

# States of Matter

## TABLE OF CONTENTS

### ABOUT DELTA SCIENCE MODULES

<b>Program Introduction</b> . . . . .	iii
Teacher’s Guide . . . . .	iv
Delta Science Readers . . . . .	vi
Equipment and Materials Kit . . . . .	vii
Scope and Sequence . . . . .	viii
Assessment Features . . . . .	ix
Process Skills . . . . .	x
Communicating About Science . . . . .	xi
Integrating the Curriculum . . . . .	xii
Meeting the Standards . . . . .	xiii
What We Believe . . . . .	xiv

### STATES OF MATTER OVERVIEW

<b>About States of Matter</b> . . . . .	1
<b>Overview Charts</b>	
Hands-on Activities . . . . .	2
Delta Science Reader . . . . .	4
<b>Science Background</b> . . . . .	5
<b>Materials List</b> . . . . .	7

### HANDS-ON ACTIVITIES

<b>Activity Summary</b> . . . . .	9
<b>Schedule</b> . . . . .	10
<b>Preparing for the Activities</b>	
Classroom Management . . . . .	11
Advance Preparation . . . . .	11
Materials Management . . . . .	12
<b>Activities</b>	
1. What Is a Solid? . . . . .	13
2. What Is a Liquid? . . . . .	19
3. What Is a Gas? . . . . .	27
4. Melting Ice . . . . .	35

5. Hurry Up or Slow Down . . . . .	41
6. Using a Thermometer . . . . .	51
7. Measuring Melting Points . . . . .	57
8. From Liquid to Gas . . . . .	65
9. From Gas to Liquid . . . . .	73
10. From Liquid to Solid . . . . .	81
11. Measuring Freezing Points . . . . .	89
12. A Tasty State of Matter . . . . .	97

### Assessment

Activities 1–12 . . . . .	103
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### Glossary

. . . . .	109
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### DELTA SCIENCE READER

<b>Overview</b> . . . . .	111
<b>Before Reading</b> . . . . .	112
<b>Guide the Reading</b> . . . . .	113
<b>After Reading</b> . . . . .	119

### TEACHER RESOURCES

<b>Unit Test: Teacher Information</b> . . . . .	121
<b>References and Resources</b> . . . . .	123
<b>Science Safety</b> . . . . .	125
<b>Standards Correlations</b> . . . . .	127

### COPYMASTERS

<b>Student Activity Sheets</b>	
<b>Assessment Activity Sheets</b>	
<b>Assessment Summary Chart</b>	
<b>School-Home Connection</b>	
<b>Unit Test</b>	



# About **States of Matter**

**DeltaScienceModules**, THIRD EDITION

**S**tudents explore *States of Matter* through twelve hands-on activities and the Delta Science Reader. Help your students begin to see—and classify—the objects in the world around them, not as primary school children but as young scientists. Students use hands-on experiences with blocks, balloons, and beakers to identify the distinctive properties of the three common states of matter. With a variety of lab tools they observe, explore, and measure solids, liquids, and gases, and investigate the processes by which one changes into another. As students conduct melting, freezing, evaporation, and condensation experiments, they learn the importance of controlling variables and keeping records. To conclude the unit, the class can celebrate by making ice cream for a “Matter Matters” party.

The Delta Science Reader *States of Matter* introduces students to matter and its physical properties. Students learn about three states of matter: solid, liquid, and gas. They read about changing from one state to another by melting, freezing, evaporation, and condensation. Students meet two scientists who work with matter in different states—one at a crayon factory and another in Antarctica. Finally, they discover how heating gases keeps a hot air balloon afloat.

# Overview Chart for Hands-on Activities

Hands-on Activity	Student Objectives
<b>1 What Is a Solid?</b> <i>page 13</i>	<ul style="list-style-type: none"> <li>observe the shapes of two solid objects</li> <li>measure the dimensions of the solid objects</li> <li>compare the sizes and shapes of the solid objects in different locations</li> <li>conclude that a solid does not change size or shape when moved from one place or container to another</li> </ul>
<b>2 What Is a Liquid?</b> <i>page 19</i>	<ul style="list-style-type: none"> <li>pour a measured amount of liquid from one container into another</li> <li>compare the liquid's shape and volume in one container to its shape and volume in the other</li> <li>conclude that a liquid can change shape but not volume when moved from one container to another</li> </ul>
<b>3 What Is a Gas?</b> <i>page 27</i>	<ul style="list-style-type: none"> <li>demonstrate that air takes up space</li> <li>identify air as a gas</li> <li>change the shape of a balloon filled with air</li> <li>infer that a gas has no fixed shape</li> </ul>
<b>4 Melting Ice</b> <i>page 35</i>	<ul style="list-style-type: none"> <li>predict what will happen to a piece of ice over time</li> <li>record the elapsed time of melting</li> <li>identify heat as a variable that affects melting</li> <li>begin a class Changing States chart</li> </ul>
<b>5 Hurry Up or Slow Down</b> <i>page 41</i>	<ul style="list-style-type: none"> <li>suggest methods of speeding up and slowing down the melting of ice</li> <li>design and construct a setup to melt ice quickly</li> <li>design and construct an insulator to slow down the melting of ice</li> <li>describe the properties of a good insulating material</li> </ul>
<b>6 Using a Thermometer</b> <i>page 51</i>	<ul style="list-style-type: none"> <li>observe the reaction of the liquid in a thermometer stem to warm and cold water</li> <li>match the level of liquid in a thermometer stem to the numbers on a thermometer back</li> <li>read and record the temperature in degrees Celsius of warm and cold water</li> </ul>
<b>7 Measuring Melting Points</b> <i>page 57</i>	<ul style="list-style-type: none"> <li>determine the melting points of ice and butyl stearate</li> <li>infer that all ice melts at the same temperature and that all butyl stearate melts at the same temperature</li> <li>operationally define <i>melting point</i></li> <li>infer that different substances have different melting points and that the melting point of a substance is a characteristic property of that substance</li> </ul>
<b>8 From Liquid to Gas</b> <i>page 65</i>	<ul style="list-style-type: none"> <li>observe that evaporation occurs when heat is added to water over a long period of time</li> <li>observe rapid evaporation of water as it boils</li> <li>operationally define <i>boiling point</i></li> <li>add <i>evaporation</i> to the Changing States chart</li> </ul>
<b>9 From Gas to Liquid</b> <i>page 73</i>	<ul style="list-style-type: none"> <li>observe water droplets collecting on the outside of cold tumblers</li> <li>infer that water changes from a gas to a liquid when it is cooled</li> <li>conclude that a substance does not change into a different substance when it changes states</li> <li>add <i>condensation</i> to the Changing States chart</li> </ul>
<b>10 From Liquid to Solid</b> <i>page 81</i>	<ul style="list-style-type: none"> <li>change water and butyl stearate from liquids to solids</li> <li>infer that when liquids are cooled sufficiently they will change state from liquid to solid</li> <li>operationally define <i>freezing</i></li> </ul>
<b>11 Measuring Freezing Points</b> <i>page 89</i>	<ul style="list-style-type: none"> <li>measure the freezing points of three different substances</li> <li>conclude that not all substances freeze at the same temperature</li> <li>operationally define <i>freezing point</i></li> <li>note that the freezing point and the melting point of a substance are the same</li> </ul>
<b>12 A Tasty State of Matter</b> <i>page 97</i>	<ul style="list-style-type: none"> <li>use salt to freeze a mixture of milk, cream, and chocolate drink mix</li> <li>make ice cream</li> <li>describe the change of state involved in making ice cream</li> </ul>
<b>Assessment</b> <i>page 103</i>	<ul style="list-style-type: none"> <li>See page 103.</li> </ul>

# States of Matter

Process Skills	Vocabulary	Delta Science Reader
observe; measure; compare; infer; predict; collect, record, display, or interpret data	<b>predict, property, shape, size, solid</b>	pages 4, 8, 9
measure, compare, infer	<b>cubic centimeter (cm<sup>3</sup>, or cc), liquid, volume</b>	pages 5, 9, 10
define based on observations, infer	<b>gas, states of matter</b>	pages 6, 9, 10
predict; collect, record, display, or interpret data	<b>melting, variable</b>	pages 8, 9
hypothesize, use variables, experiment, communicate	<b>insulation, insulator</b>	pages 7, 8, 9
observe; use numbers; measure; collect, record, display, or interpret data	<b>degree Celsius, temperature, thermometer</b>	pages 8, 9
define based on observations; infer; collect, record, display, or interpret data	<b>butyl stearate, melting point</b>	page 9
observe, define based on observations	<b>boiling point, evaporation, water vapor</b>	page 9
observe, infer	<b>condensation</b>	page 10
predict, measure, infer, define based on observations	<b>freezing</b>	page 8
measure, infer, define based on observations	<b>freezing point</b>	page 8
observe, measure, communicate		page 8

See the following page for the Delta Science Reader Overview Chart.

# Overview Chart for Delta Science Reader

## *States of Matter*

Selections	Vocabulary	Related Activity
<b>Think About...</b>		
<b>What Is Matter?</b> <i>pages 2–3</i>	atoms, balance, mass, matter, physical properties, states of matter	Activities 1, 2, 3
<b>What Are Solids, Liquids, and Gases?</b> <i>pages 4–6</i>	gas, liquid, solid, volume	Activities 1, 2, 3
<b>What Are Physical Changes?</b> <i>pages 7–11</i>	condensation, evaporate, mixture, physical changes, solution, temperature, water vapor	Activities 4, 5, 6, 7, 8, 9, 10, 11
<b>What Are Chemical Changes?</b> <i>page 12</i>	chemical change	
<b>People in Science</b>		
<ul style="list-style-type: none"> <li>• <b>Crayon Maker</b> <i>page 13</i></li> <li>• <b>Coastal Geologist</b> <i>page 14</i></li> </ul>		
<b>Did You Know?</b>		
<ul style="list-style-type: none"> <li>• <b>How a Hot Air Balloon Works</b> <i>page 15</i></li> </ul>		Activity 3

See pages 111–120 for teaching suggestions for the Delta Science Reader.

# MATERIALS LIST

## States of Matter

Quantity	Description	Quantity	Description
64 . . . . .	bags, reclosable, 7.5 cm × 7.5 cm*	<b>TEACHER-PROVIDED ITEMS</b>	
50 . . . . .	bags, reclosable, 10 cm × 15 cm*	– . . . . .	bags, paper*
20 . . . . .	balloons, round*	1 . . . . .	bicycle pump (optional)
1 . . . . .	beaker, 500-mL	16 . . . . .	boxes
8 . . . . .	blocks, foam	2 . . . . .	butter, sticks*
8 . . . . .	blocks, wooden	1 . . . . .	chocolate drink mix, powdered*
8 . . . . .	bottles, plastic	1 . . . . .	clock
6 . . . . .	boxes, cardboard, with lids	8 . . . . .	containers, 0.5-gallon
2 . . . . .	butyl stearate, 1 pt*	32 . . . . .	crayons, red
1 . . . . .	chart, Changing States*	1 . . . . .	cream, heavy, 1 quart*
1 . . . . .	clay, 1 lb*	– . . . . .	fabric scraps
50 . . . . .	cups, paper, 6-oz*	– . . . . .	foam packing material
32 . . . . .	cups, plastic, 1-oz	1 . . . . .	hot plate, electric
1 . . . . .	food coloring, red*	– . . . . .	ice cubes or crushed ice*
8 . . . . .	funnels	1 . . . . .	knife, dull
1 . . . . .	hammer	2 . . . . .	ladles, long-handled
1 . . . . .	ice bucket	2 . . . . .	lamps
16 . . . . .	lids, for tumblers	2 . . . . .	margarine, sticks*
8 . . . . .	pails, 5-quart†	3 . . . . .	markers, felt-tip, black
8 . . . . .	petri dishes	1 . . . . .	milk, 0.5 gallon
2 . . . . .	salt, 1 lb*	– . . . . .	newspaper*
1 . . . . .	sand, 2 lb*	– . . . . .	paper towels*
1 . . . . .	soil, potting, 4 quarts*	16 . . . . .	rulers, metric
32 . . . . .	spoons, plastic*	8 . . . . .	scissors
16 . . . . .	spoons, plastic, heavy-duty	1 . . . . .	spoon, large
1 . . . . .	string	– . . . . .	water, tap*
1 . . . . .	tape, masking*		
32 . . . . .	thermometer backs		
32 . . . . .	thermometer stems		
32 . . . . .	thermometers, Celsius		
2 . . . . .	trays, plastic		
16 . . . . .	tumblers, graduated		
32 . . . . .	tumblers, plain		
1 . . . . .	<b>Teacher's Guide</b>		
8 . . . . .	<b>Delta Science Readers</b>		
		* = consumable item	† = in separate box

# ACTIVITY SUMMARY

**In this Delta Science Module, students learn about the three common states of matter—solid, liquid, and gas.**

**ACTIVITY 1** Students begin by determining the characteristics of a solid. They observe the shapes of two solid objects and measure their dimensions. They also conclude that solids change in neither size nor shape when moved from one container to another.

**ACTIVITY 2** Students determine the characteristics of a liquid. They pour a given amount of liquid into two different containers and conclude that a liquid changes shape but not volume when moved from one container to another.

**ACTIVITY 3** Students determine the characteristics of a gas. They demonstrate that air takes up space and identify it as a third state of matter—gas. Then they change the shape of a blown-up balloon by pressing on it. They learn that gas changes to fit the shape and the volume of its container.

**ACTIVITY 4** Students investigate melting—the change in state of matter from a solid to a liquid. They discuss the variables that affect the rate of melting and begin a Changing States chart on which they record the effect of heat on changing the states of matter.

**ACTIVITY 5** Students continue their investigation of melting. They suggest ways of both speeding up and slowing down the melting of ice. They then carry out experiments to test their hypotheses. Finally, students discuss variables that can affect melting and the efficiency of various insulators.

**ACTIVITY 6** Students investigate how a thermometer works and learn how to use one to measure temperature. First they observe the reaction of the liquid in a thermometer stem to

both hot and cold water. They then relate the level of liquid in a thermometer stem to the numbers on a thermometer back. They identify the temperature of a substance as the level at which the red liquid in the stem stops moving.

**ACTIVITY 7** Students use their experience with thermometers to measure the melting points of ice and butyl stearate. After comparing the recorded melting points of ice and butyl stearate, they conclude that different types of matter have different melting points—that is, they change state from solid to liquid at different temperatures.

**ACTIVITY 8** Students investigate the change in state from liquid to gas. They infer that evaporation occurs when added heat raises the temperature of a liquid. They define boiling point and add the concept of evaporation to the Changing States chart.

**ACTIVITY 9** Students investigate the change of state from gas to liquid. They compare water before and after it changes state and conclude that it is the same substance in both states. Students define condensation and add it to the Changing States chart.

**ACTIVITY 10** Students investigate freezing—the change of state from liquid to solid.

**ACTIVITY 11** Students measure the temperature at which various materials freeze. They observe that not all substances freeze at the same temperature, and conclude that different types of matter have different freezing points—that is, they change state from liquid to solid at different temperatures.

**ACTIVITY 12** Students use what they have learned about states of matter to make a tasty treat!