Prehistoric Florida, Fossils and Phosphate

An intermediate grade level unit
created by

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Bartow Elementary Academy
Polk County, FL
2005
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Unit Summary

Dear Teachers,

Fourth grade, even with all its testing, is a grade level with a rich curriculum just waiting to be explored! And what better way to explore it but through learning all about Florida, including its history, people, weather, agriculture, and industries. Our year-long theme “What Does Florida Have to Do with Me?” is taught through an integrated, hands-on, technology-enriched curriculum since we believe students learn best using a brain-compatible, integrated, thematic approach. We have used this approach in our unit Prehistoric Florida, Fossils, and Phosphate, which explores the connection between these seemingly unrelated topics.

Prehistoric Florida, Fossils, and Phosphate is a fully integrated unit lasting about six weeks. A pre-test is included in the materials and should be administered prior to any instruction. Most students, and adults, are under the misconception that dinosaurs once roamed Florida. Our integrated unit explores what prehistoric Florida was like (and dispels the dinosaur myth), what fossils have to do with it, and especially how the phosphate industry is involved. The geological timescale, as well as rocks and minerals, are explored through these topics. Our students are curious to know the process of how phosphate is mined and the steps it takes to get the rock from the ground. On a field trip to the mines to see this process, the students find fossils, which they bring back to school to weigh and measure. We read If You Are a Hunter of Fossils to help explore what a fossil hunter does. Naturally, the children are curious about the animals these fossils have come from so the students research and create posters of prehistoric animals. They are also very curious about how phosphate got underground in the first place (where rocks and minerals come in) and what it is used for once it is mined. The skill of sequencing helps teach this. We also explore the role phosphate fertilizer plays in plant growth with a field trip to area farms.

This unit contains many hands-on lessons that connect Florida history to the present. Overall, your students will learn that prehistoric Florida, fossils, and phosphate are connected, as prehistoric Florida animals and plants become the fossils we find in the phosphate pits that help form the phosphate rock we mine for today. Pre- and post-test scores provide documentation that this unit teaches what is intended: the pre-test average was 74.7%, while the post-test average was 85.4%. We cement in our students’ minds that, yes, there is a definite connection between these three seemingly unconnected areas of learning, thus fulfilling our intended outcome.

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Perspective

A blanket of phosphate deposits covers much of peninsular Florida. These deposits were formed about 20 million years ago during the Miocene Epoch and offer a fascinating geologic, social, environmental and economic story that is a key part of Florida’s history.

Why is phosphate important enough to impact Florida history? It is essential to every cell, every living thing. It is necessary for many of the biochemical molecules and processes that define life itself. It cannot be produced in a laboratory. It must be mined and processed into the soluble form plants and animals need. People then get their phosphate from plants and animals.

While phosphate is mainly used in agricultural products such as fertilizer and animal feed, it is also found in thousands of other common household products such as soft drinks and toothpaste.

This unit should benefit any teacher exploring Florida’s natural history and geology since phosphate in Florida takes us back to the geological formation. Florida fossils found while mining tell the story of Florida’s diverse habitats and wildlife, which captures the imagination of children of all ages. While there were no dinosaurs in Florida, shark and camel teeth, alligator scutes and whale vertebrae are some of the fossils that bring Florida’s natural history to life.

Florida’s phosphate story also includes social history connected to its discovery in the late 1800s and the evolution of the industry, which is the third largest in Florida. It supplies the majority of America’s phosphate needs and a large portion of the world’s. For current statistics, please check our webpage at www.fipr.poly.usf.edu.

It is a story that also illustrates how Florida’s environment continues to change over time. Exploring what happens to the land after mining through reclamation history, laws, and practices can enhance student appreciation of Florida’s environment and government.

Prehistoric Florida, Fossils and Phosphate seamlessly weaves the phosphate information into the 4th grade math, science, language arts, social studies and fine arts curriculum. Its activities meet the different range of learning styles of each student in the classroom.

Jennifer Insua and Sandra Bush took the information about phosphate that they learned from FIPR and used it to enhance the 4th grade Florida history curriculum they were already teaching. FCAT practice is included in classroom activities that relate to students’ interests and experiences. In central and northern Florida where phosphate is mined, the industry personally impacts students’ and teachers’ lives and field trips to the mines are possible. Involving their science teacher, Linda Hughes, made the unit comprehensive and interdisciplinary. In addition, the unit also takes advantage of the available technology to facilitate the learning process. Teachers at other grade levels were motivated to create units that would highlight other phosphate connections.

This unit will challenge any teacher to take his/her students’ interaction with content to a higher level of understanding and excitement as students gain knowledge and skills that the state of Florida expects them to master.

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Concept Map

Directions: Develop the web below with the students as you progress through this unit. Show it on an overhead or draw it on chart paper. Students will want to refer to it as you build on their knowledge base. It is another great way to show students how much they have learned!
Next Generation Sunshine State Standards

Art Benchmarks
VA.A.1.2.1 The student uses and organizes two-dimensional and three-dimensional media, techniques, tools and processes to produce works of art that are derived from personal experience, observation, or imagination.

Language Arts Benchmarks
LA.4.1.6.7 The student will use familiar base words and affixes to determine meanings of unfamiliar complex words;

LA.4.1.7.3 The student will determine explicit ideas and information in grade-level text, including but not limited to main idea, relevant supporting details, implied message, inferences, chronological order of events, summarizing, and paraphrasing;

LA.4.1.7.5 The student will identify the text structure an author uses (e.g., comparison/contrast, cause/effect, sequence of events) and explain how it impacts meaning in text;

LA.4.1.7.8 The student will use strategies to repair comprehension of grade appropriate text when self monitoring indicates confusion, including but not limited to rereading, checking context clues, predicting, summarizing, questioning, and clarifying by checking other sources.

LA.4.2.2.2 The student will use information from the text to answer questions related to explicitly stated main ideas or relevant details

LA.4.2.2.3 The student will organize information to show and understanding of main ideas within a text through charting, mapping, or summarizing;

LA.4.4.2.1 The student will write in a variety of informational/expository forms (e.g., summaries, procedures, instructions, graphs/tables, experiments, rubrics, how-to manuals):

LA.4.4.2.2 The student will record information (e.g., notes, lists, charts, map labels, legends,) related to a topic, including visual aids, as appropriate;

LA.4.4.2.3 The student will write informational/expository essays that contain introductory, body and concluding paragraphs;
LA.4.5.2.1 The student will listen to information presented orally and show an understanding of key points;

LA.4.5.2.3 The student will listen attentively to speaker and take notes as needed to ensure accuracy of information;

Science Benchmarks

SC.4.E.6.1 Identify three categories of rocks: igneous (formed from molten rock); sedimentary (pieces of other rock and fossilized organisms); metamorphic (formed from heat and pressure).

SC.4.E.6.2 Identify the physical properties of common earth-forming minerals, including hardness, color, luster, cleavage, and streak color, and recognize the role of minerals in the formation of rocks.

SC.4.E.6.3 Recognize that humans need resources found on Earth and that these are either renewable or nonrenewable.

SC.4.E.6.4 Describe the basic differences between physical weathering (breaking down of rock by wind, water, ice, temperature change, and plants) and erosion (movement of rock by gravity, wind, water and ice).

SC.4.E.6.6 Identify resources available in Florida (water, phosphate, oil, limestone, silicone, wind, and solar energy).

SC.4.L.16.2 Explain that although characteristics of plants and animals are inherited, some characteristics can be affected by the environment.

SC.4.L.17.2 Explain that animals, including humans, cannot make their own food and that when animals eat plants or other animals, the energy stored in the food source is passed to them.

SC.4.L.17.3 Trace the flow of energy from the Sun as it is transferred along the food chain through the producers to the consumers.

SC.4.L.17.4 Recognizes ways plants and animals, including humans, can impact the environment.

SC.4.N.1.1 Raise questions about the natural world, use appropriate reference materials that support understanding to obtain information (identifying the source), conduct both
individual and team investigations through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.

SC.4.N.1.2 Compare the observations made by different groups using multiple tools and seek reasons to explain the differences across groups.

SC.4.N.1.3 Explain that science does not always follow a rigidly defined method (“the scientific method”) but that science does involve the use of observations and empirical evidence.

SC.4.N.1.6 Keep records that describe observations made, carefully distinguishing actual observations made from ideas and inferences about the observations.

SC.4.N.1.7 Recognize and explain that scientists base their explanations on evidence.

SC.4.N.3.1 Explain that models can be three dimensional, two dimensional, an explanation in your mind or on a computer model.

SC.4.P.9.1 Identify some familiar changes in materials that result in other materials with different characteristics, such as decaying animal or plant matter, burning, rusting, and cooking.

Social Studies Benchmarks
SS.4.A.2.1 Compare Native American tribes in Florida.

SS.4.A.6.1 Describe the economic development of Florida’s major industries.

SS.4.A.9.1 Utilize timelines to sequence key events in Florida.

SS.4.E.1.2 Explain Florida’s role in the national and international economy and conditions that attract businesses to the state.

SS.4.G.1.1 Identify physical features of Florida.

SS.4.G.1.4 Interpret political and physical maps using map elements (compass rose, cardinal directions, intermediate directions, symbols, legend, scale, longitude, latitude).
## Specific Objectives

**Unit:** Where Do I Come From?  
**Theme:** Prehistoric Florida, Fossils and Phosphate  

**Conceptual Key Point:** Fossils are the remains of plants and animals that lived millions of years ago. They enable us to learn about prehistoric life.


**Thinking Skills:** Measuring, Identification, Classifying, Describing, Diagramming, Composing.

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<tr>
<th>Significant Knowledge Key Point</th>
<th>Verbal/Linguistic</th>
<th>Logical Mathematical</th>
<th>Visual Spatial</th>
<th>Body/Kinesthetic</th>
<th>Musical/Rhythmic</th>
<th>Naturalist</th>
<th>Skill Key Point</th>
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<tbody>
<tr>
<td>Fossils tell us about the animals that once roamed Florida.</td>
<td>Read <em>Fossils Tell of Long Ago</em> and <em>Woolly Mammoth</em> by Aliki, <em>Fossils</em> by Kids Discover</td>
<td>Collect 4 different fossils. Weigh and measure them (length and circumference) then identify the animal the fossil came from. Use Florida’s Fossils by Brown.</td>
<td>Locate Bone Valley on a Florida map. Identify the present-day counties it is located in.</td>
<td>Collect/dig for fossils from field trip to phosphate mines.</td>
<td>Sing Saber Tooth Tiger song from Wee Sing Dinosaurs tape.</td>
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<td>From written description, name the prehistoric animals that roamed Florida.</td>
<td>Using fossils and picture identification charts, identify animals that fossils might have come from.</td>
<td>Using <em>If Bones Could Talk</em>, read about, then create, a picture of Smilodon in its habitat from its skeleton.</td>
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<td>Prompt- Write a story telling about one of your fossils, the animal it came from and how it came to be your fossil.</td>
<td>Read <em>Earth Beneath Your Feet</em>. What is a rock? How do rocks form? How do land forms change? Read poem <em>Starting Out</em>.</td>
<td>Using tests (scratch, hardness, color, luster) name different kinds of rocks.</td>
<td>Create a mind map of poem showing how to search for rocks, minerals and fossils.</td>
<td>Create own fossil using imprint method with Plaster of Paris and shells, leaves, and sharks’ teeth.</td>
<td>Science Lab-testing to determine different kinds of rocks (scratch, hardness, etc.)</td>
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<tr>
<td>Rocks and fossils are formed from heat and pressure, heating and cooling, and erosion.</td>
<td>Read <em>Earth Beneath Your Feet</em>. What is a rock? How do rocks form? How do land forms change? Read poem <em>Starting Out</em>.</td>
<td>Create a mind map of poem showing how to search for rocks, minerals and fossils.</td>
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<td>Fill in the cloze story <em>The Rock Story</em> on how rocks form.</td>
<td>Complete the rock cycle showing how sedimentary, metamorphic and igneous rocks are formed.</td>
<td>Chart observations of making sedimentary rock over a day using different time intervals.</td>
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<td>Make a sedimentary rock with layers, following directions.</td>
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**Unit:** Where Do I Come From?  
**Theme:** Prehistoric Florida, Fossils and Phosphate  
**Conceptual Key Point:** Florida’s plant, animal and geological make-up have changed since the time before the Ice Age.  
**Resources:** The Formation of Florida PEER Center materials, Florida Textbook, Wee Sing Dinosaurs cassette tape, *Phosphate Land Reclamation: An Introduction for Students* video  
**Thinking Skills:** Predicting, Constructing, Measuring, Composing, Illustrating, Describing

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<tbody>
<tr>
<td>Prehistoric Florida, fossils and phosphate are all interrelated.</td>
<td>Brainstorm answer to &quot;What is the connection between Prehistoric Florida, fossils and phosphate?&quot; Create a bulletin board of answers and refer to throughout unit.</td>
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<tr>
<td>Prehistoric Florida—Florida was very different during prehistoric times, especially in its landforms and animals.</td>
<td>Read <em>The Formation of Florida</em> from PEER Center materials.</td>
<td>Analyze diagrams of the formation of Florida from PEER Center materials.</td>
<td>Watch <em>Phosphate Land Reclamation: An Introduction for Students</em> video for historic perspective for Prehistoric Florida.</td>
<td>Big word—Prehistoric (for spelling, create words using letters in the word prehistoric)</td>
<td>Listen to Wee Sing Dinosaurs for example of prehistoric animal songs.</td>
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<td>Timeline—Construct a timeline of your own life.</td>
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- Read pp. 64-67 in Florida textbook on animals & Indians of prehistoric FL.  
- Compare maps of Florida today with maps of Prehistoric Florida.  
- Chart information on the early Indians to compare Archaic & Paleo.  
- Create a Smilodon from its skeleton. Add background of prehistoric life.  
- Write a song or rap about a prehistoric Florida animal.

- Vocabulary development  
- Create a timeline placing Prehistoric Florida in reference to the age of the dinosaurs and to modern times.  
- Guest speaker on Prehistoric Florida art, artifacts and fossils (Dean Quigley)  
- Field trip to Mulberry Phosphate Museum & Mosaic to see prehistoric animals and find fossils.
**Unit:** Where Do I Come From?  
**Theme:** Prehistoric Florida, Fossils and Phosphate  

**Conceptual Key Point:** Phosphate, a necessity of life, was formed as Florida underwent its many geological changes. The phosphate mining process leaves disturbed land that must be reclaimed and returned to its original state.

**Resources:** Phosphate Feeds You video, *Phosphate Land Reclamation: An Introduction for Students* video, *Mining Phosphate* video, Newspaper: *Phosphate from Florida*

**Thinking Skills:** Describing, Diagramming, Assessing, Labeling, Applying

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<tr>
<td>Phosphate – There is a process to mining phosphate.</td>
<td>Expository Prompt- Write to tell how phosphate is mined.</td>
<td>Using the Phosphate Story diagram, discuss the process the industry takes to get the phosphate.</td>
<td>Watch videos <em>Mining Phosphate</em> and <em>Phosphate Land Reclamation: An Introduction for Students</em>.</td>
<td>Write a haiku poem about the phosphate mining process.</td>
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<td>Field trip to Mulberry Phosphate Museum and Mosaic mines to experience the phosphate story in action.</td>
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<td>Vocabulary development</td>
<td>Have students use pictures depicting the Phosphate Story, put them in order of the mining process &amp; write description of each.</td>
<td>Identify jobs associated with the phosphate industry. Add these titles to the correct area of the Phosphate Story.</td>
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<td>Phosphate is used as fertilizer and as a nutrient in our food.</td>
<td>Chart uses of phosphate in our society from video Phosphate Feeds You.</td>
<td>Watch video <em>Phosphate Feeds You</em>.</td>
<td>Bring in samples of food from home with phosphate as an ingredient</td>
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<td>The phosphate industry reclaims land used in mining.</td>
<td>Big word-Reclamation (for spelling, create words using the letters in reclamation).</td>
<td>Draw pictures showing possible ways the phosphate industry can reclaim the land.</td>
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<td>Chart the differences in mined, unmined &amp; reclaimed land using pictures and words.</td>
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**Unit:** Where Do I Come From?  
**Theme:** Prehistoric Florida, Fossils and Phosphate  
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**Thinking Skills:** Measuring, Identification, Classifying, Describing, Diagramming, Composing.

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<tr>
<td>A paleontologist obtains information about fossils by comparing them to remains already found and carbon-dated.</td>
<td>Read <em>Fossils Tell of Long Ago</em> by Aliki and <em>Fossil</em> from Kids Discover</td>
<td>Survey and research the job of paleontologist. (School to Work).</td>
<td>Guest speaker on Prehistoric Florida to show fossils, art and artifacts (Dean Quigley)</td>
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<td>Field trip to Mulberry Phosphate Museum &amp; Mosaic to hunt fossils</td>
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<td>Read aloud <em>Panther Glade</em> by Helen Cavanagh</td>
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<tr>
<td>Fossils are found in one of the earth’s layers—the crust. They are not found in the mantle or core.</td>
<td>Read aloud Magic School Bus: Inside the Earth to distinguish earth’s layers.</td>
<td>Diagram and label the crust, mantle, and core of the earth.</td>
<td>Create a sedimentary sandwich showing layers of the earth.</td>
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<td>Field trip to Mulberry Phosphate Museum &amp; Mosaic to hunt for fossils.</td>
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<td>Read poem <em>Starting Out</em> and have chart of layers of the earth.</td>
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<td>Read <em>Earth Beneath Your Feet</em> (What Else is Beneath Your Feet?).</td>
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<td>Have student illustrate literal and implied meaning of each familiar expression.</td>
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<th>Mine cuts</th>
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<td>Cenozoic</td>
<td>Mineral</td>
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<td>Contouring</td>
<td>Mining</td>
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<td>Era</td>
<td>Overburden</td>
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<td>Extinct</td>
<td>Phosphate</td>
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<tr>
<td>Fossil</td>
<td>Phosphorus</td>
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<td>Geologist</td>
<td>Prehistoric</td>
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<td>Igneous</td>
<td>Reclamation</td>
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<td>Mammal</td>
<td>Sedimentary</td>
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<td>Matrix</td>
<td>Slurry</td>
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<tr>
<td>Metamorphic</td>
<td>Vertebrate</td>
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©FLORIDA INDUSTRIAL AND PHOSPHATE RESEARCH INSTITUTE
Vocabulary Definitions

Archaeologist: Person who studies past (historic or prehistoric) human life and culture by analyzing artifacts, inscriptions, and monuments.
(alternate spelling accepted: archeologist)

Cenozoic: Pertaining to the present era of geologic time, which began 65 million years ago. This era is characterized by the rise of mammals. Also known as the "Rise of Mammals."

Contouring: Filling holes, leveling, and reshaping disturbed land in order to maximize function and minimize erosion.

Era: A major division of geological time (shorter than an eon, longer than a period) that lasts several hundred million years.

Extinct: No longer living; describing a species that has died out without leaving any living offspring.

Fossil: A whole or part of an organism that has been preserved in sedimentary rock. The most common types of fossils are bones, teeth, molds, casts, petrified wood, and carbon films.

Geologist: A scientist who studies Earth’s origin, history, and structure, including the rocks and minerals found in Earth’s crust.

Igneous: A type of rock that forms from molten or partly molten material that cools and hardens.

Mammal: Any of various warm-blooded vertebrate animals of the class Mammalia, including humans, characterized by a covering of hair on the skin and, in the female, milk-producing mammary glands for nourishing the young.

Matrix: The phosphate-bearing layer or strata, consisting of phosphate rock, clay and sand, usually found 15-50 feet below the ground surface in the Bone Valley region of west central Florida.

Metamorphic: A type of rock that forms from existing rock because of extreme changes caused by heat, pressure, or chemical environments.

Mine cuts: Excavations made by a dragline outfitted with a boom, cable, and bucket. Draglines are used to move tons of material during mining. Excavations are typically linear and parallel in form.

Mineral: A naturally occurring, homogeneous inorganic solid substance having a definite chemical composition and characteristic crystalline structure, color, and hardness.

Mining: The process of extracting minerals from the earth.

Overburden: The soil or rock that covers a mineral source; dirt miners dig through in
order to reach the matrix below. In Florida this layer is used for reclamation.

**Phosphate:** A class of mineral that is the only known source of the element phosphorus. Phosphate is a nutrient that all living things need to survive and grow. Phosphate rock, which cannot be dissolved in water, is mined to be used as a raw material in fertilizers and animal feeds. The resulting final product is a form of phosphate that is water-soluble and usable by plants and animals.

**Phosphorus:** The chemical element with the atomic number of 15, represented by the symbol, P. Phosphorus is never found in its elemental form in nature, but rather as an oxidized form, phosphate. Phosphorus is an essential nutrient for all life, and is an important component in fertilizers.

**Prehistoric:** Pertaining to a period prior to recorded history.

**Reclamation:** The process of rehabilitating lands disturbed by mining so that they serve a desirable and useful purpose, the result of which may or may not be returning the land to its original uses and functions.

**Sedimentary:** Rock formed from layers of sediment that overlay and squeeze together, or are chemically combined.

**Slurry:** A semi-fluid mixture of a liquid (usually water) and insoluble solid particles such as clays, phosphogypsum or sand.

**Vertebrate:** Any of a large group of chordates of the subphylum Vertebrata (or Craniata), characterized by having a backbone. Vertebrates include fish, amphibians, reptiles, birds, and mammals.
Lesson 1: What’s the Connection?
Author: Jennifer Insua

Introduction:
The prehistoric Florida time period (the Cenozoic on the geological time scale) is brought to life with the fossils of prehistoric animals that are found in the phosphate pits today. The mineral phosphate was formed during this same time period. Prehistoric Florida was a time of mastodons, saber-toothed cats, glyptodons, and giant ground sloths. No dinosaurs ever roamed prehistoric Florida, nor can their fossils be found here, since Florida was underwater during the Mesozoic era.

This activity will test the students’ prior knowledge about prehistoric Florida, as well as give the teacher an idea of what background knowledge the students already have.

Activity:
Students will test their prior knowledge about prehistoric Florida, fossils, and phosphate, as well as their understanding of the relationship among the three, by drawing a picture of what they think the connection is.

Estimated Time:
One—45 minute class period

Grade Level:
4

Standards:
LA.4.4.2.2
LA.4.5.2.1
SC.4.L.17.2
SC.4.L.17.3

Objectives:
The student will…
Recall prior knowledge about prehistoric Florida, fossils and phosphate and their connection with each other.

Vocabulary:
prehistoric Florida
fossils
phosphate

Materials:
Bulletin Board paper
Notebook paper
Half sheets of 8½ x 11 paper
Laminated map of the state of Florida
Pencils
Colored pencils or crayons

Procedure:
1. Begin the lesson by asking the students to silently read the question on the bulletin board to themselves. Then choose one student to read the question aloud.
2. Discuss each of the three terms separately (prehistoric Florida, fossils, and phosphate) so the students know the meanings.
3. Hand out the half sheets of paper and have the students write their answer to the question and illustrate it. "The connection is..."
4. When each student is finished, have the student come to the bulletin board and hang their paper alongside the picture of Florida. Each student then sits in front of the board and waits until all students have posted their pictures.
5. When all pictures and answers are on the board, read each answer aloud and share each picture. Do this without indicating correct answers. These will be discovered within the unit.
6. After everyone has shared, tell the students they will find out if they are correct as they explore the connection between the three ideas.

Analysis/Conclusion:
No formal assessment of this lesson will be done because it is the beginning lesson of the unit, although this lesson does provide a beginning assessment of the students' prior knowledge about prehistoric Florida, fossils, and phosphate. This can be compared with the students' gained knowledge at the end of the unit. Refer to the students' answers and pictures throughout the unit to either affirm or disprove what has been written and drawn (pay close attention to the students' pictures—dinosaurs usually pop up).

Extension:
Some mention of careers may come up in this beginning activity. They will probably be in the area of fossils—geologists and/or paleontologists. A more in-depth study of these will be done later in the unit.

Teacher Notes:
Set up bulletin board with title, Prehistoric Florida, Fossils, and Phosphate—What's the Connection?
Cut out and laminate a map of the state of Florida.
Mount map under title of bulletin board.
Cut 8½ x 11 paper into half sheets (one half for each student)
Pre/Post Test

Directions: Read each sentence below. Decide whether it is true or false. Circle the "T" if it is true or the "F" if it is false.

1. Dinosaurs lived in Florida.
   T  F

2. Florida was once under water and was a series of small islands.
   T  F

3. The Smilodon, the woolly mammoth, and the giant armadillo roamed prehistoric Florida.
   T  F

4. There were no people during the Cenozoic time period in Florida.
   T  F

5. All of Florida's prehistoric animals and their related species are now extinct.
   T  F

6. Fossils are the remains of plants and animals.
   T  F

7. There are three kinds of fossils—imprints, preservation of the actual remains, and replacement by mineral matter.
   T  F

8. Fossils are found in all three kinds of rocks: igneous, metamorphic, and sedimentary.
   T  F

9. A paleontologist studies rocks.
   T  F

10. Rocks are formed only from heat.
    T  F

11. Phosphate is used as a fertilizer and as a mineral in our food.
    T  F

12. The phosphate industry does not have to reclaim land after mining.
    T  F

13. There is a specific process to mining phosphate.
    T  F

14. Phosphate is an important part of Polk County's economy.
    T  F

15. Prehistoric Florida, fossils, and phosphate are all connected through phosphate today and fossils from prehistoric times.
    T  F
Pre/Post Test Answer Key

1. Dinosaurs lived in Florida.  F
2. Florida was once under water and was a series of small islands.  T
3. The Smilodon, the woolly mammoth, and the giant armadillo roamed prehistoric Florida.  T
4. There were no people during the Cenozoic time period in Florida.  F
5. All of Florida's prehistoric animals and their related species are now extinct.  F
6. Fossils are the remains of plants and animals.  T
7. There are three kinds of fossils—imprints, preservation of the actual remains, and replacement by mineral matter.  T
8. Fossils are found in all three kinds of rocks: igneous, metamorphic, and sedimentary.  F
9. A paleontologist studies rocks.  F
10. Rocks are formed only from heat.  F
11. Phosphate is used as a fertilizer and as a mineral in our food.  T
12. The phosphate industry does not have to reclaim land after mining.  F
13. There is a specific process to mining phosphate.  T
14. Phosphate is an important part of Polk County's economy.  T
15. Prehistoric Florida, fossils, and phosphate are all connected through phosphate today and fossils from prehistoric times.  T
Lesson 2: Present Words of Our Prehistoric Past
Author: Jennifer Insua

Introduction:
The Cenozoic Era is the time period in which prehistoric Florida and its plants and animals thrived. Geologists have studied the earth to determine what lived during this time.

The purpose of this lesson is to develop new vocabulary word definitions with the students. The words used within this unit are ones that are content-specific and need to be taught directly.

Activity:
Within this activity, the students will learn new vocabulary word definitions, then use them in a sentence and illustrate them. They will then review the words by playing the game “Pictionary.”

Estimated Time:
One—45 minute class period

Grade Level:
4

Standards:
LA.4.1.6.7
LA.4.1.7.8
LA.4.2.2.3

Objectives:
The student will…
Be able to use new vocabulary words within the context of prehistoric Florida.

Vocabulary:
prehistoric  geologist
era  vertebrate
Cenozoic  fossil
extinct  mammal
geology

Materials:
List of vocabulary words
Vocabulary worksheet
Large sheets of manila paper (enough for teams of four)
Small sheets of manila paper for each student

Procedure:
Day 1
1. Begin the lesson with the word “prehistoric.” Write the word on the overhead and have
students find words within the word. They should pick out words such as “historic,” “to,” “rest,” etc. Focus on the two words “pre” and “historic.” Ask for definition of each (this is a good time for a prefix review). From the two definitions, form one definition for the word.

2. Introduce the following words in the same fashion: era, Cenozoic, extinct, geology, mammal, geologist, vertebrate, fossil.

3. When all words are defined, hand out a small sheet of manila paper to each student. Have students fold the paper so they have four boxes when unfolded. Have the students write the vocabulary words in each of the boxes. Next, have the students use the definitions and write a sentence using the words in each labeled box. Have them also illustrate the sentence in the box along with the sentence and word.

4. Hand out the vocabulary sheet with the definitions on it. Have the students complete the sheet for homework.

**Day 2**

1. Review each of the vocabulary words learned yesterday by checking the homework sheet.

2. Divide the class into teams of 4 students. Give each group a large sheet of manila paper. Have students fold the paper so that they have eight boxes when they unfold it.

3. The review will be done like the game "Pictionary." Have students decide the order in which they will work (who will go first, etc.). The first person chooses one of the words on the vocabulary sheet and then draws the definition of it while the remaining team members watch. It is their job to figure out the word by the time the person who is drawing it is finished. When a person finishes drawing, that student calls on team members to guess the word. A correctly identified word is written below the picture in the same block and then the next person chooses a new word and begins drawing in the following block. This continues until all the words are reviewed.

4. Hang these pictures around the room for a constant reminder of the words and their definitions.

**Analysis/Conclusion:**
The assessment of this lesson will be two-fold. One assessment can be done on how well the students use their new vocabulary words in the sentences. The other can be the group review of the words in which they illustrate the word and the other group members guess the word.

**Extension:**
Since one of the vocabulary words is geologist, this is a perfect time to discuss the exact job description of this profession. One of your students may even want to research this career and report to the class.

**Teacher Notes:**
Have all materials on hand and ready.
Homework Sheet

KEY TERMS
These words are all associated in one way or another with fossils.

**Cenozoic Era:** The most recent geological era of Earth’s history. The Cenozoic began about 65 million years ago.

**Era:** A long division of geological time.

**Extinct:** A plant or animal species that is no longer found living.

**Fossil:** The remains or traces of life from the geologic past.

**Geologist:** A scientist who studies the Earth.

**Geology:** The study of the physical Earth.

**Mammal:** Animals that are characterized as being warm-blooded, vertebrates, bearing live young, and producing milk to nourish their offspring.

**Prehistoric:** Refers to the time before recorded history began.

**Vertebrate:** An animal having a backbone.

**ACTIVITY:** Use the key words to fill in the blanks.

1. The shell imprint found in the rock is a ________________.
2. The whale has a backbone so we call him a ________________.
3. The ________________ studies rocks to learn about the Earth.
4. The ________________ Era covers the most recent portion of geological time.
5. You will never see a mastodon today because they are ________________.
6. The Cenozoic ________________ began about 65 million years ago.
7. The mammoth was a ________________, a class of warm-blooded, hairy animals that bear live young.
8. The animals of the ________________ period lived long before recorded history.
Homework Answer Key

1. The shell imprint found in the rock is a ___fossil__________.

2. The whale has a backbone so we call him a ___vertebrate______.

3. The ___geologist_______ studies rocks to learn about the Earth.

4. The ____Cenozoic______ Era covers the most recent portion of geological time.

5. You will never see a mastodon today because they are __extinct________.

6. The Cenozoic ____Era__________ began about 65 million years ago.

7. The mammoth was a __mammal__________, a class of warm blooded, hairy animals that bear live young.

8. The animals of the ____prehistoric____ period lived long before recorded history.
Lesson 3: Prehistoric Florida: Maps of Our Past
Author: Jennifer Insua

Introduction:
Prehistoric Florida changed many times. Before the Ice Age, Florida was a series of islands which were the beginnings of our present-day scrub ecosystems that are found on the Central Florida ridge. During the Ice Age, Florida more than doubled its size. After the Ice Age, it gradually took the shape we recognize today.

The purpose of this lesson is to make students aware that Florida did not always look the way it does today. It is also important for the students to understand that the land we now call Florida was under water for many years, especially during the age of dinosaurs. This important concept should be stressed so students know that they can find no dinosaur fossils here in Florida.

Activity:
The students will compare the different ways Florida looked during prehistoric times and today using a Venn Diagram.

Estimated Time:
Two—45 minute class periods

Grade Level:
4

Standards:
LA.4.2.2.3
SS.4.G.1.1

Objectives:
The student will…
Be able to compare and contrast a present-day map of Florida to maps of Florida during prehistoric times using a Venn diagram.

Vocabulary:
prehistoric Florida

Materials:
Transparencies of maps of present-day Florida and prehistoric Florida
Copies of The Formation of Florida for each pair of students
Pencils and colored pencils or crayons
Prehistoric Florida maps
Large manila paper
Large circle for tracing
Procedure:
1. Open the lesson with the question, “What did Florida look like during prehistoric times?” Discuss answers with students.
2. Display the transparency of the map of present-day Florida. Discuss its characteristics (a peninsula, has large lake, etc.). Ask students to imagine that the Ice Age has come to the land. Discuss what happened during this time when Earth’s water froze. (The oceans receded.) Ask students what happened to the ocean surrounding Florida and discuss answers.
3. Now show the map of Florida before the Ice Age and then the years of the Ice Age, discussing the characteristics of each with student responses. If students do not discuss the similarities and differences between maps, ask them to compare them.
4. Hand out copies of *The Formation of Florida*. Read this together and discuss the diagrams and captions. Relate them to the maps of prehistoric and present-day Florida when possible.
5. Hand out the sheets of manila paper with the Venn diagrams drawn on them. Direct the students to label one circle for present-day map of Florida and the other for one of the prehistoric maps of Florida (let them choose a time period).
6. Discuss how to use the Venn diagram. On either side, students will write information about each map. The middle space is used to show how the two are alike.
7. Have students complete the Venn diagram to compare the prehistoric map to the present-day Florida map by writing information in each of the spaces. Around the Venn diagram, have the students illustrate the maps of prehistoric Florida and of present-day Florida and any other details they can add such as animals or plant life. They can use their Geological Time Scales I and II from Lesson 4 to help them.
8. Leave the transparencies on the overhead and the copies of the article for the students to use as they complete their Venn diagrams.

Analysis/Conclusion:
The assessment of this lesson will be how well the student organizes the information learned about the maps of present-day and prehistoric Florida in a Venn diagram.

Extension:
Another mention of paleontologists can be given with a question to students, “How did we find out so much about a period of time so long ago?” A more in-depth study of this career will be done later in the unit.

Teacher Notes:
Create a Venn diagram using large circles on the large manila sheets of paper for each student. Have all other materials on hand and ready.
Phosphate and Florida’s Formation  
FIPR - July 2003

Florida is blessed with a bountiful supply of phosphate that primeval seas deposited millions of years ago. The phosphate comes from sediment that was deposited in layers on the sea floor. The phosphate-rich sediments are believed to have formed from precipitation of phosphate from the seawater along with the skeletons and waste products of creatures living in the sea.

In the early 1800s, it was learned that phosphorus promotes growth in plants and animals. At first, bones, which contain the element phosphorus, were used as an agricultural fertilizer. Today, phosphate rock provides fertilizer’s phosphorus.

Phosphate rock was first mined in England in 1847 for use as a fertilizer. It was in 1881 that Captain J. Francis LeBaron, working with the Army Corps of Engineers, discovered Florida’s treasure in black phosphate pebbles in the Peace River. A “hard rock” phosphate reserve in North Central Florida was discovered next. Thus began Florida’s phosphate mining industry. As of 2003, Florida’s phosphate mining accounts for about 80% of the phosphate used in the United States, as well as for about 25% of the phosphate used around the world.

The Florida we know today and the phosphate buried in its earth are relatively recent products of geological processes that have been at work for a long time.

In the 1960s, scientists introduced the theory of Plate Tectonics. This theory holds that the Earth’s crust is fractured into several large pieces called plates. These plates move around very slowly, propelled by powerful forces deep within the Earth. As the plates move, the continents are carried along on top of them as if they were passengers on a raft. Sometimes continents are split up—other times they are brought together. Throughout the long history of the Earth, this process has rearranged the continents many times.

Evidence from core samples obtained from deep wells drilled around the state indicates that the igneous and metamorphic rocks that Florida is built on may once have been part of Africa. These rocks became joined to North America more than 300 million years ago during the formation of the “super continent” that scientists call Pangaea. When Pangaea broke apart into the continents we know today, these deep “basement rocks” that underlie the state remained with North America.

Over millions of years that followed, thousands of feet of sedimentary rock deposits accumulated on top of the underlying rocks to build up the land we see today. During this time, most of what is now Florida was underwater. Marine creatures in the form of coral, shells and skeletons deposited the limestone that makes up the sedimentary layers. As time passed, the sea level dropped and the limestone became exposed as land.

Florida’s phosphate rock deposits are believed to have originated in several ways. Some of the phosphate may have formed when conditions in the seawater caused dissolved phosphorus to solidify, a process scientists call precipitation. As materials settled to the bottom of the shallow
coastal waters, phosphorus became part of the sedimentary layers that eventually formed the sediment that is mined today. It is also likely that excrement and sea life remains played a big part in forming the deposits. Bones, teeth, and other animal remains also contributed to the ore formation.

By about 12 million years ago, most of the coastline of Florida probably looked much like it does today in many coastal areas. In those times, however, the shoreline was located up to 60 miles further inland. In the shallow waters offshore, a layer of clay and sandy limestone was deposited. Today this layer is known as the Hawthorn Formation.

Rivers and streams flowed down to the sea carrying material washed from the land. This material was deposited in shallow lagoons and bays along the coast, forming deposits of sand and clay. These deposits contained the remains of land animals brought in by the rivers and streams, and also marine creatures that inhabited the coastal waters. These deposits are so rich in fossils, the term scientists use for evidence of ancient life, that they are known as the Bone Valley Formation. In Central Florida, the Bone Valley Formation is found on top of the Hawthorn Formation and is under about 20-40 feet of sand.

Fossils from the sedimentary deposits of the Bone Valley Formation are often uncovered in the process of phosphate mining and give us a glimpse of Florida’s prehistoric past. Bone Valley is the heart of Florida’s phosphate mining area.

Among the abundant fossils found in Florida are those from the sea creatures that lived in the shallow waters that covered Florida in the distant past. These fossils include the teeth of giant sharks and the bones of huge whales (both on display at the Mulberry Phosphate Museum). The remains of hundreds of species of land animals, birds, and plants are also found in the layers of rock beneath the present-day surface. These fossils include many species that came to Florida to escape the advancing glaciers of the great Ice Ages. Some of these animals migrated to North America from other parts of the world. For example, some of these animals came across the Bering Strait land bridge from Asia when the sea level was lower. Others traveled around the rim of the Gulf of Mexico, when areas that are now submerged were exposed.

Other evidence tells us that Florida supported this great variety of creatures with abundant food supplies made possible by a temperate climate. Fossilized remains dug from the Earth during phosphate mining tell us a great deal about life of the past and about early geological developments in Florida.
Lesson 4: Prehistoric Florida: What Time Is It?
Author: Jennifer Insua

Introduction:
The geological time scale traces time back from the beginnings of one-celled animals (in the Paleozoic era), through the dinosaurs (the Mesozoic era) to today (the Cenozoic era).

The purpose of this lesson is to teach the students the geological time scale, giving them a time reference for prehistoric Florida.

Activity:
In this activity, the students will explore the geological time scale and the plants and animals of each era. They will then create their own geological time scale, adding significant events and illustrations.

Estimated Time:
Two—45-60 minute class periods

Grade Level:
4

Standards:
SC.4.L.17.2
SC.4.L.17.3
SS.4.A.9.1

Objectives:
The student will...
1. Read a timeline.
2. Place events of geological history into the correct position.
3. Create a geological timeline using dates and illustrations.

Vocabulary:
Paleozoic era
Mesozoic period
Cenozoic

Materials:
Large manila paper
Pencils
Colored pencils or crayons
Fossils by Kids Discover
Overhead projector
Scissors
Glue
Transparencies from *Fossils and Prehistoric Life* by Milliken (Geological Time Scale I and II)
Copies of blank Geological Time Scale I and II for each student

**Procedure:**

**Day 1**
1. Begin the day with a quick review of the bulletin board answers given to the question "Prehistoric Florida, Fossils, and Phosphate—What's the Connection?" Especially hit on any answers that deal with the time period of Prehistoric Florida. If there are none, ask the students "When was Prehistoric Florida?" Discuss student answers. Lead into the three major time periods (Paleozoic, Mesozoic and Cenozoic).
2. Using the transparencies, discuss the time periods, beginning with the furthest back. Include the names, the dates, the plants and animals living in each.
3. Give each student a copy of the blank Geological Time Scales and have them fill in the information from the three time periods.

**Day 2**
1. Review the events in the timeline sheets. Discuss the three major periods of time and the significant events in each. Remind students that the Cenozoic time period is the one associated with prehistoric Florida.
2. Give each student one sheet of the large manila paper.
3. Have them fold it in half lengthwise and cut it down the fold. This will give them two long strips. Have them glue the strips together to make one long strip.
4. Using their Geological Time Scale I and II sheets, have the students create one long timeline of each of the eras and their significant events. Have them include illustrations for each era.

**Analysis/Conclusion:**
The assessment of this lesson will be how well the students place the events of prehistoric time in the correct order, with the correct events and correct illustrations.

**Extension:**
A mention of paleontologists can be given with a question to students such as, “How did we find out so much about a period of time so long ago?” A more in-depth study of this career will be done later in the unit.

**Teacher Notes:**
Have all materials on hand and ready.
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Florida and Geological Time

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**Directions:** Cut out the words and pictures on this page and paste them in the appropriate locations on the blank geological time scale.

**ERA**

Paleozoic        Mesozoic        Cenozoic

Paleontology

Geological Event
Lesson 5: People of Our Prehistoric Past
Author: Jennifer Insua

Introduction:
There were two groups of early Indians who made prehistoric Florida their home: first, the Paleo Indians, then the Archaic. They shared many similarities, but they also had different ways of living off Florida land and shared their home with different prehistoric animals.

The purpose of this lesson is to familiarize students with the people who inhabited prehistoric Florida.

Activity:
In the activity, the students will be researching the prehistoric Native Americans who inhabited Florida after the Ice Age. They will be using videos, the textbook, and trade books to fill in an informational chart about the Indians’ housing, food, tools, dress, where they lived, and any other interesting information. After researching, the students will create a collage picture depicting the lifestyles of the Paleo and Archaic Indian groups.

Estimated Time:
Two—45 minute class periods

Grade Level:
4

Standards:
LA.4.2.2.3
SS.4.A.2.1
VA.A.1.2.1

Objectives:
The student will…
1. Be able to identify the Indians of prehistoric Florida and the characteristics of each, including their home, what they ate, and where they lived.
2. Also compare the two Indian groups by illustrating their different ways of life.

Vocabulary:
Archaic
Paleo
ancient

Materials:
Videos Phosphate Land Reclamation: An Introduction for Students and Florida Indians
Small manila paper for each student
Florida textbook on prehistoric Florida Indians
Additional resources on Florida Indians
Art prints from artist Dean Quigley
Comparison worksheet for each student
**Procedure:**

**Day 1**

1. View the time period of Prehistoric Florida and the plants and animals of this time. Show students the Dean Quigley art prints. Point out the characteristics of each (plant life, animals, people, etc.) and how the artist-archaeologist researched the information to make his art as correct for this time period as possible. From this, tell students there were two major tribes of Indians during Florida's prehistoric times, the Paleo and Archaic Indians. Define Paleo as "old" and Archaic as "ancient."

2. Tell students they are going to find out who these people were and how they lived during these times.

3. Hand the comparison sheet to each student. Discuss the different categories and what they will be looking for about each group of Indians (where they lived in Florida, housing, foods, tools, dress, other).

4. Direct students to take notes on the Indians as they watch the videos *Phosphate Land Reclamation* and *Florida Indians* (you will only show the first few minutes of each of these videos because they go into other areas not covered by this lesson). Students will have to use the pictures from the videos for their information (the text is sketchy).

5. After the videos, discuss the information they found. Make sure each student has the information charted.

6. Have the students then read the information from the Florida textbook on "Florida's Early Indians" with a partner. As they find information about these Indians, have them chart it.

7. Have other resource books and the Dean Quigley prints available for students to use to find more information.

**Day 2**

1. Review the chart the students filled in the previous day on the Indians.

2. Give each student a piece of manila paper. Have them fold the paper into two parts. Have them label one side “Paleo” and the other side “Archaic.”

3. Direct students to use their charts to illustrate a day in the life of each of these Indians on each side of the paper.

**Analysis/Conclusion:**
Students will be assessed on how detailed their chart is with information on the early Florida Indians and on how well they use their chart in an illustration of the Indians’ different ways of life.

**Extension:**
Extension Activity, page 104. Use the poem *Early Native Floridians* for reading fluency practice.

The career of artist-archaeologist can be explored during this lesson with a discussion on how the artist researched the information on prehistoric animals and peoples for his art work.

**Teacher Notes:**
Have all materials on hand and ready.
## Native Floridians Research

<table>
<thead>
<tr>
<th>Where they lived in Florida</th>
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<tbody>
<tr>
<td>Housing</td>
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<td>Shelter</td>
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<td>Foods</td>
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<td>Dress</td>
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<td>Other</td>
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</table>
The Earliest Floridians

*Connect Main Ideas*

**Directions:** Use the table to show that you understand how Native Floridians used natural resources to meet their needs. Write one way the people of each Indian group used the natural resources around them.

<table>
<thead>
<tr>
<th>Northern Florida</th>
<th>Central and Southern Florida</th>
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<tbody>
<tr>
<td><strong>Timucuas</strong></td>
<td><strong>Tocobagas</strong></td>
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<td><strong>Apalachees</strong></td>
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<td><strong>Calusas</strong></td>
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Lesson 6: Fossil Hunters
Author: Sandra Bush

Introduction:
Alpha boxes are a sheet of paper divided into squares and labeled – one for each letter of the alphabet. These are used to record vocabulary, content words or new words. Prose writing is often new to students and should be discussed before reading the selection.

The purpose of this lesson is to read the book *If You Are a Hunter of Fossils* and identify content-specific vocabulary. It also is used to identify prehistoric time periods through the life forms and fossils mentioned.

Activity:
Read *If You Are A Hunter of Fossils* the first time using the think along questions. Build vocabulary with Alpha boxes, the vocabulary sentences, and the cloze story. Identify different time periods mentioned by the author with the geological time scale.

Estimated Time:
Three—45 minute class periods

Grade Level:
4

Standards:
LA.4.1.7.5   LA.4.4.2.1   SC.4.L.16.2
LA.4.2.2.2   LA.4.4.2.2

Objectives:
The student will…
Use their knowledge of a geological timeline to identify periods and life that existed within that time.

Vocabulary:
fossils    Brachiopod    salt flats    archaeology
mollusk    Cretaceous    Trilobite    ammonites
Pteranodon   shale

Materials:
Copies of *If You Are A Hunter of Fossils* by Byrd Baylor
Individual copies of Alpha boxes
8 x 12 white art paper
Tag board
Colored pencils or crayons

Procedure:
Day 1
1. Begin the activity by reading aloud the story *If You Are a Hunter of Fossils*. Discuss the
poetic style of writing used by the author and the meaning of each passage as read.

2. Identify on a map the locations and types of fossils found there, as mentioned by the author, and the contrast of these locations with the ocean scenes described in the same story. Discuss how these ocean scenes could be a part of the history of the mountains.

3. Review students’ knowledge of a fossil and how it can give us the clues to the past that create such vivid pictures for the author. Have the students review the story and find illustrations of life in the past.

4. Using the geological timeline, have students identify the fossil remains mentioned and the time period in which the plants and animals lived.

Day 2

1. After reading, have students work in pairs or small groups to think of words that reflect important points in the story.

2. They then put their words into the appropriate Alpha boxes on the sheet provided for this activity. They must be able to explain how each word is related to the story.

3. A class list can then be compiled on a large tag board version of the Alpha box page. As students add their words to the class list have them explain the importance or the connection of the word to the story. This provides a wealth of vocabulary and discussion about the focus of the story.

Day 3

1. Have the students individually or in small groups choose one of the previously divided passages or a favorite passage of their own from the story.

2. Have students illustrate their passage on white art paper. Their pictures should include details and complete background showing the entire scene described. (If students have access to a computer they may print out the words for their passage or they may use copies previously printed.)

3. The illustrations could be labeled with the time period and grouped accordingly for display or if all passages are used they could be put into a student-illustrated copy of the book.

Analysis/Conclusion:
The Alpha box activity can be used as an informal assessment of the students’ understanding of this book. If you do not wish to use this, the student product (illustrations or illustrated copy of the book) can be used for assessment. You may also use the FCAT style questions to assess student comprehension and vocabulary.

Extension:
People who make a career of hunting for fossils to find out about the past are paleontologists. Using a career report form, have students research the career area Social Scientists and Urban Planners, under which they will find archaeology, in the Children’s Dictionary of Occupations and Young Person’s Occupational Outlook Handbook.

Extension Activity, page 105. Use the poem Let’s Go on a Fossil Dig for reading fluency practice.

Teacher Notes:
Have individual or small group copies of Alpha boxes made.
Make a large class-size copy of Alpha boxes on tag board.
Divide the book into enough written passages to allow one for each student or group of students.
### Alpha Boxes

The book: ____________________________________________________________

The reader(s): ________________________________________________________

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FCAT Practice

If You Are a Hunter of Fossils
by Byrd Baylor

1. According to the poet, where can fossils be found in the United States? Use details and examples from the poem in your answer.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

2. Read the following lines from the poem.

There are seashells in this rock, jumbled, jammed together, large and small.
I always stop and touch the ones that curl like little ram’s horns.

What is being compared in these lines?

a. large and small
b. seashells and ram’s horns
c. seashells and rock
d. stop and touch

3. Read the following sentences from the poem. Write the fact next to the “F”. Write the opinion next to the “O”.

I see the salt flats and the dust devils blowing
and the dirt road going to a windmill
and one blue pickup truck moving slowly down that road.
But that seems far away and not quite real.

F _____________________________________________

________________________________________________________________________

________________________________________________________________________

O _____________________________________________

________________________________________________________________________

4. What does the author mean by “I am the one on the side of a West Texas mountain reading the rocks?”

a. Reading words printed on the rocks.
b. Searching for evidence of a past time.
c. Sounding out words on the rocks.
d. Making sense of letters.
5. What real life things does the author NOT see from “the side of a West Texas mountain?”
   a. Ranch land
   b. Dust devils
   c. Pickup Truck
   d. A highway

6. How does the character feel about hunting fossils? Use details and examples from the poem in your answer.

   Read
   Think
   and
   Explain

7. According to the poet, what is the largest animal to have ever flown?
   a. Pteranodon
   b. Ostrich
   c. Whale
   d. Hawk

8. What is the author’s purpose for writing this poem?
   a. To teach someone about dinosaur fossils.
   b. To entertain the reader with ideas about fossils and prehistoric times.
   c. To persuade someone to hunt for fossils.
   d. To teach the difference between rocks and fossils.

9. According to the poet, what happened “when water turned to mud?”
   a. The animals died.
   b. The sun overtook the ocean slime.
   c. The mountain formed.
   d. All of the above.
If You Are A Hunter of Fossils:
Vocabulary Activity

Directions: Complete each sentence with the correct word.

WORD BANK
swayed  vein  clumps  prickly  ledge
ancient  lapping  chalky  crevice  glimmering

In the heat of the sun, I made my way to a _______________ far up the side of the mountain. I scanned the _______________ of the rocks, hoping to find a _______________ of gold, or at the very least, _______________ _______________ of rock that would tell me of things living long ago. I rounded a corner and spotted something _______________ in the sunlight. Just then, a tree branch _______________ and blocked the sun, taking away its sparkle. I glanced around searching for the thing that had shown itself only a moment before. There, beside a _______________ cactus growing from beneath a _______________ limestone boulder, I saw it. It was just what I had been looking for. Evidence of life. But this was a strange place to find fossils of sea creatures! I was on a desert mountain, far from the sea and its _______________ water, and yet the fossil I was looking at was clearly a mollusk; a clam like creature of long ago! This was truly amazing!
If You Are A Hunter of Fossils:  
Vocabulary Activity

1. You are the one climbing rocky gray ledges in Utah.  
   What does “ledges” mean?  
   a. steep stairs  
   b. ladders  
   c. shelves on a cliff  
   d. book

2. I see it in that ancient lapping water.  
   What does “lapping” mean?  
   a. water moving slowly and gently  
   b. huge waves  
   c. drinking  
   d. running laps

3. I see sea lilies sway.  
   What does “sway” mean?  
   a. lie flat and still  
   b. grow tall  
   c. jumping up and down  
   d. move back and forth

4. I see all the creatures with shells and plates and spines.  
   What does “plates” mean?  
   a. dishes for food  
   b. bases on a baseball field  
   c. thin, flat scales  
   d. feathers

5. Slow moving, glimmering, they hide in the crevices.  
   What does “crevices” mean?  
   a. seaweed  
   b. narrow openings  
   c. calm ocean waters  
   d. sand
If You Are A Hunter of Fossils:
Vocabulary Phrases

Write a sentence about:

1. a chalky eraser

2. the prickly cactus

3. swaying branches

4. clumps of flowers

5. a deep crevice

6. a lapping tongue

7. glimmering jewels

8. a red vein

9. steep ledges

10. jumbled papers
If You Are A Hunter of Fossils: 
Vocabulary Answer Key

In the heat of the sun, I made my way to a _____ledge______ far up the side of the mountain. I scanned the __crevice_____ of the rocks, hoping to find a __vein_____ of gold, or at the very least, __ancient____ ____clumps____ of rock that would tell me of things living long ago. I rounded a corner and spotted something ____glimmering____ in the sunlight. Just then, a tree branch ____swayed____ and blocked the sun, taking away its sparkle. I glanced around searching for the thing that had shown itself only a moment before. There, beside a __prickly____ cactus growing from beneath a ____chalky_____ limestone boulder, I saw it. It was just what I had been looking for. Evidence of life. But this was a strange place to find fossils of sea creatures! I was on a desert mountain, far from the sea and its ____lapping____ water, and yet the fossil I was looking at was clearly a mollusk; a clam like creature of long ago! This was truly amazing!
If You Are A Hunter of Fossils: 
Vocabulary Answer Key

1. You are the one climbing rocky gray ledges in Utah.
   What does “ledges” mean?
   a. steep stairs
   b. ladders
   c. shelves on a cliff
   d. book

2. I see it in that ancient lapping water.
   What does “lapping” mean?
   a. water moving slowly and gently
   b. huge waves
   c. drinking
   d. running laps

3. I see sea lilies sway.
   What does “sway” mean?
   a. lie flat and still
   b. grow tall
   c. jumping up and down
   d. move back and forth

4. I see all the creatures with shells and plates and spines.
   What does “plates” mean?
   a. dishes for food
   b. bases on a baseball field
   c. thin, flat scales
   d. feathers

5. Slow moving, glimmering, they hide in the crevices.
   What does “crevices” mean?
   a. seaweed
   b. narrow openings
   c. calm ocean waters
   d. sand
Lesson 7: Fossil Imprints
Author: Linda Hughes

Introduction:
Fossils are formed in several different ways. The first way involves imprints, as this lesson demonstrates. Another way is from mineral replacement, which happens underground with the heat and pressure of the earth over thousands of years, thus forming a hard, rock-like fossil. Finally, a fossil can be formed when actual remains are trapped in amber or tar, thus preserving it.

The purpose of this lesson is to have students actually create a fossil imprint, one of three ways fossils are formed.

Activity:
The students will create a fossil imprint with a shell and Plaster of Paris.

Estimated Time:
Two—45-60 minute class periods

Grade Level:
4

Standards:
SC.4.N.3.1
SC.4.L.16.2

Objectives:
The student will…
1. Differentiate between the three different kinds of fossil formations.

Vocabulary:
fossil

Materials:
Fossils Tell of Long Ago by Aliki
White paper
Plaster of Paris
Petri dishes
Coffee filters
Vaseline
Assorted leaves
Sharks’ teeth
Shells
52 cc scoops
Plastic cups
Wooden stirring sticks
Water
Printed step-by-step directions
Journals
Medicine cups
Paper towels
Permanent markers
Newspaper
Sponges or rags for clean up
Millikin Prehistoric Life

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Procedure:

Day 1
1. Read the book *Fossils Tell of Long Ago*. Point out to students the different ways that fossils are formed (imprint, preservation of actual remains, mineral replacement).
2. Use the color transparency *Prehistoric Life* from Millikin, on the three kinds of fossil formations.
3. On a piece of paper folded into thirds, have the students illustrate and label the three ways.

Day 2
1. Review with the students the three kinds of fossil formations. Tell the students they will be creating an imprint fossil today. Students will work in teams of 4. Each student will make a fossil imprint by reading and following the directions on the handout.
2. Each student will be assigned a task such as materials gatherer, table preparer and clean-up, water person, and checker. Cooperation is emphasized among teams.
3. The materials person will gather the required materials from the materials table. The checker will check for the correct amount of materials using the list of materials on the handout. Sharks’ teeth, shells and leaves will be placed in small aluminum tins at students’ table along with the Vaseline.
4. These items will be coated with the Vaseline for easy removal. Both sides should be thoroughly coated.
5. Students will write their names with a marker on the outside edge of the coffee filter. Place the filter in the petri dish; if large filters are used, have students trim the filter down so it sticks up about 1 in. from the sides of the dish.
6. Each student will measure out 3 scoops of Plaster of Paris into the cup. This amount may be adjusted for your class.
7. Add 30 ml of water to the cup and stir until the plaster mix is like pancake batter. Once it starts thickening the process goes quickly.
8. Pour the Plaster of Paris mix into the coffee filter and gently tap 3 times on the table to get out air bubbles. Place the shark’s tooth, shell, and leaf with the textured surface down onto the Plaster of Paris. Do not submerge.
9. Place petri dishes on a table or counter and allow drying overnight.
10. Students will clean up areas and write about the activity in their journals.
11. Spend time examining the imprints students made. Ask the students why the organism that made the imprint is no longer alive.

Analysis/Conclusion:
Student success will be measured by their production of a fossil imprint. Teacher observation of team cooperation and reading to follow directions.

Extension:
This lesson may bring up the subject of careers such as paleontologists, archaeologists, and geologists.

Teacher Notes:
Have materials for students set out on table in small containers.
Lesson 8: Measuring Fossils
Author: Linda Hughes

Introduction:
Used in nearly every country in the world, the Metric System was devised by French scientists in the late 18th century to replace the chaotic collection of units then in use. The goal of this effort was to produce a system that did not rely on a miscellany of separate standards, and to use the decimal system rather than fractions.

This lesson provides practice with using the metric system to record mass and size of fossils.

Activity:
Students will use a triple beam balance scale to find the weight of each fossil provided and the circumference using a metric measuring tape.

Estimated Time:
One—30 minute class period

Grade Level:
4

Standards:
SC.4.N.1.3
SC.4.N.1.6
SC.4.N.1.7

Objectives:
The student will…
1. Learn how to use a triple beam balance scale.
2. Find the mass of fossils using a triple beam balance scale.
3. Find the circumference of various fossils.
4. Classify fossils according to circumference and mass.
5. Compare fossils by mass.

Vocabulary:
circumference
balance
mass
measure
units

Materials:
Prepared bags of fossils such as dugong bones and sharks’ teeth, etc.
Triple beam balance scales
cm measuring tapes for each table/team of students
Fossil Finds worksheet
Procedure:
1. Review/or and introduce concepts of circumference, mass, and measurement systems such as metric and U.S. Standard. Teacher may have students practice measuring a pencil, can, or eraser and record the answer.
2. Teacher will model and explain use of triple beam balance scales and centimeter measuring tapes to the class.
3. Explain to students how to record the data on the worksheet. Students who catch on quickly may help students having more difficulty using the scales and measuring tapes.
4. Students will compare and order the objects they measured (heaviest to lightest, shortest to longest, etc.)

Analysis/Conclusion:
Student mastery of balance scales and measuring tapes will be determined by their ability to use the tools to collect accurate data.

Extension:
Geology, archaeology, paleontology, and lab technician may be discussed in this lesson.

Teacher Notes:
Put selected fossils in Ziploc bags.
Balance scales and measuring tapes set out on materials table.
Fossil Finds

Sketch, identify, weigh and measure your fossils.

<table>
<thead>
<tr>
<th>Identification</th>
<th>Weight</th>
<th>Measurement</th>
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Lesson 9: Wild and Woolly Animals of Our Prehistoric Past
Author: Jennifer Insua

Introduction:
Although many prehistoric animals are extinct today, some of their ancestors still live in Florida and the continent of North America. Animals such as the Glyptodon (relative to the armadillo), the giant ground sloth (relative to the sloth), the Smilodon (relative to the bobcat) are all animals that roamed our state. Other animals, such as the mastodon and the woolly mammoth, are now extinct.

The purpose of this activity is to familiarize students with the kinds and characteristics of animals that roamed prehistoric Florida.

Activity:
In this activity the students will learn about the many prehistoric animals that roamed Florida, including those that are extinct and those that live today. This will be done using the geological time scale, written descriptions that are read aloud to the students, and the book Fossils by Kids Discovery. The students will create a replica of the Smilodon (saber-toothed cat) from drawings of its bones and accurately draw its habitat around it.

Estimated Time:
Two—45 minute class periods

Grade Level:
4

Standards:
LA.4.1.6.7
LA.4.1.7.8
LA.4.2.2.2
LA.4.2.2.3
VA.A.1.2.1

Objectives:
The student will…
1. Be able to identify the animals that lived within prehistoric Florida and understand that dinosaurs did not live in our state.
2. Draw a Smilodon from pictures of bones.
3. Illustrate its prehistoric habitat and write a description of its characteristics.
4. Research a given prehistoric animal, create a poster of information and assess themselves using a rubric.

Vocabulary:
extinct
Smilodon
paleontologist
**Materials:**
Pictures and descriptions of prehistoric animals
*Woolly Mammoth* by Aliki
Transparencies of prehistoric animals of Cenozoic period from Milliken
*Fossils* by Kids Discovery for picture of Smilodon
Copies of Smilodon bones for each student
*Florida* text
Art prints from artist Dean Quigley
Scissors
Large manila paper for each student
Overhead projector
Prehistoric Research chart
Prehistoric Animal poster rubric
Poster paper

**Procedure:**

**Day 1**
1. Begin this lesson with a review of the Cenozoic Era time period and a discussion about the shape of Florida during this time (review with transparencies of maps of Prehistoric Florida if needed).
2. Ask students what animals lived in prehistoric Florida. Make a list on the overhead of these animals.
3. Review the Geological Time Scales I and II at this time to complete your list of animals.
4. Using the pictures and descriptions of Florida animals, read the descriptions and have students decide which animal is being discussed. When they guess correctly, put the picture on the chalkboard or wall.
5. Save the Smilodon, or saber-toothed cat, for last. When they have identified that one, give each student a copy of the Kids Discovery *Fossils* books. Have them turn to the center pages for a poster of the Smilodon's bones.

**Day 2**
1. Give each student a copy of the Kids Discovery *Fossils* book and a copy of the Smilodon's bones.
2. Review the information about the Smilodon and its characteristics from the overhead.
3. Tell students they are going to be paleontologists today (review the job definition at this time) and will be putting together a life-like picture of Smilodon from its bones, just as a paleontologist does.
4. Give each student a piece of large manila paper.
5. Have each student cut out the Smilodon's bones and glue backwards onto the manila paper (when you hold the paper to light you should see the correct outline of the bones from the back).
6. From here, have the students illustrate around the bones to recreate the Smilodon and what he really looked like. Have the students also add prehistoric scenery details.
7. Finally, have the students write a caption describing the characteristics of this prehistoric animal.
Day 3
1. Have the students choose a prehistoric animal from the list given.
2. Using the research chart, have the students locate all the information about the animal they have chosen using textbooks, encyclopedias, library books, and the internet. The teacher may want to do some pre-research to have articles available to students.
3. Have the students design a poster that includes a title, a picture and the information from the research chart. Go over the rubric with students before beginning the project so students understand the requirements expected of them.
4. Have students grade themselves using the rubric when they are finished and share their posters with the class.

Analysis/Conclusion:
The assessment of this lesson will be on how well the student illustrates the Smilodon in its prehistoric habitat and writes a caption describing this prehistoric animal.

Extension:
Extension Activity, page 106. Use the poem *Mammoth* for reading fluency practice.

Since the students are acting as paleontologists, this is a perfect time to discuss the career. One of your ambitious students may even want to research about this career and report to the class.

Teacher Notes:
Have all materials on hand and ready.

Prehistoric Animal Research:

Saber Toothed Cat
Glyptodon
Mastodon
Woolly Mammoth
Giant Ground Sloth
Eohippus
Dugong
Prehistoric Animal Research Chart

Scientific Name: __________________________________________________

Common Name: __________________________________________________

<table>
<thead>
<tr>
<th>Physical Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(What did it look like?)</td>
<td>Be specific</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time Period</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(How long ago did it live?)</td>
<td>Use the geological timescale.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Predator</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(What did it eat?)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prey</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(What ate this animal?)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What other animals lived at the same time?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other interesting facts about this animal.</th>
<th></th>
</tr>
</thead>
</table>
# Prehistoric Animal Poster Rubric

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prehistoric animal facts</strong></td>
<td>Little of very sketchy facts</td>
<td>Facts included but parts may be inaccurate</td>
<td>Accurate facts included</td>
<td>Very detailed accurate details included</td>
<td></td>
</tr>
<tr>
<td><strong>Picture of prehistoric animal</strong></td>
<td>Very sketchy picture included</td>
<td>Picture included but parts may be inaccurately done</td>
<td>Accurate picture included</td>
<td>Very detailed accurate picture included</td>
<td></td>
</tr>
<tr>
<td><strong>Border related to the animal</strong></td>
<td>Border included, but not about the animal</td>
<td>Border included but parts may be inaccurately done</td>
<td>Accurate border included</td>
<td>Very detailed accurate border included</td>
<td></td>
</tr>
<tr>
<td><strong>Description of prehistoric animal</strong></td>
<td>Very sketchy description included</td>
<td>Description included but parts may be inaccurate</td>
<td>Accurate description included</td>
<td>Very detailed accurate description included</td>
<td></td>
</tr>
<tr>
<td><strong>Prehistoric animal predator and prey</strong></td>
<td>Very sketchy information included</td>
<td>Predator/prey included but parts may be inaccurate</td>
<td>Accurate predator/prey information included</td>
<td>Very detailed accurate predator/prey information</td>
<td></td>
</tr>
<tr>
<td><strong>Neat and done in color</strong></td>
<td>Messy and/or not colored</td>
<td>Mostly colored but parts may be messy</td>
<td>Colored and neatly done</td>
<td>Colored and neatly done with extra attention to detail</td>
<td></td>
</tr>
<tr>
<td><strong>Conventions correct</strong></td>
<td>Many spelling, punctuation, and capital letter errors</td>
<td>Some spelling, punctuation, and capital letter errors</td>
<td>Few spelling, punctuation, and capital letter errors</td>
<td>All spelling, punctuation, and capital letters correct</td>
<td></td>
</tr>
</tbody>
</table>
Lesson 10: Characteristics of Our Prehistoric Animals

Author: Jennifer Insua

Introduction:
The purpose of this lesson is for the students to dig a little deeper and learn more about prehistoric Florida animals and their characteristics.

Activity:
In this activity, the students will write a song about one of the prehistoric animals from Florida. They will include its known characteristics and share it with the class.

Estimated Time:
Two—45 minute class periods

Grade Level:
4

Standards:
LA.4.4.2.1
LA.4.5.2.1
LA.4.5.2.3

Objectives:
The student will...
Be able to identify the characteristics of the animals that lived within prehistoric Florida and write a song about one of them.

Vocabulary:
characteristic

Materials:
Pictures of prehistoric animals,
Woolly Mammoth by Aliki,
Transparency of song of choice from Wee Sing Dinosaurs, Other resources about prehistoric Florida animals, Wee Sing Dinosaurs tape
Florida textbook on Early Florida Indians
Art prints from Dean Quigley, artist
Transparencies of prehistoric animals of Cenozoic period from Milliken
Chart paper, Manila paper for each student
White paper for each student

Procedure:
1. Review the prehistoric animals found in Florida using the resource books, the transparencies, and the pictures and artwork.
2. On chart paper, brainstorm with students to create a table of animals and their characteristics.
Write all the animals in the left column. In the right column, list the main characteristics of the animals.

3. Tell students they are going to be choosing a prehistoric animal from the list and using its characteristics to write a song about it.

4. Ask students to listen to a song about a dinosaur (this is a good time to remind students about no dinosaurs in Florida) and they can use the song as a model to write their own.

5. Play the song once for students to listen to and enjoy.

6. Play the song again, this time with the transparency of the words on the overhead.

7. After listening to the song a second time, discuss how the song is written (the words about the characteristics of the animal, the use of a chorus and verses, for example).

8. Choose a prehistoric Florida animal from the chart as a class to write a class song about.

9. Write the song lyrics with student ideas, including the prehistoric animal’s characteristics. Have the students choose a melody (familiar or not) to sing the song to.

10. Have the students choose their own prehistoric Florida animal from the chart to write a song about. Have them go through the writing process of pre-writing, drafting, revising, editing and publishing.

11. Have students write their published copy on a white sheet of paper. Encourage the students to decorate around their lyrics with pictures depicting their prehistoric animal, as well as prehistoric plants and Indians.

12. Ideas for publishing include compiling all into a class songbook, a time to sing all the songs, or sharing with other classes.

Analysis/Conclusion:
The assessment of this lesson will be how well the student integrates the information about one of the prehistoric animals into song lyrics, including its characteristics.

Extension:
This lesson can explore the career of paleontologist, as students become paleontologists and research the animal of their choice.

Teacher Notes:
Make a two-column chart. Label the left column “Animals” and the right column “Characteristics.”
Have *Wee Sing Dinosaurs* tape and tape player ready to play, cued to the song of your choice.
Have all other materials on hand and ready.
Lesson 11: Phosphate: What Do You Know?
Author: Sandra Bush

Introduction:
In Florida, phosphate is found 10-50 feet below the ground and is mined by huge draglines. Phosphate is an ingredient in thousands of products people use every day. However, its main use is in fertilizer and animal food.

This lesson builds background by helping students recall any prior knowledge about phosphate and making connections with their lives.

Activity:
Students will, through the use of K/W/H/L chart, to record the information they already know as well as any connections and questions that may arise during the discussion. This chart is kept out and referred to as needed during the unit, including listing information learned at the end.

Estimated Time:
One—30 minute class period

Grade Level:
4

Standards:
LA.4.5.2.1
LA.4.5.2.3
SC.4.E.6.3
SC.4.E.6.6
SC.4.L.17.2
SC.4.L.17.3
SC.4.N.1.1
SC.4.N.1.2

Objectives:
The student will…
Recall prior knowledge about phosphate and its connection with their lives.

Vocabulary:
phosphate
industry
mining
mineral

Materials:
Chart paper
Marker
White paper for each student

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Procedure:
1. Begin the lesson by asking the students to think about the question “What is phosphate and what does it have to do with me?” Explain that you are going to list the things that they already know under the K and any question that may arise as they are thinking under the W. They will then give ideas about where they might find answers to their questions under the H and later fill in what they learned under the L.
2. Give time for the students to give responses about what they already know about phosphate and record them.
3. Be sure you allow time for questions to also be recorded as they come up. Sometimes, a mistaken bit of information is given by a student. The teacher or another student may challenge the information and it becomes a question to be researched.
4. After everyone has shared, tell the students they will find out if they are correct as well as answers to their questions as they study the unit. The corrections and answers may be added to the chart at any time during the unit.
5. At the end of the unit as a good review, the students fill in the L part of the chart with all the new information learned.

Analysis/Conclusion:
No formal assessment of this lesson will be done because it is the beginning lesson of the phosphate section of the unit, although this lesson does provide a beginning assessment of the students' prior knowledge about phosphate and its connection to their lives. This can be compared with the students' gained knowledge with the completion of the last column at the end of the unit. Refer to the chart throughout the unit to either affirm or disprove what has been written and to answer or add to the questions.

Extension:
Extension Activity, page 106. Use the poem Earthly Bites for reading fluency practice.

Some mention of careers may come up in this beginning activity. They will probably be in the area of students’ parental involvement in phosphate mining. A more in-depth study of these will be done later in the unit.

Teacher Notes:
Set up chart stand and paper in a group setting.
Create headings “Know,” “What I Want to Know,” “How I Am Going to Find Out,” and “Learned.”
### Know/Want to Know/How I Plan to Learn/Learn Chart

<table>
<thead>
<tr>
<th>What do I know about?</th>
<th>What do I want to know about?</th>
<th>How do I plan to learn about?</th>
<th>What have I learned about?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>
Lesson 12: Properties of Three Rock Types
Author: Linda Hughes

Introduction:
Igneous rocks are formed by melting and cooling of the rock material underground. Metamorphic rocks are formed from heat and pressure underground. Sedimentary rocks are formed from weather and erosion above the ground.

The purpose of this lesson is to teach the students to identify and classify the three kinds of rocks.

Activity:
This activity has the students classifying different rocks as either igneous, sedimentary, or metamorphic using the Washington Rock Kit.

Estimated Time:
Three—45-60 minute class periods

Grade Level:
4

Standards:
SC.4.E.6.1

Objectives:
The student will…
Identify and classify rocks as either metamorphic, igneous, or sedimentary.

Vocabulary:
igneous
metamorphic
sedimentary

Materials:
Teacher-made rock kits with samples of igneous, metamorphic and sedimentary rocks (1/2 an egg carton with 6 sample rocks)
Flow chart
Answer key (teacher-prepared to match rock kits)
Washington Rock Kit
Three Kinds of Rocks Chart
Various rocks and minerals books  
Science textbooks  

**Procedure:**  
**Day 1**  
1. Introduce the three kinds of rocks by holding up one of each kind (don’t tell which is which) and have the students tell you the similarities and differences of each. You may want to write this on a chart so these can be your characteristics of the three kinds.  
2. Give each kind of rock a name and discuss any other characteristics not mentioned by the students.  
3. Give each student a *First Field Guide Rocks and Minerals* book. Have them create a tree map of the three kinds of rocks with three characteristics of each and three examples of each from information found in the book.  
4. After students have finished, discuss information found.  

**Day 2**  
1. Students will identify properties of the 3 types of rocks.  
2. Using a flow chart they will classify given sets of rocks as metamorphic, sedimentary or igneous and record their findings in their journals.  
3. The teacher should work through one or two examples with students. Students will work independently at their seats.  
4. Class will go over the remaining rocks in kits at end of their work period. Students who finish early may examine a Washington Rock Kit, observing differences among the rocks and identifying rocks of interest.  

**Day 3**  
Using the rock chart, their textbook, and rock and mineral books, have the students fill in the three columns on the chart; characteristics, how they were formed, and examples.  

**Analysis/Conclusion:**  
Successful identification and use of flow chart will demonstrate understanding. Teacher observations as to student effort, cooperation and discussion with classmates may also be used.  

**Extension:**  
Rock hounds, geologists, and persons who work in rock shops may be among those discussed with this lesson.  

**Teacher Notes:**  
Copies of flow chart and rock kits will be needed for each team of students. Number of teams is determined by number of rock kits provided.
Rock Identification Key

1.  
   A. Rock is made up of mineral grains that you can see. Then go to # 2.  
   B. Rock is not made up of visible mineral grains. Then go to #5.

2.  
   A. Rock is made up of mineral grains that look melted together (interlocked). Then go to #3.  
   B. Rock is made up of mineral grains that look glued together (non-interlocked). Then go to #6.

3.  
   A. Mineral grains in the specimen all look to be the same kind. The rock is metamorphic.  
   B. Mineral grains in the specimen are of two or more different types. Then go to #4.

4.  
   A. Mineral grains in the specimen are not lined up; they are distributed in a random pattern. The rock is igneous.  
   B. Mineral grains in the specimen are lined up; they show a definite arrangement or bonding. The rock is metamorphic.

5.  
   A. Rock is either glassy or frothy (has small holes). The rock is igneous.  
   B. Rock is made up of strong, flat sheets that look like they will split off into slate-like pieces. The rock is metamorphic.

6.  
   A. Rock is made of silt, sand, or pebbles cemented together; it may also have fossils. The rock is sedimentary.  
   B. Rock is not made of silt, sand, or pebbles but contains a substance that fizzes when vinegar is poured on. The rock is sedimentary.
### Three Kinds of Rocks

<table>
<thead>
<tr>
<th>Metamorphic</th>
<th>Igneous</th>
<th>Sedimentary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Kinds**

- How they are formed
- How to identify
- Examples

**Name:**

**Date:**
Supplementary Activity 1

Knock, Knock Jokes

Rock rock. Who’s there? Slate. Slate who? It’s slate. Time to go to bedrock!

Rock rock. Who’s there? Coal. Coal who? If you’re coal, I’ll warm you up!

Rock rock. Who’s there? Granite. Granite who? Don’t take all rocks for granite!


Familiar Expressions

Between a rock and a hard place.
Old as dirt.
Hard as a rock.
Solid as a rock.
You’ve got rocks in your head!
He’s as old as a fossil!
Supplementary Activity 2

This excerpt from *How to Dig a Hole to the Other Side of the World* is about taking an imaginary journey through Earth and discovering what’s inside.

Find a soft place.
Take a shovel
and start to dig a hole.
The dirt you dig up is called loam.
Loam, or topsoil, is made up of
tiny bits of rock
mixed with many other things,
such as plants and worms that died
and rotted long ago.

When you have dug through the topsoil
you will come to clay or gravel or sand.
The digging will be harder.
When the hole is five or six feet deep,
you had better ask a friend to help.
He can pull up the clay or gravel
in a bucket,
while you stay at the bottom of the hole
and keep digging.

Sooner or later you will come to rocks;
all sorts of rocks; big rocks, little rocks;
granite, limestone, sandstone.
If you started your hole in Africa
you might find diamonds.
In Brazil you might find emeralds.
In other places you might find coal
or gold or silver.
Wherever you dig watch for
old bones and shells.
The bones of many animals—
dinosaurs, giant tigers, turtles,
and other creatures of long ago—are buried everywhere.

If you find some, dust them off carefully
and save them.

Supplementary Activity 3

Starting Out
by Faith McNulty

1. What is another word for loam? What is it made up of?

2. What types of rocks might you find in your hole?

3. Emeralds are found in:
   a. Africa
   b. Brazil
   c. Greenland

4. What gem might be found in a hole in Zimbabwe?

5. Which of the following is a fact found in the reading?
   a. Rocks are fun to save.
   b. Digging a hole is hard work.
   c. In a hole, you might find coal, gold or silver.

6. Write to explain why you would need a friend to help you dig a hole that is five or six feet deep.

7. Why should you save a rock, mineral or fossil that you find?
Supplementary Activity 3 – Answer Key

Starting Out
by Faith McNulty

1. What is another word for loam? What is it made up of?

   Another word for loam is “topsoil.” It is made up of tiny bits of rock mixed with many other things, such as plants and worms that died and rotted long ago.

2. What types of rocks might you find in your hole?

   Granite, limestone, and sandstone.

3. Emeralds are found in:

   a. Africa
   b. Brazil
   c. Greenland

4. What gem might be found in a hole in Zimbabwe?

   Diamonds (Zimbabwe is found in Africa)

5. Which of the following is a fact found in the reading?

   a. Rocks are fun to save.
   b. Digging a hole is hard work.
   c. In a hole, you might find coal, gold or silver.

6. Write to explain why you would need a friend to help you dig a hole that is five or six feet deep.

   Example from excerpt:
   He can pull up the clay or gravel in a bucket, while you stay at the bottom of the hole and keep digging.

7. Why should you save a rock, mineral or fossil that you find?
Lesson 13: The Rock Cycle
Author: Sandra Bush

Introduction:
The three kinds of rocks (metamorphic, igneous, and sedimentary) can all change from one kind of rock to another. If heat and pressure is applied, a rock will become metamorphic. If melting and cooling occurs, a rock will become igneous. Finally, weather and erosion will cause a sedimentary rock to form from any one of the other kinds of rocks.

This lesson helps students understand the processes rocks go through in the rock cycle to change from one kind of rock to another.

Activity:
In this activity, the students will illustrate the rock cycle and the process applied to change it.

Estimated Time:
One—45 minute class period

Grade Level:
4

Standards:
SC.4.E.6.1
SC.4.E.6.4
SC.4.N.1.3
SC.4.N.1.6
SC.4.N.1.7

Objectives:
The student will...
1. Explain and model the steps in a rock cycle.
2. Describe the processes that take place during the rock cycle.

Vocabulary:
pressure
sedimentary
igneous
cycle
metamorphic

Materials:
Construction paper
Colored pencils or crayons

Procedure:
1. Review the three kinds of rocks and how each is formed.
2. Define a cycle and relate this to rocks. Discuss how one rock can change into another depending on the process applied. Be sure to discuss the location of the rock in relation to the
earth’s surface and how it determines what process could be applied. (Above ground-
weathering produces sedimentary, below ground heat and pressure produces metamorphic,
extreme underground heat produces igneous.)
3. On construction paper, have the students illustrate the rock cycle in color, labeling each kind
of rock and the process applied to change it.
4. Have the students write a summary of their cycle.

**Teacher Notes:**
Have materials on hand.
Lesson 14: Sedimentation
Author: Linda Hughes

Introduction:
Sedimentation is the process in which rainwater and water run-off collects sand, silt, and clay. The water then deposits the sand, silt, and clay on land or in lakes or oceans to form hard crystals and different layers of rock. The result of sedimentation is the formation of sedimentary rock.

The purpose of this lesson is for students to observe how sedimentation works and relate it to sedimentary rock formations.

Activity:
In this activity, the students will create and observe sedimentation in action and how it relates to the formation of sedimentary rocks.

Estimated Time:
One—45 minute class period

Grade Level:
4

Standards:
SC.4.E.6.4

Objectives:
The student will...
1. Observe the result of sedimentation.
2. Know how sedimentary rock is formed.

Vocabulary:
sedimentation

Materials:
4 oz. baby food jars
Bucket of white sand
Bucket of soil
Bucket of clay
1 Box chalk or collected chalk leftovers
Water
Waxed paper
Styrofoam cups
Wooden stirring sticks
Newspaper
Copy of directions for each team
1 oz or 52cc plastic scoops

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Procedure:
Teacher will demonstrate the activity and read the directions from the worksheet. Students will then read and follow the directions from the worksheet after they collect their materials.

1. Put a combination of 1/3 sand and 2/3 soil into the baby jar. Mix together. Then add the baking soda and chalk dust to the mixture. Mix in a little water to break up any clots.
2. Fill the jar 2/3 of the way with water. Screw on the cap, place a paper towel over the cap, hold jar and cap securely and shake the jar.
3. Stand the jar upright on a table and observe. Record findings on the worksheet after 5 minutes, 10 minutes, 30 minutes and 24 hours. These jars may be kept indefinitely for observations.
4. The students should see the slow separation of materials as time goes by.
5. Lead a discussion with students on how what they just observed relates to the formation of sedimentary rocks.

Analysis/Conclusion:
Teacher observation of students’ effort, student ability to cooperate with others to complete a task, and student observations.

Extension:
Geologists, mining engineers, archaeologists, and paleontologists may be discussed in this lesson.

Teacher Notes:
Teacher will have collected white sand, soil and clay. Soil or sand may have grass or leaf litter in it. Clay may be left out if soil is muck-like or if potting soil is used.
Lesson 15: Phosphate Vocabulary
Author: Sandra Bush

Introduction:
The mining process begins with clearing trees and vegetation from the land and relocating endangered species. A dragline is used to dig through layers of the earth. The overburden, or top layers of soil, are removed to reach the matrix which contains the phosphate rock, clay and sand. The matrix is then dumped into a pit and broken up with high-pressure water guns to make a muddy consistency, or slurry. The slurry is then pumped through a long pipeline to the beneficiation plant, where the clay and sand are separated from the phosphate rock. The phosphate rock is transported to a chemical processing plant to produce the phosphoric acid used to make fertilizer. The sand is sent back to the mine site to be used for reclamation and the clay is sent to a settling pond where it is left to dry. The mined land is then reclaimed into useable land through contouring and replanting. Some land is reclaimed into wetlands, forested uplands and pasture, while other land is turned into farmland, housing developments, and recreation facilities.

Activity:
This activity is to build vocabulary for the phosphate and mining process. The students will determine word definitions from context clues and give a definition and a sentence for each.

Estimated Time:
One—45 minute class period

Grade Level:
4

Standards:
LA.4.1.7.8
LA.4.4.2.2
LA.4.5.2.1
LA.4.5.2.3
SC.4.E.6.1
SC.4.E.6.2
SC.4.E.6.3
SC.4.E.6.6

Objectives:
The student will…
Build vocabulary for the phosphate and mining process.

Vocabulary:
phosphorus slurry
phosphate matrix
mining overburden
dragline contouring
minr cuts reclamation
Materials:
Notebook paper
Manila paper
Pencils
Colored pencils or crayons
Chart paper
White paper for each student

Procedure:
1. Begin the lesson by reading aloud the words and have students make a copy of the list, leaving four lines between each word.
2. Read, or have a student read, the first context sentence and discuss the implied meaning of the word from the sentence.
3. Go over the word's definition in more depth, adding to the student-generated meaning as needed. Have the students write these meanings on their paper as they are given.
4. When all the words are defined, have the students write an original sentence for each of the words under its definition.
5. As a homework assignment, have the students expand (add adjectives, prepositional phrases etc.) and illustrate 2-5 sentences each night on manila paper. Paper may be folded in half or fourths for expanded sentences.
6. Create a vocabulary board in the room with examples of the words expanded and illustrated. This makes a good point of reference during the unit as the words appear in lessons.

Analysis/Conclusion:
Assessment of this lesson will be done through observation of student work and a formal vocabulary test. Informal assessment will also take place throughout the unit as students use the vocabulary in their work and writing.

Extension:
Some mention of careers may come up in this activity as definitions are expanded. A more in-depth study of these will be done later in the unit.

Teacher Notes:
Give students a list of vocabulary words.
Have an overhead and transparency of the context sentences to be used with the vocabulary.
Vocabulary Context Sentences

1. In Florida phosphate mining, the top layer of soil, called **overburden**, must be removed before mining.

2. The **matrix**, a layer of phosphate rock mixed with clay and sand, is under the overburden.

3. The huge **dragline** is used to scoop the matrix containing phosphate rock out of the ground.

4. At the **washer**, the sand and clay are separated from the phosphate rock.

5. **Phosphorus** is a nutrient needed by every animal and plant.

6. At the **processing** plant, phosphate rock is mixed with sulfuric acid to form **phosphoric acid**, a main ingredient in fertilizer and animal feeds.

7. The sand from the washer is used to fill the holes made by mining and then the overburden is put back on top. This process, called **reclamation**, creates land that can be reclaimed for another use.
Lesson 16: Mineral Detectives
Author: Linda Hughes

Introduction:
Determining the hardness of an unknown rock or mineral is often very useful in the identification process. Hardness is a measure of a mineral's resistance to abrasion and is measured against a standard scale — the Mohs Scale of Hardness. The Mohs Scale was named after Frederick Mohs (1773-1839), a German mineralogist. It consists of 10 minerals, all of them but the diamond fairly common ones, with known hardness. They are organized from softest (1) to hardest (10).

They are:
1. Talc (H=1)
2. Gypsum (H=2)
3. Calcite (H=3)
4. Fluorite (H=4)
5. Apatite (H=5)
6. Orthoclase (H=6)
7. Quartz (H=7)
8. Topaz (H=8)
9. Corundum (H=9)
10. Diamond (H=10)

The purpose of this lesson is to have the students test rock samples for hardness against a standard — the Mohs Scale of Hardness.

Activity:
In this activity, the students will become mineral detectives by gathering data about the physical properties or rock samples. By making observations and testing samples, they will identify the scale of hardness for each rock.

Estimated Time:
One—45 minute class period

Grade Level:
4

Standards:
SC.4.E.6.2

Objectives:
The student will…
Use different methods to test rocks and minerals for hardness, a physical property, and use the information to identify the kind of rock or mineral.
Vocabulary:
Mohs Scale hardness
luster property

Materials:
Teacher-prepared rock kits (1/2 egg carton with samples)
Pennies
Baby food jars
Unpolished tiles
Transparency of testing chart
Flow charts for each team of students
Mohs sample rock kits
Washington rock kits
FIPR rock kits
Magnets
Boxes of miscellaneous rock samples
Copies of the Mohs Scale of Hardness

Procedure:
1. The teacher will demonstrate the process of testing a rock to the class and recording the result on a chart. The class should work through a couple of samples together before students work independently or with a team.
2. Students should use each rock sample to do a scratch test on a penny, then glass. Observations of the rock color and color on the streak plate should be recorded on chart.
3. FIPR mini posters are great charts to use for student teams instead of self-made charts. See attached sample form.

Analysis/Conclusion:
Students will be evaluated by their ability to make and record observations.

Extension:
This activity may connect to careers such as geologists or careers related to the mining industry.

Teacher Notes:
Teacher will need rock kits, testing materials and flow chart prepared in advance.
Concepts of luster, hardness and Mohs Scale of Hardness should be taught as part of vocabulary.
### Scratch Test Record Sheet

<table>
<thead>
<tr>
<th>Name</th>
<th>Color</th>
<th>Scratch A Penny</th>
<th>Streak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>WILL NOT SCRATCH</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>METALLIC LUSTER</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SCRATCHES PENNY</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NOT GLASS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>SCRATCHES GLASS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Minerals and Their Characteristics

**Biotite**
Does not scratch a penny; leaves colorless streak; has a glassy or pearly luster, peels off in layers; commonly is black, brown, or dark green.

**Calcite**
Scratches a penny but does not scratch glass; leaves a colorless streak; nonmetallic luster may appear glassy; some faces are rhomboids; common colors are white and gray.

**Fluorite**
Scratches a penny but not glass; leaves colorless streak; common colors are clear, white, green, and purple.

**Galena**
Will not scratch a penny; leaves a gray streak; has metallic luster, feels heavy for its size; faces are square, common colors are lead gray and silver.

**Graphite**
Will not scratch a penny; leaves a gray streak on paper; may appear either metallic or nonmetallic; common colors are black and gray.

**Halite**
Will not scratch a penny; leaves colorless streak, nonmetallic luster may appear glassy; some faces are rectangular; tastes salty; common colors are colorless, white, and brown.
Minerals Detective Record Sheet

MINERAL DETECTIVE

Place your mineral(s) here, then move them downward observing their individual physical characteristics.

SMELL

LUSTER

MAGNETIC

COLORS

STREAK

FEEL

HARDNESS

MOHS SCALE OF HARDNESS

Finger nail (Hardness ≤ 2)    Penny (Hardness = 3)    Steel blade (Hardness = 5)    Glass quartz (Hardness = 6)    Steel & glass (Hardness > 7 & over)

WEIGHT
Lesson 17: The Way We Mine the Land
Author: Sandra Bush

Introduction:
This lesson teaches the steps in the phosphate mining process.

Activity:
After viewing the mining process, the students will create and illustrate a diagram of the steps and then use expository writing to explain them.

Estimated Time:
Two—45 minute class periods
(Some students may need extra time to complete the diagram)

Grade Level:
4

Standards:
LA.4.5.2.1
LA.4.5.2.3
SC.4.E.6.3
SC.4.E.6.6
SC.4.L.17.2
SC.4.L.17.3
SS.4.A.6.1
SS.4.E.1.2
VA.A.1.2.1

Objectives:
The student will…
Demonstrate an understanding of the process used in the mining of phosphate and be able to explain the steps involved.

Vocabulary:
Covered in prior lesson

Materials:
Phosphate Story diagram (transparency)
Blank Phosphate Story diagrams for each student
Colored pencils or crayons
Overhead projector
Video Mining Phosphate
VCR
Procedure:
1. Begin the lesson by showing the video *Mining Phosphate*. Tell the students to take notes on the process.
2. Discuss each of the steps in the mining process using the transparency *Phosphate Story*. The steps pictured are as follows (beginning in the upper left-hand corner):
   - Phosphate is found in ordinary land.
   - Environmental areas are explored for potential impacts of mining.
   - Plans for mining and reclamation are often designed using computer technology like GPS and AutoCAD programs.
   - The land is cleared using a bulldozer. Topsoil from areas like wetlands and scrub may be moved to make use of the soil’s organic matter or propagules in reclamation.
   - Draglines are used to remove the earth above the phosphate rock, known as overburden. Overburden is dumped to the side in spoil piles to be used later in reclamation. Once the overburden is removed, the dragline digs out the matrix and dumps it into pits where it is broken up with high-pressure water guns into a slurry.
   - The slurry is then pumped through a pipe system to the flotation/beneficiation plant.
   - At the plant, the phosphate is separated from the clay, sand, and water and is shipped out by truck and rail to chemical processing plants.
   - The land is then reclaimed. Reclamation can include creating wetlands, uplands and other habitats, farmland, housing developments, parks, golf courses, etc.
3. Hand out the blank worksheets of the *Phosphate Story* and have the students illustrate the process for themselves using colored pencils or crayons.
4. The following day, have the students use this diagram to explain how phosphate is mined in an expository writing exercise. Use the following prompt: Phosphate mining has many steps. Write to explain each of the steps that a phosphate company must go through to get phosphate from the ground to a fertilizer plant.

Analysis/Conclusion:
Expository prompt—Write to tell how phosphate is mined.

Extension:
Some mention of careers (environmental regulators, mine operators, machine operators, etc.) may come up in this activity. A more in-depth study of these will be done in the next lesson of this section of the unit.

Teacher Notes:
Set up VCR and overhead projector
Lesson 18: Jobs Available in Phosphate Mining
Author: Sandra Bush

Introduction:
A specific job list is included for this lesson. Jobs may be specific or general, depending on the maturity level of the students.

Activity:
This activity has students connect the jobs necessary to accomplish each step in the mining process. They then choose a job and further research that job using an Occupational Dictionary and Occupational Handbook.

Estimated Time:
One—45 minute class period

Grade Level:
4

Standards:
LA.4.5.2.1
LA.4.4.2.2
LA.4.5.2.3
SC.4.E.6.3
SC.4.E.6.6
SC.4.L.17.2
SC.4.L.17.3
SS.4.A.6.1
SS.4.E.1.2

Objectives:
The student will…
Demonstrate an understanding of the process used in the mining of phosphate and the careers involved in each step.

Vocabulary:
surveyor
environmental engineer
geologist
mining engineer
machine operators
laborer
foreman
supervisor
chemist
Materials:
*Phosphate Story* diagram (transparency)
Overhead projector
Blank *Phosphate Story* diagrams created by each student in previous lesson
5 x 8 index cards

Procedure:
1. Begin the lesson by reviewing the previous lesson on the mining process referring to the "Phosphate Story" diagrams created by each student.
2. Discuss each of the steps in the mining process using the transparency *Phosphate Story*. This time list all jobs involved in each step under the picture. According to the maturity of the students, jobs may be presented very basically (surveyors, environmentalists, bulldozer operators, truck drivers, dragline operators, etc.) or more in depth, as listed on the attached pages.
3. Have the students fill in their diagrams with the careers discussed under each oval.
4. Have students each choose a job that interests them and look up the job in the *Occupational Dictionary* and the *Occupational Handbook*. They then may write a job description and other information about their chosen job on a 5 x 8 card. Possible questions might be:
   - What education is required?
   - What skills are necessary?
   - What is the pay scale?
   - Future outlook for the job?
5. These cards can be used to share with the class and then bound into a class book entitled "Working in the Phosphate Industry."

Analysis/Conclusion:
Completed diagram and class book of job cards.

Extension:
This is a school-to-work lesson with a focus on the many careers in the phosphate industry.

Teacher Notes:
Set up overhead projector
The Permitting Process of the Phosphate Industry

I. Land Acquisition
   A. Land Acquisition
      1. Land Manager negotiates possible sale based on reserve on landowner’s property.
      2. Reserve Analyst coordinates comprehensive drill plan to explore reserve base.
         a. Surveyors set up a grid of the property to drill.
         b. Drillers core-drill the property.
         c. Geologists cut the core to log the drill data and strata.
         d. Metallurgical technicians grade the ore for quality and quantity in the strata.
         e. Reserve Analyst evaluates economics of ore.
      3. Environmental study done to assess any potential permitting problems.
         a. Environmental technicians sample water and look for potential liabilities such as Indian mounds, endangered species, etc.
         b. Permitting biologists assess wetlands and wildlife habitat.
      5. Land Manager is given a set of parameters for the purchase of the property.
   B. Permitting and Developing Property for Mining
      1. Development of Regional Impact (DRI)
         a. Company coordinates impact study with the following agencies:
            • Department of Community Affairs
            • Regional Planning Council
            • Department of Environmental Protection
            • U.S. Army Corps of Engineers
            • U.S. Environmental Protection Agency
            • U.S. Wildlife Service
            • Florida Game and Freshwater Fish Commission
            • Southwest Florida Water Management District
            • County Commissioners
            • County Zoning and Planning
            • Department of Transportation
      2. Conceptual Plan
         a. Assess the property to determine land uses.
            • Aerial photographers supply data to surveyors and mappers.
            • Biologists mark boundaries of wetlands.
            • Surveyors locate boundaries of wetlands and arrive at acreages.
            • Biologists locate wildlife habitat.
            • Hydrologists evaluate watershed basins.
            • Reclamation engineers design new land forms based on the information on an acre-for-acre basis.
            • CAD operators work with surveying and mapping along with the engineers to design the new programs.
            • Company submits information to DEP reviewers to determine feasibility of design.
      3. Permitting
         a. Attempt to obtain permission to mine wetlands under state and federal jurisdiction.
            • Permitting biologists obtain all information needed from reclamation, mining surveying, hydrologists, and the DRI coordinator.
            • Information is submitted to agencies for review. If the permit is granted, mining can begin.
C. Job Positions
1. Mining
   a. Vice President of Minerals
      • Mine Manager
      • Production Superintendent
      • Beneficiation Superintendent
      • Assistant Superintendents
      • Shift Supervisors
      • Float Crew Supervisors
      • Flotation Supervisors
      • Production Support Superintendent
      • Maintenance Superintendent
      • Maintenance Supervisors
      • Dragline Operators
      • Dragline Oilers
      • Float Crews
      • Waste Systems Operators
      • Equipment Operators
      • Washer Operators
      • Flotation Operators
      • Loadout Operators
      • Laborers
      • Mine Clerks
      • Maintenance Planners
      • Geologists
      • Mine Planners
      • Safety Supervisors
      • Maintenance crews
2. Technical Services
   a. Vice President of Technical Services
      • Environmental Manager
         – Reclamation Manager
            Reclamation Engineers
            Reclamation Field Supervisors
            DEP Coordinator
            CAD Operators
         – Environmental Superintendent
            Environmental Supervisors
            Environmental Technicians
         – Permitting Superintendent
            Biologists
            Permitting Technicians
         – DRI Coordinator
         – Mapping & Surveying Superintendent
            Survey Supervisor
            Mapping Supervisor
            Survey Crews
Lesson 19: Reclamation: Putting it in Order
Author: Sandra Bush

Introduction:
*From Wetlands to Mining to Reclamation* begins before the mining process with a picture of an original wetland showing the larger plants and animals living in the area. It then shows mining with a dragline making cuts. The next picture in the series shows the cuts and spoil piles where the overburden is piled up until all mining is complete. The reclamation is illustrated with large bulldozers, pan scrapers and other equipment contouring the land, putting it back into a useable form. The final illustration shows a reclamation site with small plants and flags staked beside them to indicate that replanting has taken place. Allow the students to be imaginative with their predictions and illustrations.

The purpose of this lesson is to have students review the reclamation process and then make a prediction of what will happen to the land in the future.

Activity:
In this activity the students will go through the steps of reclamation as illustrated on the *From Wetlands to Mining to Reclamation* paper. Color, cut out, arrange them in order and write captions for each. They will then predict what the reclaimed land will look like 50 years later and illustrate their prediction on the blank area of their paper.

Estimated Time:
One—45 minute class period
(Some students will require extra time with illustrations)

Grade Level:
4

Standards:
LA.4.4.2.2
LA.4.5.2.1
LA.4.5.2.3
SC.4.L.17.4
SS.4.A.2.1

Objectives:
The student will…
Recall prior knowledge about phosphate mining and reclamation and form a prediction of what the future holds for the land.

Vocabulary:
reclamation
contouring
spoil piles
wetland
Materials:
Manila paper 12 x 18  
Individual copies of *From Wetlands to Mining to Reclamation*  
Colored pencils or crayons  
Video *Mining Phosphate*

Procedure:
1. Begin the lesson by asking the students to recall what they know about the reclamation process.  
2. Using the transparency *From Wetlands to Mining to Reclamation*, have the students discuss what is being shown in each picture and what part of the reclamation process it represents.  
   • Replanted area - note little flags by each plant and absence of large water plants  
   • Mine cut and spoil piles - note water in the center of cut  
   • Mining process, dragline digging cut  
   • Blank for student's prediction of what will be there 50 years from now  
   • Original wetland—note animal life and larger water plants  
   • Beginning of the reclamation process, contouring the land and using spoil piles to fill in and rebuild the land.  
3. Hand out the individual copies and have the students color the pictures they have just discussed. The blank picture is to be drawn and colored to show what the student thinks the land will look 50 years in the future.  
4. After the pictures are colored, have students cut them apart and arrange them in order, gluing them down on a large sheet of manila paper (vertically). The students should leave enough room under each to write a caption explaining the picture.  
5. When all pictures and captions are completed, have them share with their teammates, especially their predictions for the future of the land.

Analysis/Conclusion:  
The students’ product will be used as an assessment of this lesson. Be sure and accept any reasonable prediction for the last picture. Many students will predict development, building, etc. Others will argue for the value of preserving wetlands. This often lends itself to a very good class discussion on different values and being able to present good reasons for your views while still being considerate of others and their opinions.

Extension:  
Many careers are included and can be discussed with reclamation: engineers, developers, laborers, biologists, supervisors, inspectors and regulators for government agencies, machinery operators, etc.

Teacher Notes:  
View the video - *Mining Phosphate*: Field trip to a mining area and a reclamation site  
Have individual copies run of *From Wetlands to Mining to Reclamation*  
Transparency of *From Wetland to Mining to Reclamation*
“From Wetlands to Mining to Reclamation” Sequencing Activity
Lesson 20: Phosphate in Our Food
Authors: Sandra Bush

Introduction:
Phosphate is a substance needed by plants and animals for healthy growth and development. We get a lot of the phosphate we need from the foods we eat. Many other common products contain phosphate as an ingredient, such as soaps, detergents, toothpaste, and carbonated drinks. Plants get phosphate from fertilizer and the earth.

This lesson is to help students make a connection between phosphate and the foods and products in their homes.

Activity:
In this activity students will compile a collection of everyday items they find in their home that contain a form of phosphate or phosphoric acid.

Estimated Time:
Two—30 minute class periods

Grade Level:
4

Standards:
LA.4.1.7.3
LA.4.2.2.2
SC.4.E.6.3
SC.4.L.17.2
SC.4.L.17.3
VA.A.1.2.1

Objectives:
The student will…
1. Identify every day products containing forms of phosphate.
2. Collect food items from home that contain forms of phosphate.
3. Highlight labels on food items that contain forms of phosphate.

Vocabulary:
phosphate
phosphorous
phosphoric acid
product
chemical

Materials:
Worksheet Phosphate In Our Food
Phosphate from Florida newspaper
Various products containing phosphate, phosphorous, phosphoric acid in their labels.
Procedure:
1. Ask students what foods they think contain phosphate.
2. Read in the newspaper Phosphate from Florida, Phosphorus: A Link in the Food Chain, Florida Rock Stars in Film, Then Goes on Road, and Rocks in Your Lunch Box.
3. From the articles, create a class list of the products mentioned. Show some of the sample products, reading the ingredients list. Be sure to point out that products containing phosphate may be labeled as phosphorus or phosphoric acid.
4. After completing the discussion of products containing phosphate, assign homework to identify at least six products found at home containing phosphate. Students will illustrate the Phosphate In Our Food worksheet with at least six of the items found and label each with the phosphate it contains.
5. Have the students bring in empty boxes, cartons, cans, etc. with phosphate highlighted on the ingredients list. We build a display of these items and continue adding items for about a week.

Analysis/Conclusion:
The assessment for this activity is the completed drawing and labeling of phosphate containing products.

Extension:
Have the students compile a menu for their three meals for one day. Then, have them identify all products eaten that contained phosphate. This could also be extended by having the students figure the percentages of their daily phosphate consumption.

Teacher Notes:
Have copies of the worksheet run for each student.
Gather various products containing phosphate, phosphorous, phosphoric acid in their labels.
Phosphate in Our Food

Look in your home to find six foods at home that contain phosphate. Use the food’s ingredients listing to find out if it contains phosphate. Draw a picture of each item and label it with the phosphate product.

1. ____________________________  4. ____________________________
2. ____________________________  5. ____________________________
3. ____________________________  6. ____________________________
Lesson 21: Prehistoric Florida, Fossils and Phosphate

Author: Sandra Bush

Introduction:
Phosphate is a substance needed by plants and animals for healthy growth and development. We get a lot of the phosphate we need from the foods we eat. Many other common products contain phosphate as an ingredient, such as soaps, detergents, toothpaste, and carbonated drinks. Plants get phosphate from fertilizer and the earth.

This is the culminating lesson of the unit. The purpose of this unit is to tie together fossils, mining, and phosphate into a culminating booklet.

Activity:
In this culminating activity the students will each complete a booklet illustrating the formation of fossils and include one page on measurement, one of the uses of phosphate, and their page from Lesson 3, The Phosphate Story. They will also investigate everyday products that contain phosphate.

Estimated Time:
Several class periods are needed to complete the booklet.

Grade Level:
4

Standards:
LA.4.2.2.3
SC.4.E.6.3
SC.4.E.6.6
SC.4.L.17.2
SC.4.L.17.3
SS.4.A.6.1
SS.4.A.9.1
SS.4.E.1.2
VA.A.1.2.1

Objectives:
The student will…
1. Recall prior knowledge about prehistoric Florida, fossils and phosphate and their connection with each other.
2. Use prior knowledge of measurement.

Vocabulary:
prehistoric
fossil

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Materials:
Metric scales
Two sheets of construction paper per student
Rulers and tape measures
Colored pencils or crayons

Procedure:
1. After completion of the unit Prehistoric Florida, Fossils and Phosphate, the students will make their own Phosphate book. The text for each page can be found under the Teacher Notes.
2. Have the students illustrate the pages on fossil formation (1-3).*
3. Page 4 can be done in a series of pictures across the page or in a circular chart similar to The Phosphate Story.
4. Page 5, Fossil Finds, is to be completed after the field trip to the mines and a fossil hunt. Each student is to choose four fossils and sketch a picture of each, recording all measurements (length, circumference, width). Students then weigh and record their findings for each fossil. Each fossil should be identified using charts given or reference books on fossils. (This part of the lesson is further explained in the science Lesson 8 on weight and measurement.)
5. Page 6, Phosphate is Everywhere, is completed after a discussion of products containing phosphate and a homework assignment to identify at least six products found at home containing phosphate. (I have my students bring in empty boxes, cartons, cans, etc. with the ingredients list highlighted for phosphate. We build a display of these items and continue adding items for about a week.) Students then illustrate page 6 with at least six of the items found and label each with the phosphate it contains.
6. All pages are then combined and stapled into a booklet with a construction paper cover front and back. The front cover is illustrated and titled by the student.

*Pages 1-3 have been compiled from the work of fourth-grade students. These pages could easily be rewritten individually or as a cooperative effort for an original beginning to the booklet.

Analysis/Conclusion:
The assessment for this activity is the completed booklet. In assessing the students’ work be sure to check the illustrations for accuracy in depicting the paragraph on each page. Also check for accuracy in measurement on page 4 and correct identification of fossils.

Extension:
Creation of the booklet can lead to a discussion of illustrators and their job in accurately illustrating the written word and the importance of accurate scientific illustrations with the fossils.

Teacher Notes:
Have copies of each page of the booklet run for each student.
Gather scales, rulers, tape measures and other measuring tools (string, etc.)
Page 1 –
Millions of years ago, there were prehistoric animals in Florida. Some of these animals were the giant ground sloth, woolly mammoth, long-haired mastodon, and saber-toothed tigers. These animals found large grassy plains for food. As the sea rose, Florida became divided into small islands and many of these animals became trapped.

Page 2 –
During this time many sea animals swam over the parts of Florida that were covered by the seas. Some of the many sea animals were the dolphins, dugongs, whales, and sharks. As these animals died, their bones were covered with layers and layers of sand.

Page 3 –
The sea creatures’ bones were buried. As the bones were covered by sand they became fossils. As the bones were covered by sand the pressure caused them to turn hard. The mud filled the blood vessel holes in the bones after they were buried. The minerals and the mud helped turn the bones to fossils. Another kind of fossil is made of an imprint. Leaves, plants, and shells decomposed (rotted out) in the mud. They left an imprint as the mud hardened millions of years ago. Archaeologists discover the fossils that can tell us about long ago.

Page 4 –
The product, phosphate, goes through many steps from the ground to the factory. First, a hole is drilled into the land to test for phosphate. Second, an environmental study is done for the site to be considered for mining. If the company gets a permit to mine at the site, they begin clearing the land and start to dig. Then, they dump the phosphate into pits to be pumped to the plant. There they run the matrix through screens to separate the sand and clay from the phosphate. The phosphate is shipped to a processing plant where 90% is used to make fertilizer, 5% goes into animal feed, and 5% is used to make other products. Finally the land must be reclaimed so that animals or people can use it again.

Page 5 –
The worksheet can be found in Lesson 8, page 55.

Page 6 –
The worksheet can be found in Lesson 20, page 99.
Extension Activity: Poetry and Reading Fluency

Reading poetry on a daily basis is an effective way to enhance students’ reading fluency. It also exposes your students to different reading material that often uses words and phrases in rhythms, rhymes, and feelings/emotions that are expressed differently than expository or narrative text. We like to read one poem a week, reading it once a day. We choose from these ways to read it differently each day with the students:

Choral:
The entire class reads the poem together. We usually do this on the first day of the poem. Then, we discuss any vocabulary words or phrases that the students do not understand.

Actors:
Several students stand up front and act out the poem as it is read chorally with the rest of the class.

Echo:
One side of the class echoes the other side as the poem is read aloud chorally.

Hot Potato:
Using a soft ball you read a line of the poem and then quickly pass the ball to another student who reads the next line.

Popcorn:
Students pop up and read a line then call someone else’s name who in turn pops and to read the next line.

Round:
One group starts reading, another chimes in on the second line, and then another group joins with the third line, etc.

For homework during that same week, the students take the poem home and read it to five different people and get their signatures on the back. This extra fluency practice involves families in literacy.

Use the following poems with the different parts of the unit.
1. Early Native Floridians—Lesson Plan 5
2. Let’s Go On a Fossil Dig—Lesson Plan 6
3. Mammoth—Lesson Plan 9
4. Earthly Bites—Lesson Plan 11

Some of these poems have been adapted for the unit by its authors in order to create an integrated connection between the poetry and the unit.
Early Native Floridians
By Nate Ivv and Flora Dian

Early Native Floridians dwelled
   In this Florida land
Before the coming of the Spanish man

Many tribes inhabited the land
   Calusa, Timucuan, Ais, Appalachee, Tocobaga

With weapons and tools of stone and trees
   The Calusas hunted and fished for their food
   Living off the seashore

Forming large communities, Timucans and Appalachee
   Farmed the land
   Coming together as a great society

Settled in villages near rivers and lakes
   Cut trees and built houses
   And made roofs of palm

Using the land’s bounty to supply their needs
   Still protecting Florida’s resources

Slowly over time strangers arrive
   And the Explorers take over the land

What was to become of the Native ways
   When those strangers brought disease, slavery, and change?

   Early Native Floridians are no longer
   In this land called Florida.
Let’s Go on a Fossil Dig
By Foss L. Hunter

Let’s go on a fossil dig. What tools should I bring?
I know I’ll need a camera to take pictures of everything.
A tape measure I will use to check the distances between--
The fossils I find on the ground or by a big ravine.

My dad will bring his jackhammer to remove those large hard rocks.
And a geological hammer that will help him with smaller spots.
I will use a little brush to remove some sand and dust--
Once the rock has been removed this tool is quite a must.

If we find a fragile bone--I know just what to do.
We’ll wrap the bone in foil or maybe some tissue.
Some plaster of paris we will add in order to protect
The bone from breaking while we try to complete this tough project.

A magnifying glass I’ll take and keep right by my side.
I’ll look at teeth or small fossils that I hope we will find.
Now if we find a huge amount of fossils in the ground,
We might need ropes and pulleys to move them all around.

Let’s go on a fossil dig.
I know the tools I’ll bring.
Let’s go on a fossil dig
with supplies and everything.
Let’s go on a fossil dig;
my tools are now all packed.
A paleontologist I will be
I think I have the knack!
Mammoth!
by Justa Fossil and Ben Fossilized

The giant, hairy mammoth
was a prehistoric chap
with four fat feet to stand on
and a very bulging lap.

The scientists assure us
of a most amazing thing-
A mammoth really blossomed
when he had a chance to sing!

The mammoths, big as buses
who liked to sing in choruses
would close their eyes and harmonize
and sing most anything.

They growled and they yowled,
They deedled and they dummed;
They warbled and they whistled,
They trumpeted and they hummed.
They didn’t eat, they didn’t sleep;
They sang and sang all day.
Now all you’ll find are footprints
where they tapped the time away!

Adapted from “Brontosaurus” by G. Kredenser
Earthly Bites
by Ima Miner

Animals flee
as their habitat disappears
beneath the pounding footsteps.

With long neck bending down
to munch large bites of earth
the insatiable beast revolves
to deposit its mouthful on an ever mounting pile,
leaving behind large chasms of watery filled useless space.
Slowly turning, it swings, only to eat again

What is to be done?
What of the earthly bites left behind by this gigantic, hungry beast?

A plan in place, rebirth begins.
In comes the army of small earth movers
to push and move the leftovers about,
filling and creating a useful space.

And once again life returns.
FCAT Practice
Part 1

Phosphate from Florida - Newspaper

1. Why is phosphate mining an important industry? Use the article Mining for Food to give details and examples in your answer.

2. How many layers of the earth do you have to dig through to reach the limestone layer?
   a. three
   b. four
   c. five
   d. six
   Name the layers.

3. Create a pie graph to show the three major uses of Florida’s phosphate.

4. Explain why phosphate is considered “gray gold.” Use details and examples from Can You Dig It? in your answer.

©FLORIDA INDUSTRIAL AND PHOSPHATE RESEARCH INSTITUTE
5. Who discovered phosphate in Florida?
   a. Ft. Meade
   b. Juan Ponce de Leon
   c. Peace River
   d. Captain J. Francis LeBaron

   Explain when and where it was discovered using details and examples from *Phosphate Pebbles Got a Slow Start* in your answer.

6. Where does phosphorus fit as a link in the food chain? Explain who or what needs it. Use details and examples from *The Fertilizer Factor* in your answer.

7. Color the Florida counties map to show the areas where phosphate is mined. Use *Where Phosphate Is Found* to help you.

8. Read *Dragline Details* and *What a Drag*. What simile is used to illustrate the draglines?
   a. Giant draglines dot the landscape like strange, modern dinosaurs.
   b. All draglines are powered by electricity.
   c. From the top of a Central Florida phosphate processing plant, you can see for miles around.
   d. He drags the enormous scoops of soil and rock toward him by working knobs and levers.

9. If a dragline has to be moved at least 50 feet to the next site, how many steps would it have to take? How long would it take? Use details and examples from *Dragline Details* in your answer.
10. What standard number represents the cost of an average dragline? Use Dragline Details to help you.
   a. 70 tons  
   b. $20,000,000  
   c. 600 feet  
   d. $2,000,000

11. Reclaim this phosphate pit by filling it up with the missing words.

A. __ __ __ __ P __ __ __ __ __ __

B. __ H __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __

C. O __ __ __ __ __ __ __ __ __

D. S __ __ __ __ __

E. __ __ P __ __ __

F. __ __ __ H __ __

G. __ A __ __ __ __ __ __ __ __ __ __ __ __ __ __ __ __

H. __ __ T __ __ __

I. __ E __ __ __ __ __ __ __ __ __ __

J. __ R __ __ __ __ __ __ __

K. __ O __ __ __ __ __ __ __

L. C __ __ __

M. __ __ __ K __ __

A. The mineral needed by every living thing on earth.
B. The main ingredient in fertilizer and animal feeds made from phosphate.
C. Soil laid aside as phosphate is mined and used for reclamation.
D. A mixture of water, phosphate, clay, and sand.
E. A product left over when making phosphate fertilizer that may be used for building roads.
F. The machine that separates the clay and sand from the phosphate matrix.
G. The sand that is separated from the phosphate and then used for reclamation.
H. The layer of earth or rock where a mineral lies.
I. Returning land to a useful state after it has been mined for phosphate.
J. A big machine used to mine phosphate.
K. Remains of animals that lived long ago.
L. One of the materials found in the phosphate matrix.
M. The shovel or scoop part of a dragline.
12. Read the following sentence from *Where Phosphate is Found*.
“Some experts think that Florida’s phosphate deposits may last for hundreds of years.” What does the word “deposits” mean?

a. rocks  
b. fertilizers  
c. collections  
d. holes

13. How does the author of *Keeping an Eye on the Environment* want you to feel about reclamation?

a. to be sad that the land is being dug up  
b. to be satisfied that the land is being put back to its original state  
c. to like reclaimed land  
d. to be afraid of reclaimed land

14. Use the chart in the center of *Phosphate from Florida*. What happens right AFTER the matrix is pumped through a pipe to the washer plant?

a. the dragline scoops off the overburden  
b. the slurry is washed  
c. the watery clay goes to a settling pond  
d. the land is reclaimed

15. What are the effects of phosphate being one of Florida’s largest industries? Use details and examples from *Mining for Food* in your answer.

16. Which of the following is an OPINION from *Rocks in Your Lunch Box*?

a. You can see how phosphorus is a part of the food chain.  
b. We get other food from those animals as well as from plants.  
c. It helps grow the plants we eat to give us the phosphorus our bodies need.  
d. That’s why it’s easy to see how phosphate feeds you.
Measurements

1. Which letter shows a shark tooth that is twice as long as the one to the right?

   a. 
   b. 
   c. 
   d. 

2. The mines have mapped out a space for you to fossil hunt. The drawing shows the area assigned. What is the area of the space provided for fossil hunting?

   a. 450 square feet
   b. 364 square feet
   c. 405 square feet
   d. 54 square feet

3. What is the best measurement to use to weigh a small shark's tooth?
   a. grams
   b. pounds
   c. inches
   d. feet

4. You have just measured the circumference of your dugong rib bone to be 3½ inches. How did you do this? Write to explain how you found the circumference.

   ____________________________________________________
   ____________________________________________________
   ____________________________________________________
   ____________________________________________________
Writing prompts following a fossil hunting field trip to the mines

On your field trip, you observed many of the steps involved in mining phosphate and reclamation of the mined land. These steps you have discussed and illustrated on The Phosphate Story worksheet.

Before you begin writing, review your worksheet and think about each of the steps in the mining and reclamation process.

Now write to explain how phosphate is mined and the land reclaimed.

While fossil hunting, you found many interesting pieces of bone, teeth, and other animal remains.

Before you begin writing, think about what you have learned about early Florida and how all of these many animals came to be here.

Now write to explain why the fossils of the animals you found were here in Central Florida.

On your field trip, you learned many interesting things about phosphate, mining, and fossils.

Before you begin writing, think about all you learned on your trip.

Now write to explain what you learned while on your trip to the phosphate mine.

During the fossil dig, you found many bones, teeth and other fossilized remains.

Before you begin writing, choose your favorite fossil and try to imagine the animal it came from, its habitat, how it lived, how it looked, and how it ended up where you found it.

Now write to tell a story of the animal it was and how it came to be the fossil you found.

Your class has just finished the final touches on a time machine that will transport you back in time to prehistoric Florida. As the first volunteer to test the machine, you will be the first human to see Florida in the days of the woolly mammoths, giant ground sloths and saber-toothed cats.

Now write to tell about your adventure on a trip back in time to prehistoric Florida.
FCAT Practice Scoring Rubric  
Part 3

<table>
<thead>
<tr>
<th>6 Points</th>
<th>5 Points</th>
<th>4 Points</th>
<th>3 Points</th>
<th>2 Points</th>
<th>1 Point</th>
<th>Unscorable</th>
</tr>
</thead>
</table>
| • Focused on the topic  
• Uses a topic sentence  
• Has a beginning, middle, and end, with an ending/closing sentence  
• Many details and examples  
• Completeness to the paper  
• Sentences are complete with correct noun and verb forms | • Focused with a beginning, middle, and end  
• Details and examples, yet may drift off the topic at times  
• Completeness to the paper  
• Most sentences are complete although there may be some incorrect noun and verb use  
• A variety of sentence structure  
• Correct punctuation, capitalization, and spelling | • Generally focused, although it contains some extra information not related to the topic  
• Completeness to the paper  
• Beginning, middle and end  
• Some details, but they may not be fully developed  
• Most spelling, punctuation, and capitalization is correct  
• Some variety of sentence structure, but most are simple sentences | • Generally focused, although it may contain some extra information not related to the topic  
• An attempt at a beginning, middle, and end, but they are not complete  
• Little use of details or examples  
• Most spelling, punctuation and capitalization is correct  
• Most sentences are simple sentences | • Only slightly related to the topic  
• Few details  
• No real beginning, middle, and end  
• Many errors in punctuation, capitalization and spelling  
• Most sentences are simple sentences | • Only addresses the topic slightly  
• No details or examples  
• Information that has nothing to do with the topic  
• No beginning, middle or end  
• Many errors in punctuation, capitalization and spelling  
• Most sentences are simple sentences | • The paper is unscorable because  
• The response was not related to what the prompt asked  
• The response simply rewords the prompt  
• The writing folder is blank  
• The response is a copy of a published work  
• The student refused to write  
• The response is unreadable  
• There is not enough writing to tell if the student tried to address the prompt |
FCAT Practice
Part 1 - Answers

Phosphate from Florida—Newspaper

1. Why is phosphate mining an important industry? Use the article Mining for Food to give details and examples in your answer.

Answer is student driven

2. How many layers of the earth do you have to dig through to reach the limestone layer?
   a. three
   b. four
   c. five
   d. six
   Name the layers.

   Sand, leach zone, ore and clay bed

3. Create a pie graph to show the three major uses of Florida’s phosphate.

   90% fertilizer
   5% feed
   5% other

4. Explain why phosphate is considered “gray gold.” Use details and examples from Can You Dig It? in your answer.

   Answer is student driven

5. Who discovered phosphate in Florida?
   a. Ft. Meade
   b. Juan Ponce de Leon
   c. Peace River
   d. Captain J. Francis LeBaron
   Explain when and where it was discovered using details and examples from Phosphate Pebbles Got a Slow Start in your answer.

   Answer is student driven
6. Where does phosphorus fit as a link in the food chain? Explain who or what needs it. Use details and examples from *The Fertilizer Factor* in your answer.

   **Answer is student driven**

7. Color the Florida counties map to show the areas where phosphate is mined. Use *Where Phosphate Is Found* to help you.

8. Read *Dragline Details* and *What a Drag*. What simile is used to illustrate the draglines?
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9. If a dragline has to be moved at least 50 feet to the next site, how many steps would it have to take? How long would it take? Use details and examples from *Dragline Details* in your answer.

   **It would have to take at least 6 steps (8 feet each step)**
   **It would take 5 minutes to go 50 feet (600 ft/hour which is 10 ft/minute)**

10. What standard number represents the cost of an average dragline? Use *Dragline Details* to help you.
    a. 70 tons
    b. $20,000,000
    c. 600 feet
    d. $2,000,000
11. Reclaim this phosphate pit by filling it up with the missing words.

A. PHOSPHORUS
B. PHOSPHORIC ACID
C. OVERBURDEN
D. SLURRY
E. GYPSUM
F. WASHER
G. SANDTAILINGS
H. MATRIX
I. RECLAMATION
J. DRAGLINE
K. FOSSILS
L. CLAY
M. BUCKET

A. The mineral needed by every living thing on earth.
B. The main ingredient in fertilizer and animal feeds made from phosphate.
C. Soil laid aside as phosphate is mined and used for reclamation.
D. A mixture of water, phosphate, clay, and sand.
E. A product left over when making phosphate fertilizer that may be used for building roads.
F. The machine that separates the clay and sand from the phosphate matrix.
G. The sand that is separated from the phosphate and then used for reclamation.
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   c. **405 square feet**  
   d. 54 square feet

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   a. grams  
   b. pounds  
   c. inches  
   d. feet

4. You have just measured the circumference of your dugong rib bone to be 3½ inches. How did you do this? Write to explain how you found the circumference.

   **Answer is student driven**
Materials

Bulletin board paper
Notebook paper
Half sheets of 8½ x 11 paper
Laminated state of Florida
Pencils
Colored pencils or crayons
Large sheets of manila paper (enough for teams of 4)
Small sheets of manila paper for each student
Large manila paper
Large circle for tracing
Overhead projector
Scissors
Glue
Copies of Smilodon Bones for each student
Florida Textbook on Florida Indians
8 x 12 white art paper
Tag board
White paper
Plaster of Paris
Petri Dishes
Coffee Filters
Vaseline
Assorted Leaves
Sharks’ teeth
Shells
53 cc scoops
Plastic cups
Wooden stirring sticks
Journals
Medical cup
Paper towels
Permanent markers
Newspaper
Chart paper
White paper for each student
Markers
Metric scales
Rulers
Tape measures
Tag board
8 x 12 art paper
5 x 8 index cards
Construction paper
4 oz. baby food charts
Bucket of white sand
Bucket of soil
Bucket of clay
Chalk
Waxed paper
Styrofoam cups
Notebook paper
Unpolished tiles
Molhs sample rock kits
Washington rock kits
Magnets

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Resources

Books and Magazines
Milliken Prehistoric Life and Rocks and Minerals
Kagan Cooperative Learning
MacMillan Instant Activities
Revisit, Reflect, Retell by Hoyt
Woolly Mammoth by Aliki
Fossils Tell of Long Ago by Aliki
Fossils by Kids Discover
If Bones Could Talk by Kids Discover
If You Are a Hunter of Fossils by Byrd Baylor
Young Person’s Occupational Outlook Handbook
Young Person’s Occupational Dictionary
First Field Guide Rocks and Minerals
Magic School Bus: Inside the Earth by Joanna Cole and Bruce Degen
Panther Glade by Helen Cavanagh
Florida Fossils by Brown

Visual
Phosphate Land Reclamation: An Introduction for Students
Florida Indians
Phosphate Feeds You
Mining Phosphate
Science Court Simple Machines (5th-6th grade)

Audio
Wee Sing Dinosaurs

Newspapers and Brochures
The Formation of Florida—Peer Center Materials
Phosphate from Florida—Orlando Sentinel