Knowing Science

3-DIMENSIONAL TEACHING & LEARNING

GRADE 5

Literacy Guide

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Introduction

Introduction to the *Knowing Science*® Literacy Guide

Elementary science instruction today features teachers introducing students to the investigative practices of "real" scientists to answer their questions about the natural world. Why do objects move or stop moving? Why do earthquakes happen? Why do baby mammals look like smaller versions of their parents?

When students generate inquiries about the natural world, they embark on a journey to find the answers. They make observations, read books, or search the Internet for relevant information. They plan investigations, make predictions, and suggest answers. They perform experiments, accumulate and analyze data, and communicate their findings to others orally and/or in writing. Introducing students to these genuine scientific procedures during their formative years encourages critical thinking and excitement about science.

Evidence suggests that children learn science best in the context of an interdisciplinary approach. It is clear that mathematics and science are inextricably linked, but the important role literacy plays in the study of science has received less attention. When children engage in science content as one of the contexts for developing literacy skills, they not only become well informed about science; they also develop proficient reading, writing, and speaking skills. Student scientists, just like professional scientists, must possess good reading and communication skills in order to conduct research and share the results effectively.

The *Knowing Science* program employs both fiction and nonfiction to assist in developing students' understanding of science. Most young children have a strong concept of story. In kindergarten, children's literature (which sometimes adds fact to fiction) motivates students to follow a story line and at the same time acquire important information and concepts. In first and second grade, fiction still plays a role in understanding science concepts, but nonfiction science trade books (NOT textbooks) assume growing importance as sources of accurate information about various topics. Nonfiction titles help students learn facts about a topic through text, photographs, charts, maps, and the visual presentation of data.

Integrating literacy—reading, writing, and speaking—into the study of science is one of the strengths of the *Knowing Science* program. For those seeking to incorporate literacy into the teaching of science, the *Knowing Science Literacy Guide* suggests how to embed literacy into the content of *Knowing Science* units.

Using the Knowing Science® Literacy Guide

For Grades 4 and 5, selected lessons in the *Knowing Science* Teacher's Manual have corresponding literature recommendations in the *Knowing Science* Literacy Guide. Each unit includes a list of recommended titles, as well as their authors and Lexile ratings. A brief synopsis for each book is included to help you determine how to incorporate the books into the science lessons.

Tips & Tricks: Integrating Science with Literacy

There are many good reasons to include science literature as part of a balanced literacy program. The most important reason is that to teach science well, *science must be done and not just read about*. Effective science teaching requires students to actively engage in experiences that are relevant and applicable to their daily lives.

Reading and responding to quality science literature supports science learning. It leads to better comprehension and retention of science concepts. Students are able to transfer topic-specific information from one instructional setting to another (from science to literacy and literacy to science). Additionally, skills needed for understanding and responding to science texts (or any informational text) are applicable to other subject areas and not limited to use only during literacy time.

Comprehension skills required to read informational text are different from the skills required to read narrative text. This is because informational text tends to include many details in a small amount of writing, both at the sentence level and at the paragraph level. Therefore, to understand the author's message, informational text needs to be read more slowly. Repeated readings may be necessary in order to fully extract the meaning from the text.

Students benefit from actively reading nonfiction text. This requires frequent stops to ask questions (*What did I just read? What details were included? What do I want to know more about?*) and to react (*Wow – that just got my attention!*). Active reading also involves making connections – to self and personal experiences; to other texts, movies, or videos on the same topic; and to events in the world.

Text features may give as much if not more information than written text. If informational reading is new to students, they may have seen text features before but may not know why or how they are used. Arranging a "text feature hunt" is an easy way to introduce students to features such as:

- Table of contents, glossary, index
- Main heading (title) and subheadings or chapter titles
- Special print: **boldface**, *italics*, or highlighted
- Bulleted lists of information
- Diagrams: illustrations labeled to show parts
- Captions: usually a sentence or two that describes an image
- Text box, inset box, or call out: to define vocabulary or "fun facts"
- Illustrations such as photographs and drawings
- Other graphics: graphs, charts, tables, maps, timelines, Venn diagrams

Informational text is organized differently from narrative text. It may be structured in any of several ways, depending on the author's purpose. Here is a

list of text structures, along with uses and examples of signal words featured in each type of text:

Description	Uses topic-specific vocabulary and details to create a mental image for the reader *first of all; an example is; such as; also*
Comparison	Discusses similarities and differences between two objects or ideas *same; both; different; unlike; similar to; also*
Sequence, Order, or Procedural	List of events that have occurred or should occur in a set order *first; next; then; last; finally; after that; before that; numbered list*
Cause and Effect (Before and After)	What causes an event and the resulting change *because of; before; after; since; as a result of; however*
Problem and Solution	A problem or task to be solved is described along with possible solutions *problem; task; issue; answer; possible; solution; try*
Fact and Opinion	The author states a claim and then gives detailed reasons to support the claim *one reason is; another reason is; finally*

When writing responses to informational text, have students answer questions in complete sentences, using topic-specific vocabulary from the question. This strategy is sometimes referred to as "TTQA" or **T**urn **T**he **Q**uestion **A**round. For example:

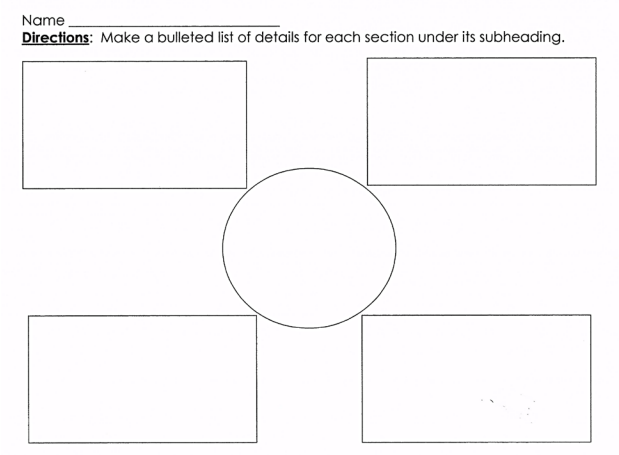
Question: How do *all food chains begin*?
Answer: *All food chains begin* with energy from the Sun.

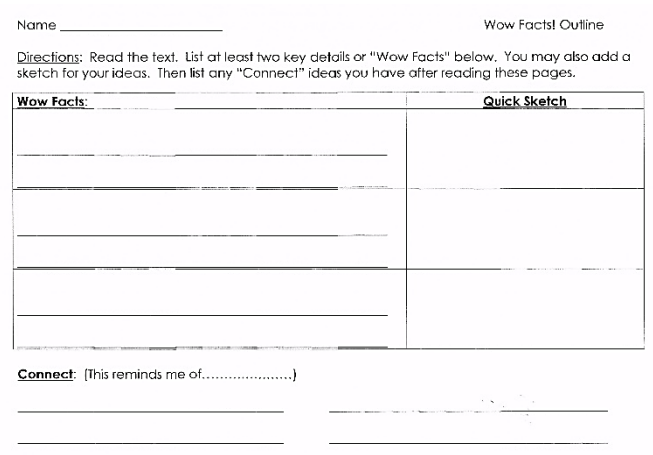
Written responses should mirror the specific type of text structure (description, comparison, procedural, cause/effect, problem/solution or fact/opinion). Responses should include signal words that are characteristic to each type of text. For example:

Question: How are solids *different* than liquids?
Answer: Solids have their own shape, *but* liquids take the shape of their container. They *both* take up space and have mass.

Guided reading groups may take several forms, depending on the needs of your specific class and available resources. One approach is using *leveled readers*. When using leveled readers, the books will all cover the same topic but will be at

different reading levels. Questions written specifically for each title may be used. If that is not possible, use a generalized graphic organizer for each title, such as the ones shown below:


Name _____
Directions: Make a bulleted list of details for each section under its subheading.


Name _____ Wow Facts! Outline

Directions: Read the text. List at least two key details or "Wow Facts" below. You may also add a sketch for your ideas. Then list any "Connect" ideas you have after reading these pages.

Wow Facts:	Quick Sketch

Connect: (This reminds me of.....)

Another approach is to use the *same book* and same set of questions. Different levels of support can be provided for each ability group. One group will need little support, one will need moderate support, and one will need a greater amount of direct support and instruction. Questions may be modified as needed to meet the needs of each group. The number of questions and required length of responses may be adjusted for each ability level. Challenge or bonus questions may be provided for groups or individuals that finish early.

A third approach is *parallel reading*. Each group reads a different subtopic of a main idea or topic. For example, when studying natural disasters, one group might read about volcanoes, another about earthquakes, and a third about tsunamis. A general graphic organizer or parallel questions may be used. Parallel questions ask for the same information, but specific answers vary. For example:

- What causes the natural disaster?
- What happens to surrounding areas during the disaster?

Integrating science literature into a balanced literacy program benefits students in many ways. It promotes better retention of knowledge, and it encourages development and transference of skills across subject areas. Any time a student finds a connection between multiple segments of learning, the result is always a better-quality learning experience.

PHYSICAL SCIENCE

UNIT 1: STRUCTURE, PROPERTIES, AND INTERACTIONS OF MATTER

RECOMMENDED LITERATURE

Recommended titles are listed below, along with their authors and Lexile ratings. The list is followed by a brief synopsis for each book, to help you determine how to incorporate the books into the unit's science lessons.

LESSON NUMBER	TITLE	AUTHOR	LEXILE LEVEL
1.2 Matter is Made up of Small Particles	***Atoms and Molecules***	Molly Aloian	IG860
	Introducing the Periodic Table	Tom Jackson	1030L
1.3 States of Matter — Nothing Gets Lost	***States of Matter***	Lynnette Brent	IG810
	Solids, Liquids, and Gases	Richard Spilsbury, Louise Spilsbury	1000L
1.4 Properties of Matter	***Materials***	Richard Spilsbury, Louise Spilsbury	1060L
1.5 Can Matter Change?	***Chemical Changes***	Lynnette Brent	IG780
	Mixtures and Solutions	Molly Aloian	IG810
	Materials	Richard Spilsbury, Louise Spilsbury	1060L

SYNOPSES

Atoms and Molecules
Rebecca Motil / Newbridge Educational

What is matter made of? Young readers will be amazed to learn about the tiny particles that make up everything from this book to their very own bodies. Colorful illustrations and fun fact boxes will help readers understand how atoms come together to form molecules, the building blocks of everything in the universe. Topics include:

- the discovery of the atom
- the parts of an atom
- how atoms combine to form molecules
- and how atoms relate to elements and the periodic table

Introducing the Periodic Table
Molly Aloian

This informative title introduces readers to periodic table of elements. Clear, concise text and supportive images explain how the periodic table was created and its significance in the scientific world. Readers will discover what the table reveals about the distinct properties of each major group of elements and how the elements are used in everyday life.

States of Matter
Lynnette Brent

Young people intuitively understand that matter takes different forms – water, for example, can be liquid, solid ice, or gaseous steam. This book will give readers a deeper understanding of the different states of matter. Through colorful photographs and lively discussions of familiar materials, readers will be drawn in to learn about matter's many forms. Topics include:

- understanding matter, mass, volume, and density
- differences between solids, liquids, and gases
- how matter passes from one state to another
- properties of matter, such as hardness and viscosity.

Solids, Liquids, and Gases
Richard Spilsbury, Louise Spilsbury

All materials can exist in different states, but what are the differences, and how do materials change from one state to another? This book explores solids, liquids, and gases, looking at their properties and the processes involved in changing state.

Materials
Richard Spilsbury, Louise Spilsbury

The world is full of materials, and they are all different. This book explores the wide range of materials we use, looking at their properties and what makes them suitable for different applications.

Chemical Changes
Lynnette Brent

Chemical changes are more common than you might think, from rust forming on steel to a cake baking in the oven. Through exciting, familiar examples and engaging illustrations, readers will discover how chemicals react and change. Topics include:

- how chemicals react with one another
- chemical changes such as precipitation and oxidation
- how catalysts affect chemical reactions
- what everyday events are actually chemical reactions

Mixtures and Solutions
Molly Aloian

Most of the materials around us contain blends of more than one substance. These are mixtures and solutions. Seawater, for example, is a solution of salt and water. The engaging text and vivid illustrations in this book will help readers understand how mixtures and solutions form and how they apply to everyday life. Topics include:

- the difference between mixtures and solutions
- how solutions may be diluted or concentrated
- how distillation and filtration work
- the principles of osmosis.

LIFE SCIENCE

UNIT 1: MATTER AND ENERGY IN ORGANISMS AND ECOSYSTEMS

RECOMMENDED LITERATURE

Recommended titles are listed below, along with their authors and Lexile ratings. The list is followed by a brief synopsis for each book, to help you determine how to incorporate the books into the unit's science lessons.

LESSON NUMBER	TITLE	AUTHOR	LEXILE LEVEL
1.1 Food Webs and Energy	***What are Food Chains and Webs?***	Bobbie Kalman Jacqueline Langille	940L GRL Q
	Food Webs-Who Eats What?	Claire Llewellyn	890L GRL T
	The Producers	Melissa Stewart	930L GRL U
1.3 Wiggly Worms	***Life Cycle of an Earthworm***	Bobbie Kalman	940L GRL L

SYNOPSES

What are Food Chains and Webs?
Bobbie Kalman and Jacqueline Langille

Starting with the Sun, food chains link plants and animals together to help them survive in various ecosystems. This book describes the connections between herbivores, carnivores, scavengers, and decomposers. It also explains transfer of energy between and within energy pyramids and photosynthesis.

Food Webs – Who Eats What?
Claire Llewellyn

This book teaches about food webs, predator/prey relationships, and the concepts of competition and limiting factors in ecosystems.

The Producers
Melissa Stewart

Using the process of photosynthesis, plants make food for their own survival. They in turn provide food for almost all of Earth's other life forms. Learn why this leads biologists to call plants "producers".

Life Cycle of an Earthworm
Bobbie Kalman

Following earthworms from birth to maturity, this book explains the stages of development these creatures undergo before they reach adulthood. It presents illustrations and photographs to explain how earthworms live and move underground, earthworm cocoons, how young earthworms grow, and how earthworms reproduce.

EARTH AND SPACE SCIENCE

UNIT 1: EARTH SURFACE PROCESSES

RECOMMENDED LITERATURE

Recommended titles are listed below, along with their authors and Lexile ratings. The list is followed by a brief synopsis for each book, to help you determine how to incorporate the books into the unit's science lessons.

LESSON NUMBER	TITLE	AUTHOR	LEXILE LEVEL
1.1 What is a System?	***The Biosphere***	Mary Kay Carson	970L GRL T
1.2 Earth's Systems	***The Ocean Biome***	Bobbie Kalman	980L GRL R
1.5 Human Impact on Earth's Systems	***Humans and the Hydrosphere***	Ava Sawyer	780L GRL U
	Humans and Earth's Atmosphere	Ava Sawyer	900L GRL W
	Humans and Other Life on Earth	Ava Sawyer	940L GRL U
	Human Environmental Impact	Ava Sawyer	830L GRL V

SYNOPSES

The Biosphere
Mary Kay Carson

All life on Earth depends on complex systems in the atmosphere, the hydrosphere, and the geosphere. Together, these systems are called the biosphere. This book illustrates and describes these systems.

The Ocean Biome
Bobbie Kalman

Oceans and seas form the world's largest biome. It covers three-quarters of the Earth's surface. This text uses full-color illustrations and photography to explain the four zones in the marine biome, plants and animals that inhabit the zones, diversity and importance of coral reefs and estuaries, importance of oceans to the rest of the Earth, and ocean conservation.

Humans and the Hydrosphere
Ava Sawyer

The hydrosphere encompasses all water on Earth—from glaciers and ice to rivers and oceans. People use water every day. This title asks the question, how much do you use? Readers will learn how humans use water, how humans positively and negatively affect water, and how to protect the water supply.

Humans and Earth's Atmosphere
Ava Sawyer

Nitrogen, oxygen, argon, and carbon dioxide are all gases in Earth's atmosphere. But what happens when there is too much or two little of a certain gas? Readers will learn how every day activities such as driving, heating buildings, and using aerosols release harmful gases into the air and how it affects the air we breathe.

Humans and Other Life on Earth
Ava Sawyer

Humans have influenced the world around them since they first walked on Earth. Hunting has impacted animal populations. Pollution and deforestation have affected habitats. Humans have also worked to protect the environment through preserves and breeding programs. In this title readers will learn about both the positive and negative impacts humans have on the biosphere.

Human Environmental Impact
Ava Sawyer

Pollution and mining for resources have negatively impacted Earth. Nonrenewable resources will someday run out. Then what? In this title readers will learn about alternative energy sources such as solar, wind, and geothermal energy, and what they can do to positively affect Earth.

UNIT 2: SPACE SYSTEMS: STARS AND THE SOLAR SYSTEM

RECOMMENDED LITERATURE

Recommended titles are listed below, along with their authors and Lexile ratings. The list is followed by a brief synopsis for each book, to help you determine how to incorporate the books into the unit's science lessons.

LESSON NUMBER	TITLE	AUTHOR	LEXILE LEVEL
2.1 Which Way is Down?	***Gravity***	Nick Hunter	990L GRL X
2.3 Predictable Patterns	***Earth in Space***	Rebecca Motil	910L GRL V
2.4 How Far Away are the Sun and Other Stars?	***The Stars: Glowing Spheres in the Sky***	Davis Jefferis	930L GRL Q

SYNOPSES

Gravity
Nick Hunter

Why does the rain fall? Why do rivers flow to the sea? The scientific theory of gravity answers these and many more questions we may have about this invisible force. This fascinating book looks at the historical controversies that surround the theory of gravity and tells the stories of the scientists who worked on the theory. It also examines how the theory of gravity was arrived at, how it was tested, and what impact the theory has had on our understanding of science today.

Earth in Space
Rebecca Motil

Earth's position in our solar system gives us seasons, eclipses, polar caps, tides, and, ultimately, life. Students learn why this is so, and they learn what would change if the Earth's position relative to the Sun and moon were different.

The Stars: Glowing Spheres in the Sky
David Jefferis

Everyone knows what those glowing points of light in the night sky are—but do you know what they are made of? The Stars: Glowing Spheres in the Sky answers this question as well as many others, such as How are stars formed? How far away from Earth is the nearest star? What is the biggest star? and What is a black hole?