Knowing Science

3-DIMENSIONAL TEACHING & LEARNING

GRADE 3

Literacy Guide

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Literacy Guide

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.

Guide to Lesson

Using the Knowing Science® Literacy Guide

At the K-3 levels, selected sessions in the *Knowing Science* Teacher's Manual have a corresponding entry in the *Knowing Science* Literacy Guide. The following elements are contained in each of the entries.

PURPOSE

Outlines the main concepts of the unit and describes the kinds of literature that can be used to complement the science themes and enhance students' understanding of the topic.

OBJECTIVES

Provides a list of the learning goals for a specific lesson.

RECOMMENDED LITERATURE

Provides a list of recommended titles, along with their authors and Lexile ratings. Also furnishes additional titles that you may wish to use because their Lexile levels are appropriate for specific individuals or small groups of students in your class. Titles that fall into this category carry a general rather than detailed suggestion for how to use them during the course of the lesson.

EMBEDDING LITERATURE

A detailed description of how to use the recommended titles during the course of a lesson.

BUILDING LANGUAGE FOR LITERACY

If applicable… Provides opportunities in some lessons to develop students' acquisition of vocabulary, as well as oral language structures to talk about scientific subject matter. For example, sentence frames guide students to communicate about aspects of the lesson in correct grammatical form. The repeated use of this approach fosters fluent expressive language skills around the content of the curriculum.

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*

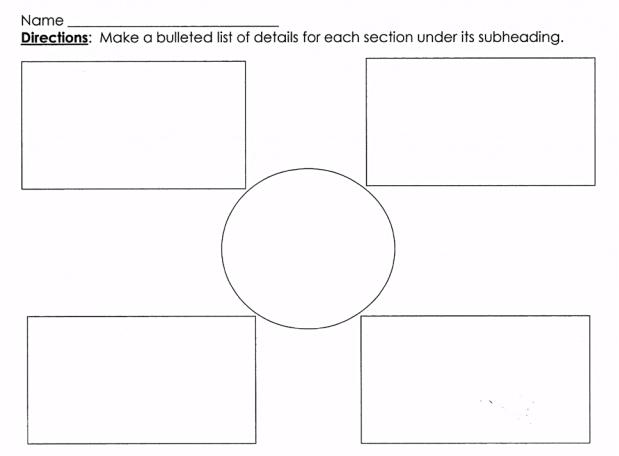
When writing responses to informational text, have students answer questions in complete sentences, using topic-specific vocabulary from the question. This strategy is sometimes referred to as "TTQA" or **T**urn **T**he **Q**uestion **A**round. For example:

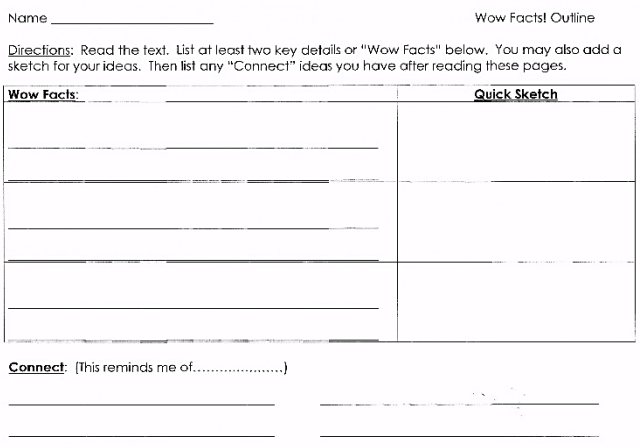
Question: How do *all food chains begin*?
Answer: *All food chains begin* with energy from the Sun.

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: FORCES AND INTERACTIONS

Motion is everywhere around us. Even something like a building that does not appear to be moving is in motion. On a miniscule scale, electrons are in perpetual motion, traveling around the nuclei of atoms. On a scale of the unimaginably huge, the universe is continuously expanding outward.

Because movement is all around us, students intuitively understand motion. The goal in this unit is for students to continue to study motion on a more formal scientific level.

In this unit, students engage in motion-related measurement—distance traveled and time it takes to travel. They then reinforce their understanding about force and motion by investigating how pushes and pulls in different directions and different magnitudes affect the motion of object, as well as the roles balanced/unbalanced and contact/noncontact forces play in motion.

Children's literature plays a role in engaging students in the topics of force and motion. Various titles introduce, summarize, supplement, or reinforce the concepts in this unit. Books that work well include those that focus on measuring distance traveled, time traveled, and speed; the role of balanced and unbalanced forces in creating motion; and contact and non-contact forces.

The titles listed below fit the criteria for inclusion in this unit. The list is followed by suggested techniques for incorporating the books into the unit's science lessons.

RECOMMENDED LITERATURE

Recommended titles are listed below, along with their authors and Lexile ratings. The list is followed by suggested strategies for incorporating the books into the unit's science lessons.
Read the Big Book version of this title to the whole class, and follow up later with leveled readers as necessary.

LESSON	TITLE OF BOOK	AUTHOR	LEXILE LEVEL
1.1 Measure That!	***How Short, How Tall, How Far Away***	David A. Adler	850L
1.2 Measuring Distance and Motion	***Just a Second***	Steve Jenkins	870L
1.3 Let's Move!	***Move It!*** ***Motion: Push and Pull, Fast and Slow*** ***Force and Motion***	Adrienne Mason Darlene Stille Lisa A. Boehm / Newbridge Educational	690L IG 570L 910L
1.5 Contact and Non-Contact Forces	***Attract and Repel***	Jennifer Boothroyd	580L
1.6 Magnets Make Things Move	***Attract and Repel*** ***Magnet Power***	Jennifer Boothroyd Buffy Silverman	580L 480L

Lesson 1.1 Measure That! — A Review of Linear Measurement

PURPOSE

Comparison of an unknown with a fixed standard allows us to define physical quantities—those that can be quantified by measurement. The purpose of this lesson is to have students review the concept of measurement and recognize the importance of standard units in measurement. Students practice using non-standard and standard units to describe length and width, and they select appropriate tools for measurement.

OBJECTIVES

By the end of the lesson, students will be able to:

- Compare measurements obtained by using a non-standard unit
- Compare measurements obtained by using a standard unit
- Explain why a standard unit is more reliable and practical than a non-standard unit
- Define in their own words what measurement means

EMBEDDING LITERACY

Session 1: *How do we measure length and width?*

At the conclusion of the session, share the following book with students.

How Tall, How Short, How Far Away
David A. Adler

This nonfiction book presents the history of measurement with captivating illustrations and activities in which children will want to participate.

- Begin reading the book and stop on page 2 where two ancient nonstandard Egyptian units of measurement are pictured: the digit and the palm. Discuss with students.
- Read on to page 3 and have students follow the directions for representing a *span* and a *cubit*.
- Divide students into pairs and guide them through the measurement activity on pages 4-5 so they can figure out how tall they are in cubits. You can use masking tape instead of a pencil to mark each cubit on the wall.
- On pages 6-9, there are directions for children to figure out their height not only in cubits but also in spans, palms, and digits. If it is too unwieldy for the entire class to perform these measurements, you might want to ask one or two student pairs to demonstrate these measurements for the class.

- Read pages 10-13 and discuss what a *pace* is. Ask two students to demonstrate a pace for the rest of the class. Did both students end up traveling the same distance? What is the problem with using body parts as standard measures?
- Review with students the Roman measurements on pages 16-17. These should be familiar to students.
- Review the metric system on pages 18-19. How does it differ from the customary system?
- Divide students into pairs and have them answer the questions on pages 20-23, and then quickly share their answers with the class.
- Close the discussion of the book with a look at measuring distance with a car's odometer. Tell students that the next session will focus on one of the functions of an odometer: measuring distance traveled.

Lesson 1.2 Measuring Distance and Motion

PURPOSE

This lesson engages students in a review of two important concepts. First, the motion of an object can be described by the distance it has moved from its original position to its final position. Second, the time it takes an object to move can be measured. Therefore, we can measure not only how far an object has traveled in two dimensions, but also how long it took to travel. Finally, students will observe patterns and use their observations to predict future motion.

OBJECTIVES

By the end of the lesson, students will be able to:

- Define and measure distance
- Explain the importance of initial and final positions when measuring distance traveled
- Explain why people need a standard unit for measuring time
- Use time to measure how long it takes an object to move
- Demonstrate an understanding that the faster something moves, the less time it takes to cover the same distance
- Use patterns to predict future motion

EMBEDDING LITERACY

Session 2: *How do we measure how long it takes an object to move?*

In this unit, students learn about measuring time. We cannot see or hear or touch or smell time. Historically, we looked to the natural world to measure time—the passing of the seasons, periods of darkness and light, etc. Eventually, we moved away from measuring time by natural cycles and our measurements became much more precise. Read the following book aloud to students for a fresh way of looking at time.

Just a Second
Steve Jenkins

This non-fiction picture book explores time and how we think about it in a different way – as a series of events in the natural world (some of them directly observable, others not) that take place in a given unit of time. Steve Jenkins' extraordinary illustrations will accompany this engaging look at time.

As you read, ask students to pick a fact that surprised them the most for each of the time periods (a second, a minute, an hour, and so on). For instance, in one second a human can blink seven times. Periodically have students share their "most surprising fact."

Proceed with the rest of the session.

Lesson 1.3 Let's Move!

PURPOSE

Motion is one of the big ideas of science. When an object moves from one position to another, motion takes place. A push or pull on an object at rest initiates motion. We call that push or pull a *force*. In this lesson, students engage in activities in which they can see and/or feel that a force (contact force) causes motion, and that an object travels in a straight line, unless another force stops the motion or changes its direction. Students will also learn that the greater the force, the faster an object travels, and that a heavier object requires a greater force to initiate motion than does a lighter one.

OBJECTIVES

By the end of the lesson, students will be able to:

- Explain that a push or pull causes an object at rest to move
- Explain that a force can cause a moving object to stop or change direction
- Explain that it requires more force to move a heavier object that a lighter one
- Use arrows to represent the direction and effort of the force

EMBEDDING LITERACY

Session 1: *What is a force and how does it make object at rest move?*

Before beginning this session, read aloud to the class the following book. It reviews important principles associated with motion.

Move It!
Adrienne Mason

This book with its appealing and colorful illustrations explores the physics of how and why things move.

- Read pages 4-5. Emphasize that pushes and pulls (forces) make things move. Ask students for examples of pushes and pulls that occur in their everyday lives.
- Read pages 6-7 and let students study the pictures. Then ask if they can find five ways the children are using a force to move their bodies or other things.
- Read pages 8-9. Do students think it will take more force to move heavy things? Ask them to give examples.
- Read pages 10-11. Ask students to find five ways the children in the picture are using pushes or pulls to make things move.
- Show students the pictures on pages 12-13. Do you think the boy or the girl is using more force to throw a ball? Which child makes the ball go the longer distance?

Proceed with the rest of the session.

Session 2: *What can stop an object in motion or make an object go faster?*

At the beginning of the lesson, read aloud pages 16-19 of ***Move It!***.

- Show students the pictures on pages 16-17. What is happening? Why doesn't the soccer ball travel in a straight line?
- Show students pages 18-19. How are the children stopping a moving object in this picture? Is it by pulling or pushing?

Proceed with the rest of the session.

Additional Texts: These titles may be used as supplementary texts for students at different reading levels. You can use ***Motion: Push and Pull, Fast and Slow*** for students that are ready for a somewhat faster pace through the concept of motion. You can challenge very advanced readers with the book ***Force and Motion***, which uses scientific language and outlines Newton's Laws of Motion in more depth than either of the other books on this topic.

Motion: Push and Pull, Fast and Slow
Darlene Stille

Explore the concepts of motion by learning about movement, speed, force, and inertia.

Force and Motion
Lisa A. Boehm / Newbridge Educational

You might have guessed that pushing and pulling keeps the whole world in motion. But some forces are at work on you even as you sit still. This book explores the physics that not only keep us on the ground but also catapult us into space.

Lesson 1.5 Contact and Non-Contact Forces

PURPOSE

The purpose of this lesson is for students to understand the difference between applying a force that requires surface contact and applying a force that does NOT require surface contact. Students engage in activities to make objects move with contact and non-contact forces.

OBJECTIVES

By the end of the lesson, students will be able to:

- Demonstrate that a magnetic force is a non-contact force
- Describe gravity as an invisible, non-contact force that pulls objects closer to the earth
- Classify various forces as contact or non-contact

EMBEDDING LITERACY

Session 2: *Which forces are non-contact forces?*

After students have completed *Activity Sheet 1: Non-contact Forces*, you might want to preview the properties of magnets by reading the following book. Magnets will be addressed in greater depth in the next lesson.

Attract and Repel: A Look at Magnets
Jennifer Boothroyd

We are all used to magnets holding drawings, photos, and so on to refrigerators. Magnetic forces surround us. But what is a magnet? How do magnets work? This book tells us.

Lesson 1.6 Magnets Make Things Move

PURPOSE

The previous lesson briefly introduced students to the concept of magnetic force—a non-contact, invisible force. In this lesson, students will learn more about the properties of magnets and how magnets make things move. A series of activities allows them to explore how various materials respond to magnetic force and to investigate the polarity of magnets. Finally, students construct a toy train propelled by magnetic force.

OBJECTIVES

By the end of the lesson, students will be able to:

- Explain what kinds of materials magnets attract
- Demonstrate that like poles of two magnets repel each other
- Demonstrate that opposite poles of two magnets attract each other
- Demonstrate and explain that magnetic force can pass through some non-magnetic materials
- Construct a toy train that incorporates magnetic levitation

Session 1: *What objects are attracted to magnets? How do magnets make things move?*

Before beginning the lesson, read (or re-read) ***Attract and Repel: A Look at Magnets*** to review the properties of magnets.

Attract and Repel: A Look at Magnets
Jennifer Boothroyd

We are all used to magnets holding drawings, photos, and so on to refrigerators. Magnetic forces surround us. But what is a magnet? How do magnets work? This book tells us.

If you have multiple copies of this book, you can have students read it for themselves in small groups. If you have only one copy, you will need to read it aloud to the class.

Either way, students should find/listen for the answers to the following questions:

- What kinds of materials do magnets attract?
- What happens when you try to put two like poles of magnets together?
- What happens when you try to put two unlike poles of magnets together?
- Can magnetic force pass through non-magnetic materials?

Have students share their answers briefly with the class.

Proceed with the rest of the session.

Additional Text: This title may be used as a supplementary text for individuals or small groups of students who would benefit from a slower pace or simply need reinforcement for the principles of magnetism.

Magnet Power
Buffy Silverman

Introduces magnetism by explaining the concepts of force fields, attraction, and repulsion.

LIFE SCIENCE

UNIT 1: LIFE CYCLES AND TRAITS

Plants and animals have predictable characteristics at different stages of development. These stages include birth (animals) or germination (plants); growth and development; development into an adult or mature stage; reproduction; and death. Reproduction is essential to the continued existence of any kind of animal or plant. Without successful reproduction, a plant or animal will become extinct.

All animals have life cycles that follow a predictable pattern which includes: birth, growth, reproduction, and death. Each life cycle stage has its own predictable characteristics of development. Animals are generally born in one of two ways: live birth and eggs. Some animals are born resembling their parents and some animals go through life cycle stages which include metamorphosis.

Many characteristics of organisms are inherited from their parents. These characteristics, or traits, include physical structures and behaviors. Other traits are learned or acquired and are the result of the organism's interactions with its habitat.

Within organisms of the same species there are variations or slight differences. This is possible even with offspring of the same parents. Sometimes these variations give an organism an advantage in meeting its basic needs for survival and adapting to changes in its habitat. Scientists study fossils to learn about animals from the past that did not survive.

Being part of a group helps animals meet their basic needs for survival: food and water, shelter, protection from predators, and changes in their habitat. Animals form groups for many different reasons. These groups vary greatly in terms of size and structure. Some groups are stable and exist long term, while others are fluid, with members constantly moving in and out. Some groups have specific roles for their members while members of other groups share equally in tasks necessary for the group's survival. Communication between group members is essential for survival. Group members communicate in a variety of ways, primarily using their senses.

In this unit, teachers can use literature to help students understand these concepts.

RECOMMENDED LITERATURE

The titles listed below fit the criteria for inclusion in this unit. The list is followed by suggested techniques for incorporating the books into the unit's science lessons. You may wish to select additional books that help students understand the concepts.

LESSON NUMBER	TITLE	AUTHOR	LEXILE LEVEL
1.1 Introducing… Life Cycles!	***What is a Life Cycle?***	Bobbie Kalman	880L
1.2 Plant Life Cycles	***Seed, Sprout, Fruit: An Apple Tree Life Cycle***	Shannon Knudsen	490L
1.3 Frog Life Cycles	***Life Story of a Frog***	Charlotte Guillain	720L (GRL L)
	The Life Cycle of a Frog	Bobbie Kalman/ Kathryn Smithyman	910L (GRL N)
1.4 Nature or Nurture – Traits in Animals and Plants	***I Look Like My Mother***	Julie Lundgren	950L
1.5 Animal Communities	***Amazing Animal Communicators***	Leon Gray	800L
	Animals That Live in Groups	Kelsi Turner Tjernagel	640 L (GRL M)
	Animals That Live in Social Groups	Bobbie Kalman	860L (GRL N)
	How Animals Communicate	Stephen Currie / Newbridge Educational	880L (GRL T)
1.6 Fossils Tell Stories of Prehistoric Life on Earth	***Prehistoric Actual Size***	Steve Jenkins	890L
	Fossils Tell of Long Ago	Aliki	540L
	Plant Fossils	Natalie Hyde	990L
	Animal Fossils	Natalie Hyde	990L

Lesson 1.1 Introducing…Life Cycles!

PURPOSE

The purpose of this introductory lesson is for students to identify and sequence general life cycle stages common to plants and animals.

OBJECTIVES

By the end of this lesson, students will be able to:

- Identify and sequence life cycles stages common to flowering plants and trees
- Identify and sequence general animal life cycle stages
- Differentiate among direct development and complete and incomplete metamorphosis
- Comprehend and respond to nonfiction reading texts

EMBEDDING LITERACY

Note: Informational texts have been written specifically for this lesson. Students build comprehension and note taking skills. Because of the reading focus, any reading part of this lesson could be taught during a reading or ELA block. The text for each session is referenced in the *Knowing Science* Teacher's Manual. Books included in this lesson are intended for use as supplementary texts.

Session 1: *What is a life cycle?*

In first grade, students were introduced to the concept of plant and animal life cycles. They learned that offspring may or may not look like their parents. They explored the life cycles of a chicken, butterfly, frog, and human. This lesson builds on foundational knowledge from earlier experiences.

You may use selected pages from ***What is a Life Cycle?*** to introduce the session, or read it as a follow-up at another time. For this session, read "The human life cycle" (pages 26-27) and "What is a life cycle?" (pages 4-5).

What is a Life Cycle?
Bobbie Kalman

This book explains the basic concept of the life cycle and features examples which explain both plant and animal life including: insects, amphibians, reptiles, birds, mammals, and underwater life; the process from seed or egg through birth, growth, reproduction, and death; and, the dangers to existing life cycles from man and other predators.

Session 2: *How are plant life cycles similar?*

In this session, students compare life cycles and life spans of plants. It may also be done as and ELA lesson.

You may use selected pages from ***What is a Life Cycle?*** to introduce the session, or read as a follow-up at another time. For this session, read "Plants and their seeds" (pages 6-7).

Session 3: *How are animal life cycles similar?*

In this session, students compare life cycles and life spans of selected animals and learn the differences between direct development, incomplete, and complete metamorphosis. This may also be done as and ELA lesson.

You may use selected pages from ***What is a Life Cycle?*** to introduce the session, or read as a follow-up at another time. For this session, read the following sections:

(pages 8-23)

"Many kinds of eggs"

"Metamorphosis"

"The life cycle of arthropods"

"An amphibian's life cycle"

"Life as a reptile"

"Living underwater"

"The life cycle of birds"

"Life as a mammal"

(pages 30-31)

"Dangers to life cycles"

Lesson 1.2 Plant Life Cycles

PURPOSE

The purpose of this lesson is for students to explore and compare the life cycles of common plants and the various means by which plants reproduce.

OBJECTIVES

By the end of this lesson, students will be able to:

- Conduct investigations to compare life cycles of familiar plants
- Make and record accurate observations regarding growth of familiar plants
- Comprehend and respond to nonfiction reading texts

EMBEDDING LITERACY

Note: The book included in this lesson is intended for use as supplementary text.

Seed, Sprout, Fruit: An Apple Tree Life Cycle
Shannon Knudsen

The life cycle of an apple is shown in a graphic format. Cartoon-style drawings support informational text presented in text boxes.

If the graphic format is new to students, take a picture walk through the first few pages prior to reading. Point out that this text uses drawings, not photographs, to convey information. The text supports and describes the drawings.

Lesson 1.3 Frog Life Cycles

PURPOSE

The purpose of this lesson is for students to understand the frog life cycle and the unique characteristics of each stage.

OBJECTIVES

By the end of the lesson, students will be able to:

- Identify, describe, and sequence life cycles stages common to most frogs
- Conduct investigations which relate to frog life cycle stages
- Make and record accurate observations regarding growth of tadpoles and froglets
- Recognize and understand that conducting science investigations involving animals requires safe and ethical practices
- Comprehend and respond to nonfiction reading texts

EMBEDDING LITERACY

Note: Informational texts have been written specifically for this lesson. Students build comprehension and note taking skills. Because of the reading focus, any reading part of this lesson could be taught during a reading or ELA block. The text for each session is referenced in the *Knowing Science* Teacher's Manual. Books included in this lesson are intended for use as supplementary texts.

Leveled Texts: The following titles are at different reading levels and may be used for guided reading groups.

Life Story of a Frog
Charlotte Guillain

This book tells the life story of a frog, using simple, concise text and stunning photographs. Read it to discover the unique life cycle and metamorphosis undergone by this fascinating amphibian as it changes from an egg to a tadpole to a fully grown adult frog.

Life Cycle of a Frog
Bobbie Kalman/Kathryn Smithyman

Frogs begin their lives as tiny tadpoles living in water. As adults, they live both on land and in the water. The Life Cycle of a Frog details the changes in a frog at the four stages: egg, tadpole, froglet, and adult. Illustrations, photographs, and easy-to-read text explain:

- facts about how the frog breathes and eats at each stage
- differences in the metamorphosis of frogs in southern and northern climates
- dangers to frogs from pollution, pesticides, and destruction of habitat

Lesson 1.4 Nature or Nurture – Traits in Plants and Animals

PURPOSE

The purpose of this lesson is for students to understand various types of traits and how variation in traits may affect an organism's chances for survival.

OBJECTIVES

By the end of the lesson, students will be able to:

- Differentiate among inherited, learned, and acquired traits.
- Understand that physical and behavioral traits are passed from parent to offspring
- Conduct a structured inquiry survey about inherited human traits
- Explore how nature has influenced human learning and technology
- Explain the role of trait variation in the survival of plants and animals
- Comprehend and respond to nonfiction reading texts

EMBEDDING LITERACY

Note: Informational texts have been written specifically for this lesson. Students build comprehension and note taking skills. Because of the reading focus, any reading part of this lesson could be taught during a reading or ELA block. The text for each session is referenced in the *Knowing Science* Teacher's Manual. Books included in this lesson are intended for use as supplementary texts.

Session 2: *How can we learn about our own inherited traits?*

You may use selected pages from ***I Look Like My Mother*** to introduce the session, or read it as a follow-up at another time. For this session, read "Your Inheritance" (pages 4-7), "Inherited or Learned?" (pages 12-15), and show the picture of the earlobes on page 20.

I Look Like My Mother

Julie Lundgren

This book introduces the idea of genetics. It teaches the differences between inherited and learned traits in humans, plants, and other animals and also discusses how trait variation may be an advantage for some living things.

Session 5: *How does trait variation help animals survive?*

You may use selected pages from ***I Look Like My Mother*** to introduce the session, or read it as a follow-up at another time. For this session, read "Successful Living Things" (pages 18-21).

Lesson 1.5 Animal Communities

PURPOSE

The purpose of this lesson is for students to understand the various types of animal groups and how each type of group increases its members' chances for survival.

OBJECTIVES

By the end of the lesson, students will be able to:

- Differentiate between types of animal groups and the purposes of each
- Associate specific animals with each type of group
- Explain how different senses are used for communication between group members
- Comprehend and respond to nonfiction reading texts

EMBEDDING LITERACY

Note: Informational texts have been written specifically for this lesson. Students build comprehension and note taking skills. Because of the reading focus, any reading part of this lesson could be taught during a reading or ELA block. The text for each session is referenced in the *Knowing Science* Teacher's Manual. Books included in this lesson are intended for use as supplementary texts.

Session 2: *How do animals communicate with smell?*

In this session, students are introduced to the idea of animal communication and participate in an activity that simulates animal communication with smell.

You may use selected pages from ***Amazing Animal Communicators*** to introduce the session, or read it as a follow-up at another time. For this session, read "Introduction" (pages 4-5) and "Chemicals" (pages 25-29).

Amazing Animal Communicators
Leon Gray

Sound, sight, and chemicals are all important as animals attempt to communicate warnings, information about food, to attract a mate, or sometimes just for pleasure. Whales communicate across hundreds of miles of ocean with ultrasound 'songs.' Fireflies uses flashes of light to attract a mate. Skunks squirt foul-smelling chemicals to ward off attackers. Learn about how animals communicate.

Session 3: *How do animals communicate with sound?*

In this session, students are introduced to the idea of animal communication and participate in an activity that simulates animal communication with sound.

You may use selected pages from ***Amazing Animal Communicators*** to introduce the session, or read it as a follow-up at another time. For this session, read "Sound" (pages 6-13). In first grade, students learned about life in a dolphin pod and in an elephant herd. These two animals are featured in this section of the text.

Session 4: *How do animals communicate by sight?*

In this session, students are introduced to the idea of animal communication and participate in an activity that simulates animal communication with visual messages.

You may use selected pages from ***Amazing Animal Communicators*** to introduce the session, or read it as a follow-up at another time. For this session, read "Signals" (pages 14-21).

Additional Texts: These titles may be used as supplementary texts.

Animals That Live in Groups
Kelsi Turner Tjernagel

This book was featured as a read-aloud in the first-grade study of animal families. Why do millions of flamingoes flock together in Africa? Why do meerkats live in colonies? Animal groups have some fascinating behaviors. Discover the amazing bonds that keep animal groups together and the benefits of living in a group.

Animals That Live in Social Groups
Bobbie Kalman

Some animals live and work together as a group to ensure their survival.This book shows how social animals communicate and interact with members of their own species. Elephants, dolphins and orcas, monkeys, apes, lions, and wolves, educate their young, work together to find food, and take care of their group members. Smaller animals that work together in micro-societies include termites, ants, bees, and wasps.

How Animals Communicate
Stephen Currie

Animals have a lot to say! A beaver slaps its tail against the water to warn other beavers of danger. A bee does a dance to tell the rest of the hive that it has found food. Howler monkeys howl to claim their territory. Explore the many different ways animals send their messages, and how communication helps animals survive. Colorfully illustrated with photographs and illustrations. Includes a glossary.

Lesson 1.6 Fossils Tell of Prehistoric Life on Earth

PURPOSE

The purpose of this lesson is to introduce students to evidence that organisms lived long ago before human beings lived on the Earth. They will learn what fossils are, how fossils develop, and what fossils tell us about prehistoric organisms and their environment.

OBJECTIVES

By the end of the lesson, students will be able to:

- Explain what a fossil is
- Describe how fossils are formed
- Develop an argument from evidence that Earth's environments/organisms have changed over millions of years

EMBEDDING LITERACY

Note: Informational texts have been included in this lesson. Students build comprehension and note taking skills. Because of the reading focus, any reading part of this lesson could be taught during a reading or ELA block.

Session 1: What is a fossil?

The book ***Prehistoric Actual Size*** provides a visual introduction to the lesson.

Prehistoric Actual Size
Steve Jenkins

What is it like to come face-to-face with the ten-foot-tall terror bird? Or stare into the mouth of the largest meat eater ever to walk the earth? Can you imagine a millipede that is more than six feet long, or a dinosaur smaller than a chicken? In this "actual size" look at the prehistoric world, which includes two dramatic gatefolds, you'll meet these awe-inspiring creatures, as well as many others.

To begin the lesson, follow these steps:

1. Gather the students around you and browse through the book ***Prehistoric Actual Size*** with them. Be sure to show students the pictures and read the short descriptions of each, including how long ago each organism lived. Make sure that students understand that the drawings depict the actual size that each organism is thought to have been. (They may even want to measure a drawing with a ruler.)
2. At the end of the book, say, **"All of the animals in this book are *extinct*. That means that they don't exist anymore. So how do we know they used to live here?"** Give students time to offer their thoughts, and then ask, **"How do we know how big they were? Do you think people were alive**

and took pictures of them that long ago? No… so what clues do we have about these *prehistoric* animals?" (*Prehistoric* means before recorded history.) If no one mentions ***fossils***, guide them to understand that fossils from each of these ***organisms*** (forms of life) have been found on Earth and scientists have learned about these animals by studying those fossils.

Continue with the rest of the session.

Session 2: How are fossils formed?

Use ***Fossils Tell of Long Ago*** with this content reading lesson.

Fossils Tell of Long Ago
Aliki

What is a fossil? Sometimes it's the imprint of an ancient leaf in a rock. Sometimes it's a woolly mammoth, frozen for thousands of years in the icy ground. Sometimes it's the skeleton of a stegosaurus that has turned to stone. A fossil is anything that has been preserved, one way or another, that tells about life on Earth. But you can make a fossil, too--something to be discovered a million years from now--and this book will tell you how.

Begin the session by going over the homework (*Activity Sheet 1: Fun with Fossils*) and having students share their dried "fossil" creations from the previous session. Then read, or have small groups read, ***Fossils Tell of Long Ago***. Small groups of students should then complete *Activity Sheet 2: What are Fossils?* using the information from the book and from the text provided on the activity sheet.

Continue with the rest of the session.

Session 3: What can fossils tell us about Earth's history?

This session is a continuation of the previous session, also using ***Fossils Tell of Long Ago*** as informational text.

Have students review the information from the previous session and add details to a chart of major questions (subtopics) answered in the text (see the *Knowing Science* Teacher's Manual).

Then, students should work in the same small groups as before in order to answer questions on *Activity Sheet 3: Fossils Tell a Story*.

Continue with the rest of the session.

Additional Texts: ***Plant Fossils*** and ***Animal Fossils*** are supplementary texts that may be read at any time.

Plant Fossils
Natalie Hyde

Students are encouraged to "dig in" and discover how different plant fossils unlock clues to the Earth's past. Through full-color photographs and thought-provoking questions, students will investigate how plants fossils form, how they are excavated, and how paleobotanists study them to learn about life millions of years ago.

Animal Fossils
Natalie Hyde

This book brings to life animals that lived long ago. With clear text and engaging questions, a full range of fossils from microscopic insects to gigantic prehistoric mammals is examined. Students are encouraged to discuss the idea of "living fossils" and examine how fossilized animals have adapted into life forms still present today.

The following selections are suggested readings from ***Plant Fossils*** and ***Animal Fossils***. Each selection is two pages, and includes detailed photographs as well as labels, captions, and inset boxes.

Plant Fossils	
Introduction; Planet of Plants	pages 4-5
First Fossils	pages 6-7
A Sticky Solution	pages 10-11
Fossils in Coal	pages 12-13
Sowing Seeds (trait variation over time)	pages 14-15
A Tough Exterior	pages 16-17
Megaflora (trait variation over time)	pages 22-23

Animal Fossils	
Reliving the Past	pages 4-5
Made in Many Ways	pages 6-7
I'm stuck	pages 8-9
A Sticky Situation	pages 10-11
Nature's Freezer	pages 12-13
Just a Trace (poop)	pages 14-15
Under the Sea (trait variation over time)	pages 18-19
Giant Mammals (trait variation over time)	pages 22-23
Past and Present (trait variation over time)	pages 26-27

EARTH AND SPACE SCIENCE

UNIT 1: WEATHER AND CLIMATE

Weather is a constant in everyone's life. Weather affects everything from what we decide to wear in the morning when we get up to what safety measures we should take when severe storms are brewing. Weather is the state of the atmosphere at a particular time and place—the temperature, wind, air pressure, humidity, and precipitation. Meteorologists analyze these factors and make weather forecasts.

Climate is not the same thing as weather. Whereas weather describes atmospheric conditions over a short period of time, climate takes into account typical weather of a particular place over a period of years. Several biomes may exist within a climate zone. Biomes are regions with similar weather conditions, as well as plant and animal life.

Students begin this unit with a detailed study of weather and the instruments to measure it; the water cycle; and the role of clouds in weather. They then move to the concept of biomes and an examination of Earth's three main climate zones. Finally, the unit concludes with a study of the causes and characteristics of extreme weather, as well as an engineering unit on the construction of a hurricane-safe house.

Children's literature plays a role in engaging students in the study of weather. Various titles introduce, summarize, supplement, or reinforce weather concepts. Books that work well for this unit include those that focus on the various components of weather, instruments that measure those components, and the various kinds of extreme weather. Also important are titles that offer information on Earth's climate and biomes. The titles listed below fit the criteria for inclusion in this unit.

RECOMMENDED LITERATURE

Recommended titles are listed below, along with their authors and Lexile ratings. The list is followed by suggested strategies for incorporating the books into the unit's science lessons. You may wish to select additional books that help students understand the concepts.

LESSON NUMBER	TITLE	AUTHOR	LEXILE LEVEL
1.1 What is Weather?	***Studying Weather and Climate***	Conrad J. Storad	930L
	What are Cumulus Clouds?	Lynn Peppas	760L
1.2 Climate and Biomes	***What are Earth's Biomes?***	Bobbie Kalman	750L
1.3 Extreme Weather	***What is a Hurricane?***	Robin Johnson	640L
	Hurricane Katrina	Gail Tuchman	600L
	Wild Weather	Melvin Berger	850L (GRL O)
	Extreme Weather	Emma Rose	575L (GRL N)
1.4 Hurricane House	***Engineers Solve Problems***	Reagan Miller & Crystal Sikkens	800L

Lesson 1.1 What is Weather?

PURPOSE

Weather is the condition of the atmosphere in one particular area for one particular period of time. Different parts of any country, state, and even town may experience different types of weather at the same time. Weather affects our day-to-day activities, and weather conditions can change from minute to minute. Scientists record weather patterns in an area over time so they can make predictions about what kind of weather might happen next. This lesson provides opportunities for observation and collection of weather data, as well as deeper foundational knowledge about the components of weather and how they interact.

OBJECTIVES

By the end of the lesson, students will be able to:

- Identify and describe components of weather (temperature, precipitation, air pressure, wind, and humidity)
- Make observations and collect data on local weather over a period of time
- Build working models of weather instruments
- Describe the relationship between the water cycle and weather
- Match cloud formations with weather conditions
- Describe the interdependent components of weather in forecasting
- Comprehend and respond to nonfiction reading texts

EMBEDDING LITERACY

Session 2: *How is weather measured?*

Studying Weather and Climate
Conrad J. Storad

What is the difference between weather and climate? What tools do meteorologists use to collect weather information? What kinds of extreme weather events happen? This book answers all these questions and more.

- After recording the daily sky conditions and temperature, quickly review with the class the "ingredients" of weather. Tell students that today they will look at tools that meteorologists use to measure weather.
- Read ***Studying Weather and Climate*** to the class. Focus on pages 10-11, which show four of the tools that measure weather. What are they and what is each one used for?
- Tell students that today, they will work with one of the tools: a thermometer.

Proceed with the remainder of the lesson.

Session 4: *How does the water cycle affect weather?*

What are Cumulus Clouds?
Lynn Peppas

What are clouds? How do they form? What is the water cycle? What kinds of clouds are there and how are they different from each other? Through text and photographs, this book explains the answers.

- After recording the daily sky condition and temperature, read ***What are Cumulus Clouds?*** to the class. When you reach pages 6-7, have students look closely at the diagram of the water cycle. Ask them to imagine that they are water in a puddle and the sun is heating the puddle up. What happens to them next in the water cycle?
- When you are sure that students are accurately tracing the water cycle, distribute *Activity Sheet 5: Water Cycle*. As students complete it, they will learn more details about the water cycle.

Proceed with the remainder of the session.

Session 5: *What role do clouds play in the weather?*

- After recording the daily sky conditions and temperature, post the following questions and have students copy them into their science notebooks:
    - What are clouds made up of?
    - What are the three main types of clouds, and what do their names mean?
    - What are cumulus clouds, and what kind of weather are they associated with?
    - What are cumulonimbus clouds, and what kind of weather might they bring?
    - What are altocumulus clouds, and what weather might they bring?
    - What are cirrocumulus clouds, and what kind of weather do they bring?
    - What are stratocumulus clouds, and what kind of weather do they bring?
- Referring back to ***What are Cumulus Clouds?*** and ***Studying Weather and Climate***, go through the answers to each of the questions. Make a class chart that lists the type of clouds and the kind of weather they may bring with them.
- After all the questions have been discussed, ask students to summarize what they have learned about clouds since the beginning of the session.

Proceed with the remainder of the session.

Lesson 1.2 Climate and Biomes

PURPOSE

Weather is the condition of the atmosphere in one particular area for one particular period of time. Climate describes an area's typical weather conditions and the extent to which those conditions vary over time. Earth has three main climate zones. The conditions within each climate zone are directly related to their location (latitude) and the angle and amount of solar energy they receive. Each climate zone may be further divided into biomes, which are regions with similar climate conditions, plants, and animal life. This lesson provides foundational knowledge about climate and biomes.

OBJECTIVES

By the end of the lesson, students will be able to:

- Identify and describe general characteristics of polar, tropical, and temperate climate zones
- Explain the connection between Earth's orbit and seasons in temperate zones
- Understand the concept of biome and make comparisons between biomes in each climate zone
- Comprehend and respond to nonfiction reading texts

EMBEDDING LITERACY

Session 2: *Where are Earth's biomes?*

What are Earth's Biomes?
Bobbie Kalman

The text and photographs in this book work together to give readers a clear understanding of what a biome is, as well as the six major kinds of biomes on our planet: forest, desert, grassland, tundra, marine, and fresh water.

- Before distributing *Activity Sheet 2: Earth's Biomes*, read ***What are Earth's Biomes?*** to the class. Tell students to pay close attention as you read pages 4-9 and take notes about the definitions given for the following words: *biome, climate, habitat,* and *ecosystem*. Before continuing to read, have student volunteers share what they discovered with the class.
- Review the information on pages 8-9 about types of biomes on Earth, and tell students that over the next few sessions they will be conducting further research about specific biomes.

Proceed with the remainder of the session.

BUILDING LANGUAGE FOR LITERACY

Have students work with their groups to write a formal definition for each of the key vocabulary terms: *biome, climate, habitat,* and *ecosystem*.

Lesson 1.3: Extreme Weather

PURPOSE

Weather is a combination of several components, each providing its own set of variables for weather conditions. Extreme weather events significantly impact the areas in which they occur. This lesson provides foundational knowledge about tornadoes, hurricanes, and winter storms in preparation for the engineering design task that is the focus of the following lesson.

OBJECTIVES

By the end of the lesson, students will be able to:

- Identify and describe general characteristics of tornadoes, hurricanes, and winter storms
- Understand the damage that each type of extreme weather event may cause
- Comprehend and respond to nonfiction reading texts

EMBEDDING LITERACY

Session 2: *What are hurricanes?*

What is a Hurricane?
Robin Johnson

Hurricanes fall into the severe weather category, largely because they can cause loss of life and extensive damage to land and structures. How and where do they form? What happens if they make landfall?

- At the beginning of the session, read ***What is a Hurricane?*** to the class. Tell students to take notes on the following topics as you read:
    - What is a hurricane and why is it called an example of severe weather?
    - Where and how do hurricanes form?
    - What can happen when a hurricane makes landfall?
    - How do meteorologists help keep us safe when they detect a possible hurricane?
    - What are the five categories of hurricanes?
- After students have finished note taking on the above topics, discuss what they have discovered about hurricanes.

Hurricane Katrina
Gail Tuchman

What can happen when a hurricane makes landfall? Find out by reading about Hurricane Katrina, a hurricane that made landfall in New Orleans in 2005.

- After learning about hurricanes in general, give students a chance to learn about a real-life hurricane in New Orleans in 2005. Read ***Hurricane Katrina*** to the class, and afterward ask students to share what surprised them about the event or what new information they learned about hurricanes.

Wild Weather
Melvin Berger

Here is a close-up look at tornadoes, hurricanes, thunder, lightning, blizzards, ice storms, dust storms, dust devils, and more.

This text is at a third grade independent or partner reading level. It briefly (two-page spread) describes several types of severe weather, including: tornadoes, water spouts, thunderstorms, blizzards, ice storms, hurricanes, droughts, hail, fog, monsoons, and weather resulting from a volcanic eruption. The book may be used at the end of the lesson to summarize or to extend information on even more types of severe weather. It also provides examples of effective use of text features, including: table of contents, index, photographs, text, and fact inset boxes.

Extreme Weather
Emma Rose

In Extreme Weather, you'll learn all about hurricanes, tornadoes, and blizzards. You'll find out how these weather systems form and what to expect and how to stay safe if you're caught in the middle of one.

This text is also at a third grade independent or partner reading level. It summarizes three types of severe weather featured in this lesson; hurricanes, tornadoes, and blizzards. This text is a well written, well organized example of informational text which uses text features effectively. These include: table of contents, chapter titles/headings, photographs, map, and index.

BUILDING LANGUAGE FOR LITERACY

One of the things students should have learned in their reading about hurricanes is that meteorologists give each one a name. The names should be short and in alphabetical order. Divide the students into groups of five and ask each group to come up with their own list of names, from letters A through T, for hurricanes. Then have each group share their list.

Lesson 1.4 Hurricane House

PURPOSE

Students have foundational knowledge about the causes and characteristics of extreme weather, including tornadoes, hurricanes, thunderstorms, and winter storms. In this lesson, students will "build" upon that knowledge as they design and construct a model house capable of withstanding simulated "hurricane-force" winds.

OBJECTIVES

By the end of the lesson, students will be able to:

- Understand the basic engineering design process (define a problem, brainstorm possible solutions, build, test, evaluate, revise, retest, communicate).
- Identify hazards to property associated with extreme weather
- Learn the basics of house construction
- Match stormproof technology to appropriate focus areas of the house
- Design, build, and test a model house capable of withstanding extreme weather
- Work cooperatively in a small group to accomplish the task
- Comprehend and respond to nonfiction reading texts

EMBEDDING LITERACY

Session 1: *What damage can extreme weather do to our homes?*

This lesson requires students to think and act like engineers. Before beginning the sessions associated with the lesson, have students read the following book.

Engineers Solve Problems
Reagan Miller & Crystal Sikkens

What do engineers do? What process do engineers use to create solutions to a problem? This book takes readers through the design process and emphasizes that kids can be engineers, too!

- Read ***Engineers Solve Problems*** to the class. Ask students to take notes on the following as you read:
  - Who are engineers?
  - What do they design?
  - What are the five steps of the design process?
- After students have finished writing down answers to the questions above, bring the class together and present their task: designing a hurricane-proof house.

Proceed with the remainder of the sessions.