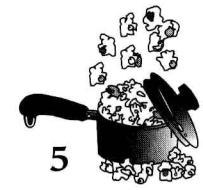
Do This

1 Align the bowls in a row and fill the first one about half full with very cold water.

2 Fill the middle bowl about half full with water at room temperature.

⚠ 3 Fill the one on the right about half full with very warm water. The water should be almost hot, but not hot enough to burn you.

4 Place your left hand in the cold water and your right hand in the very warm water. Leave them in the water a few seconds. (Figure 2-1)



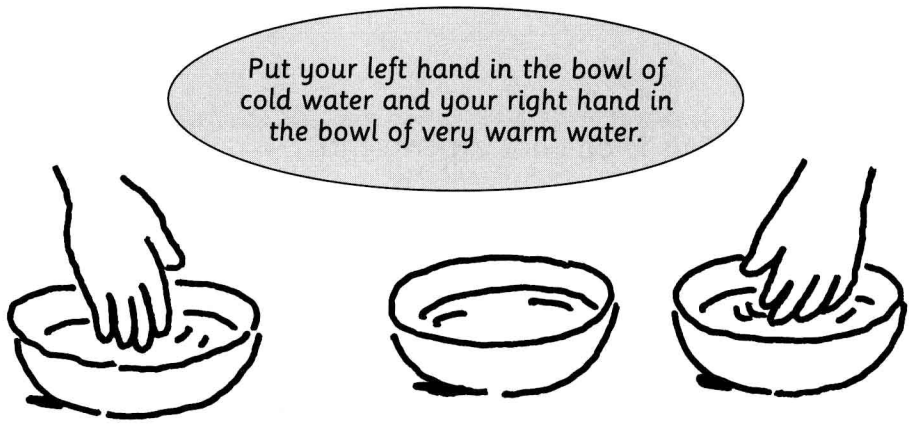


Figure 2-1

5 Now take your right hand from the very warm water and quickly place it in the middle bowl with the water at room temperature. What do you feel?

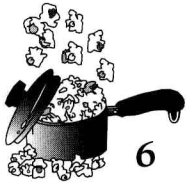
6 Remove your right hand and place your left hand from the cold water into the middle bowl. What do you feel now?

7 Place your left hand back into the cold water and your right hand back into the very warm water. Leave them there several seconds. Then quickly swap hands.

8 Place the hand from the cold water into the warm water and the one in the warm water into the bowl of cold water. Can you explain the differences in the temperatures you feel?

What Happened?

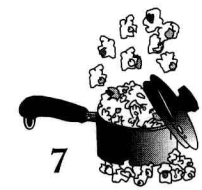
In each case, the temperature you felt should be much warmer or colder than the actual temperature of the water. Using your sense of touch can only give a relative measure of temperature, not an accurate one.

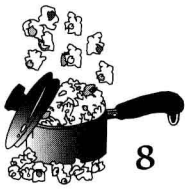


Guess What?

- *When you shiver from the cold, it's the body's way of increasing heat production. (Figure 2-2)*
- *Nearly all the energy from the food we eat leaves the body as heat.*

Figure 2-2





This activity will tickle your tongue!

Pepper Rally

Your Challenge

To demonstrate how heat can be created from any form of energy, such as electrical, chemical, and mechanical.

You Need

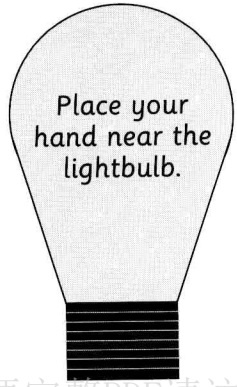
Lamp

Hot pepper, such as a jalapeño

Bare hands

Do This

1 Turn on the lamp and hold your hand near the bulb. What do you feel? What kind of energy do you think this is? (Figure 3-1) (Hint: Is it plugged in?)



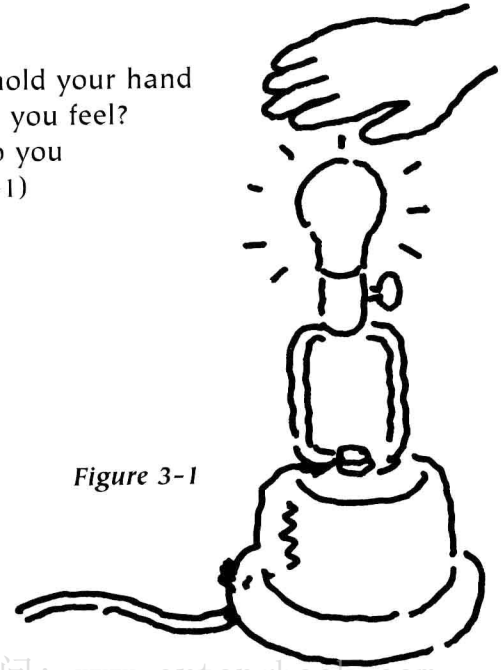


Figure 3-1