

THE LEARNING WORKS

Published in Australia by Hawker Brownlow Education

TABLE OF CONTENTS

Introduction	3
Hot and Cold	4-21
Fuzz, Feathers, and Fins	22-38
Getting to Know Me	39-56
Forces	57-74
Green Friends	75-91
Kitchen Chemistry	92-110
Notes	111-112

The purchase of this book entitles the individual teacher to reproduce copies for use in the classroom.

The reproduction of any part for an entire school or school system or for commercial use is strictly prohibited.

No form of this work may be reproduced or transmitted or recorded without written permission from the publisher.

Copyright © 1980 — THE LEARNING WORKS

All rights reserved.

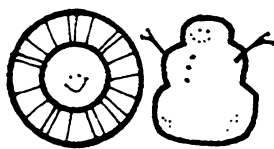
© 1989 Copyright HAWKER BROWNLOW EDUCATION

235 Bay Road, Cheltenham, 3192

Victoria, Australia

Printed in Australia

ISBN 1-86299-246-0



HOT AND COLD

BACKGROUND

Everything is made up of tiny particles called *atoms* and groups of atoms called *molecules*. The arrangement of these atoms and the spaces between them determines the kind of matter which is formed.

In a *solid*, the atoms or molecules are packed tightly together. In a *liquid*, the particles are more widely spaced. In a *gas*, the particles are far apart.

The faster atoms and molecules move, the more they bump into each other and spread apart. Ice is an example of a solid. If ice is heated, the molecules begin to move faster until the ice changes to water. If more heat is added, the water molecules speed up, the spaces widen, and water vapour — a gas — forms.

Heat can be caused by *friction*. Whenever objects rub together, this rubbing action — *friction* — causes the molecules or atoms to speed up.

Chemical reactions also can speed up particles and create heat. A chemical reaction is the combination of two or more substances, which causes a change or creates a completely new substance.

Heat is measured in *degrees* and a thermometer tells us how many degrees of heat something has.

The first known work to measure heat was done by Galileo Galilei in 1593. His thermoscope was a narrow glass tube filled with liquid. It was able to show changes in temperature without accurately measuring them. Because it was an open tube, air molecules pressed on the liquid and prevented it from expanding as completely as it would in a vacuum (a complete absence of atoms and molecules).

Gabriel Daniel Fahrenheit invented the first accurate thermometer in 1714. He used a vacuum-sealed glass tube into which he had inserted mercury. Fahrenheit created a scale for measuring temperature based on the lowest temperature possible for a mixture of salt and water and at the opposite extreme the blood temperature of humans.

In 1742, Anders Celsius developed the Celsius scale of measurement. It was developed particularly to measure the high melting temperatures of metals.

The boiling point of water is 212° F. and 100° C. The freezing temperature of water is 32° F. and 0° C.

Cold is the absence of heat. In the investigations in this unit, students explore the fact that cold water molecules move more slowly than warm water molecules. They discover that water expands as it freezes and that salt water freezes at a lower temperature than fresh water. It is also interesting that the salt separates and rises to the top as the water freezes.

Which freezes faster: hot water or cold water? Surprise — hot water does. The faster molecular movement of the hot water exchanges the heat more quickly with the air.

Before refrigeration, blocks of ice were stacked in layers of sawdust. They often lasted through the spring and into the summer.

Students are challenged in this unit to find a way to keep ice from melting. To motivate their creativity, you could make the following suggestions: (1) stack several cubes together; (2) put the ice in a cup and cover it to prevent air movement over the cube; (3) wrap the ice in layers of paper to insulate the ice.

WORD BOX:

degrees	temperature	friction
thermometer	freeze	chemical reaction
Celsius	Fahrenheit	

LEARNING OBJECTIVES:

1. Students will be able to read a thermometer.
2. Students will understand how friction and chemical reactions cause heat.
3. Students will be able to determine what happens to the salt as salt water freezes.
4. Students will understand what affects the freezing of water and how water changes as it freezes.



PREDICTIONS:

1. Do you think that rubbing something can make it warm?
2. Do you think that adding rubbing alcohol to water will make the water warmer?
3. Which do you think will move faster, the molecules in warm water or in cool water?
4. Do you think that water will take up more or less space as it freezes?
5. Which do you think will freeze faster, fresh or salt water?

DISPLAY BOARD IDEAS:

1. Put a giant cardboard thermometer on one wall. Cover the centre with flannel and have sections of red flannel to fit on this part of the thermometer.

Let students take turns reading the temperature on an outside thermometer and then make the giant thermometer match this reading. You may also want to include a sign that displays the expected daily high and low temperature in Fahrenheit and Celsius readings.

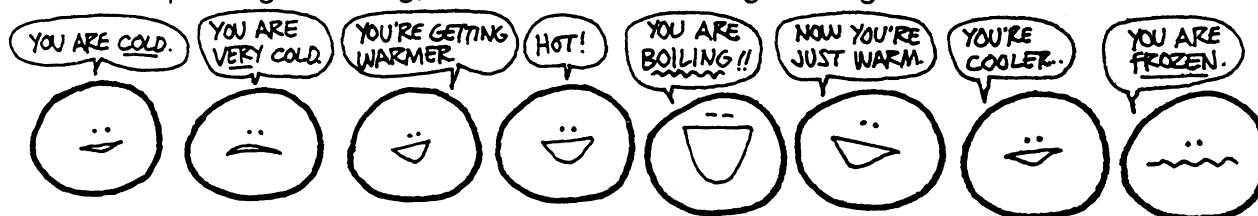
2. Divide a notice board into two parts. Label one section HOT and the other COLD. Put up pictures that illustrate things and places that are warm, hot, cool, or cold. Encourage your students to bring in other examples. Include word cards that illustrate HOT or COLD such as *shiver* and *burn*.

EXTRA SPARK STARTER:

1. Play “Hot or Cold.”

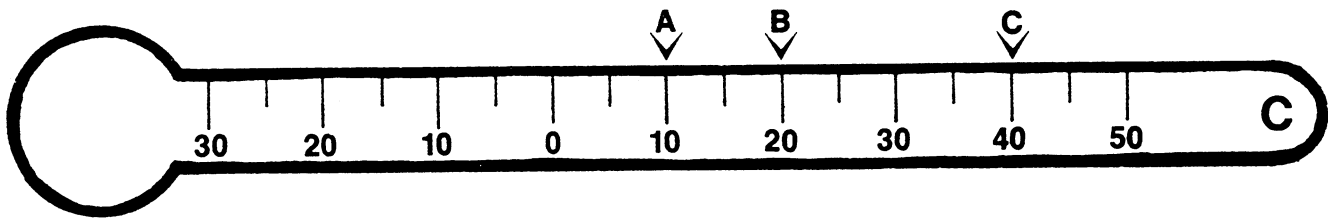
Send one student out of the room. Quickly decide on a mystery object. The student returns and moves around the room. The class calls out clues — “You are getting colder” or “You are very cold” if the student moves away from the mystery object. “You are getting warmer” or “You are hot” would indicate that the student is getting close to the mystery object.

To keep things moving, set a time limit for guessing.



EVALUATION:

Answer each question carefully. Print the answer on the blank to the right of each question.



1. What temperature is at arrow A? (10° C.)
2. What temperature is at arrow B? (20° C.)
3. What temperature is at arrow C? (40° C.)
4. How many degrees does each line represent? (5° C.)
5. How many degrees are between A and C? (30° C.)

Find the word or words that correctly complete each statement. Put the letter of the answer on the blank.

- A. Faster C. Friction E. More
B. More slowly D. Thermometer F. Less

1. A (D) measures temperature.
2. Salt water freezes (B) than fresh water.
3. Hot water molecules move (A) than cold water molecules.
4. (C) is a rubbing together of objects that makes heat.
5. Water takes up (E) space when it freezes.

EXTENDED LEARNING:

1. Make ice cream.
2. Investigate how much heat objects can hold.
3. Investigate which objects hold heat longer.
4. Make candles.
5. Which freezes faster: hot or cold water?
6. Which colour absorbs more heat: black or white?
7. How does salt affect ice?
8. Write a story about a young pioneer boy alone in the woods. It is getting dark and he needs to start a fire. How can he do it without matches?

