3rd Grade Earth Changes Unit
Unit Blueprint

Lesson	Essential & Unit Questions (for conceptual benchmarks)	Benchmarks (**Bolded** sections indicate portion of benchmark addressed)	Formative and Summative Assessments (Unless noted as a Summative Assessment, the assessments are formative and should be used to guide teaching and learning.)	Using Assessments to Monitor Student Learning
Throughout Unit	Why do the results of experiments rarely turn out exactly the same?	1A(3-5)#1: Results of similar scientific investigations seldom turn out exactly the same. Sometimes this is because of unexpected differences in the things being investigated, sometimes because of unrealized differences in the methods used or in the circumstances in which the investigation is carried out, and sometimes just because of uncertainties in observations. It is not always easy to tell which.	As opportunity arises during discussion of experimental results	• Do students recognize that experimental results rarely turn out exactly the same? • When students observe significant differences in results, do they seek possible reasons? • Do students identify differences in methods and differences in recording/interpreting results as reasons for experimental results not being exactly the same? • Do students support their conclusions/findings with data from experiments? • When discussing results of experiments, do students listen to and reflect on ideas suggested by others?
	Why is it important to follow directions and keep accurate records of experiments?	1B(3-5)#2: Results of similar scientific investigations are seldom exactly the same, but if the differences are large, it is important to try to figure out why. One reason for following directions carefully and for keeping records of one's work is to provide information on what might have caused the differences.		
		12A(3-5)#2: Offer reasons for their findings and consider reasons suggested by others.		

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<u>Lesson 1: Science Sleuths</u> **Pacing Suggestions:** **Day 1 –** Session 1 **Day 2 –** Experiment (Temporary Tombstones) and *Sharing Ideas* **Day 3 –** *Checking Understanding* **Teacher Resources:**  Tips  Student Lab Directions  Pictures of Tombstones	What is the nature of science and who "does" science?	1C(3-5)#1: **Science is an adventure that people everywhere can take part in,** as they have for many centuries.	General class discussion about the introduction to Lesson 1 and the idea that science can be an "adventure" or "mystery" and that all people can be involved in science (Reading on pages 19 & 20 in Student Guide) *Note: This is not specifically noted in the Teacher's Edition. Teachers need to be deliberate in making the Lesson 1 introduction address the benchmark.*	• Do students understand that science is about asking questions and seeking answers questions? (Thus, it is an adventure.) • Do students realize that all people, not just scientists, can be involved in science?
	How does nature cause the surface of the earth to change?	4C(3-5)#1: Waves, wind, **water** and ice **shape and reshape the earth's land surface by eroding rock** and soil in some areas and depositing them in other areas, sometimes in seasonal layers.	• Student journal entry and class discussion of *Temporary Tombstone* Step 3, bullet 4 on page 26 of Student Guide (See *Sharing Ideas* on page 51 in Teacher's Edition.) • *Checking Understanding* Questions 2, 4, & 5 on pages 27 and 28 in Student Guide (See pages 52-53 in Teacher's Edition.)	Do students know that water can weather or wear away rock and other materials? *Note: Students might focus on the sugar cubes dissolving. If necessary, help them understand that this simulation is about wearing away pieces of the sugar cubes, just like water weathers rock over a long period of time.*
		12D(3-5)#2: Make sketches to aid in [describing observations and] explaining procedures or ideas. 12C(3-5)#3: **Keep a notebook that describes observations made,** carefully distinguishes actual observations from ideas and speculations about what was observed, **and is understandable weeks or months later.**	• Students draw a series of pictures showing the changes to the sugar cubes. <u>Click to view a sample of student work</u>	These initial drawings provide rich data about how students organize their drawings, to what extent the drawings are understandable, and how students approach the drawing task. Following this first set of drawings, the teacher will most likely need to share strategies for making clear sketches and organizing drawings. (See *Helpful Tips* under Teacher Resources for additional support.)

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		Related to 1B(3-5)#4: Scientists do not pay much attention to claims about how something they know about works unless the claims are backed up with evidence that can be confirmed and with a logical argument.	Class discussion of *Sharing Ideas* on page 27 in Student Guide (See Step 7 on page 51 in Teacher's Edition.) *Note: Benchmark not directly addressed in lesson. When teachers request students to use evidence to support their ideas, they need to emphasize that this is what scientists do.*	Do students understand that scientists do not accept random ideas/claims that are not backed up with evidence and logic?
	How does the model show how the real thing works?	11B(3-5)#1: Seeing how a model works after changes are made to it may suggest how the real thing would work if the same were done to it.	*Checking Understanding* Question 3 on page 27 of Student Guide (See pages 52-53 in Teacher's Edition.)	• Can students identify the similarities and differences between the model and real tombstones? • Do they understand how the model simulates weathering of rocks?

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Lesson 2: Sandblasters **Pacing Suggestions:** **Day 1 –** Introduce students to goggles and *Directions* 2 & 3 on page 31 in Student Guide **Day 2 –** *Directions* 4-6 on pages 33-34 in Student Guide **Day 3 –** *Ideas to Think About* & extra activities on page 64 in Teacher's Guide **Day 4 –** *Nature's Sand Blaster* reading & *Checking Understanding*		12D(3-5)#2: Make sketches to aid in [describing observations and] explaining procedures or ideas. 12C(3-5)#3: **Keep a notebook that describes observations made,** carefully distinguishes actual observations from ideas and speculations about what was observed, **and is understandable weeks or months later.**	• Student drawings of the effect of wind on sand (See the sixth bullet on page 32 in the Student Guide.) • Student drawings of the three index cards (See Step 6 on page 34 in Student Guide.) Click to view a sample of student work	• Just as in Lesson 1, the initial drawings of the piles of sand provide rich data about how students organize their drawings, to what extent the drawings are understandable, and how students approach the drawing task. Following the first set of drawings, the teacher will most likely need to share strategies for making clear sketches and organizing drawings. (See *Helpful Tips* under Teacher Resources for additional support.) • The teacher should observe the second set of drawings (the three index cards) for improvement.
	How does the model show how the real thing works?	11B(3-5))#1: Seeing how a model works after changes are made to it may suggest how the real thing would work if the same were done to it.	*Ideas to Think About* (specifically bullets 3 & 4) on page 34 in Student Guide (See bullets 2-4 on page 64 in Teacher's Edition.)	• Do students understand that the sand blaster is a model of what occurs in nature? Do they make this connection and understand why the experiment was conducted? • Do students understand that by modeling different wind strengths, they can see how this might work in nature?

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Teacher Resources:  Tips  Student Lab Directions  Pictures of Sandblasters Cards	How does nature cause the surface of the earth to change?	4C(3-5)#1: Waves, wind, water and ice shape and reshape the earth's land surface by eroding rock and soil in some areas and depositing them in other areas, sometimes in seasonal layers.	• Class discussion of the following question: *How could sand and wind together make rocks change?* (See last bullet on page 64 in Teacher's Guide.) • *Checking Understanding* questions 1 & 3	**Class Discussion of Question** • Do students know that (1) wind moves the sand, (2) the sand hits rocks, and (3) the sand rubbing the rocks causes the rocks to wear away or weather? **Checking Understanding** • See pages 66 & 67 in Teacher's Guide. • In general, are the students starting to understand how wind and water can shape and reshape the earth by wearing down rock?

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<u>Lesson 3: Downhill Rollers</u> **Pacing Suggestions:** **Day 1 –** Session 1 **Day 2 –** Session 2, Steps 3 & 4 on pages 75-76 in Teacher's Guide **Day 3 –** *Checking Understanding* **Teacher Resources:**  Tips  Student Lab Directions	How does the model show how the real thing works?	11B(3-5)#1: Seeing how a model works after changes are made to it may suggest how the real thing would work if the same were done to it.	Class discussions and Student Journal entries comparing the movement of sand to the movement of rocks and soil on hillsides (See Step 6 in *Sand Castles* on page 43 in Student Guide.) *Note: The benchmark is not directly addressed through the questions in Step 6. If students don't raise the idea of the sand piles serving as models, the teacher will need to do so.*	• Do students understand that the sand piles are models of hillsides/mountains? Do they make this connection and understand why the experiment was conducted? • Do students understand that by modeling different wind strengths, they can see how this might work in nature?
	What happens to earth materials on steep slopes?	Introduce 4B(3-5)#1: Things on or near the earth are pulled toward it by the earth's gravity.	• *Ideas to Think About* (specifically bullet 3) on page 44 in Student Guide (See page 75 in Teacher's Edition.) • *Checking Understanding* Activity on pages 44-48 in Student Guide (See pages 76-77 in Teacher's Edition.)	***Ideas to Think About*** • Are students able to explain why the sand piles decrease in height? (The dry, unsupported sand grains on the sides are pulled down toward earth by gravity.) • Are students able to generalize from the sand pile experiment to earth materials outdoors, such as the movement of rocks down hillsides? ***Checking Understanding*** • Do students understand that loose/unstable earth materials will fall or roll down a hillside? • Do students know that earth's gravity pulls material down?

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		12D(3-5)#3: Use numerical data in describing and comparing objects and events. 12C(3-5)#3: **Keep a notebook that describes observations made,** carefully distinguishes actual observations from ideas and speculations about what was observed, **and is understandable weeks or months later.** (Also, see benchmarks listed at beginning of blueprint that are addressed throughout the experiments.)	Class discussions and Student Journal recordings of observations and descriptions about what happens over time to sand grains in piles of sand (See #3 and #4 on page 75 in Teacher's Edition.)	• Are students able to measure their sand piles accurately? • Are students able to use their measurements to describe and compare sand piles? • Are students able to organize the data in some meaningful way so that it's understandable weeks later? (Teachers should see improvement in this area.)
	How have humans changed the surface of the earth? Why have humans made some of these changes?	Introduce 3A(3-5)#4: Technology extends the ability of people to change the world: to cut, shape or put together materials; to move things from one place to another; and to reach farther with their hands, voices, senses, and minds. The changes can be for survival needs such as food, shelter, and defense, for communication and transportation, or to gain knowledge and express ideas.	Class discussion about scenario in *Checking Understanding (Note: The Teacher's Guide does not direct teachers to focus on human-made changes to the hill. To address the benchmark, a deliberate conversation about humans' impact on the earth is necessary. See Checking Understanding on page 164 in the Teacher's Guide for some questions to use during a class discussion. While the activity on page 164 is designed as an independent activity, it can be used as a basis for a conversation about changes humans make to the environment.)*	• Do students recognize that in addition to nature, humans also change the surface of the earth? • Can students identify some reasons changes to the earth are made (survival, shelter, transportation…)?

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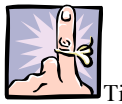
<u>Lesson 4: The Great Mover</u> **Pacing Suggestions:** **Day 1 –** Session 1 **Day 2 –** *Water Destinations experiment* **Day 3 –** *Sharing Ideas, The Great River Bed* reading, and *The High-Low Game* **Day 4 –** Make model for the *Modeling the Mississippi* **Day 5-** Test models & *Sharing Ideas* **Day 5 –** *Checking Understanding* **Teacher Resources:**  Tips  Student Lab Directions	How does the model show how the real thing works?	11B(3-5))#1: Seeing how a model works after changes are made to it may suggest how the real thing would work if the same were done to it.	Class discussion of models in general and models used in previous lessons (See *Introducing the Lesson* on page 84 in Teacher's Edition.) *Sharing Ideas* on page 56 in Student Guide (See page 87 in Teacher's Edition.) *Checking Understanding* Question 1 on page 61 in the Student Guide (See page 92 in Teacher's Edition.)	**Class Discussion about Models** • Do students understand the value of models? • Do students understand the strengths and limitations of models? ***Sharing Ideas* (Page 60 in Student Guide)** • See page 87 in Teacher's Guide. ***Checking Understanding*** • Do students understand that models are used to study how the real thing works?
		1C(3-5)#2: **Clear communication is an essential part of doing science. It enables scientists to inform others about their work, expose their ideas to criticism** by other scientists, and stay informed about scientific discoveries around the world.	Students share their models with their classmates in *Sharing Ideas* on page 60 in Student Guide. As part of the discussion, students should be encouraged to practice good science by asking questions about others' models and communicating what they learned as a result of sharing. *(Note: To meet the intent of the benchmark, the teacher needs to help students understand why it's valuable to share their work and establish a classroom climate that supports students critiquing/questioning others' work.)*	***Sharing Ideas* (Page 60 in Student Guide)** • Do students understand the value of sharing/communicating their work and ideas? • Do students understand that exposing their ideas to others is part of the scientific process?

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<u>Lesson 5: Stream Studies</u> **Pacing Suggestions:** **Day 1 –** *Session 1* **Day 2 –** *Testing Your Stream Model* **Day 3 –** *Forming a Stream* **Day 4 –** *Sharing Ideas* **Day 5 –** *The Flood of 1993* **Day 5 –** *Checking Understanding*	How can flowing water change the surface of the earth?	4C(3-5)#1: Waves, wind**, water** and ice shape and **reshape the earth's land surface by eroding rock and soil in some areas and depositing them in other areas,** sometimes in seasonal layers.	Use of stream models to answer questions about streams and erosion of earth materials (See questions related to Events 1, 2, and 5 on pages 70-71 in Student Guide and page 105 in Teacher's Edition.) *Sharing Ideas* (bullet point 5) on page 72 in Student Guide *Checking Understanding* (bullet points 2 and 4 on page 78 in the Student Guide)	**Events 1, 2, & 4** • Do students understand that flowing water can break down the surface of the earth? • Do students understand that water moves earth materials from one place to another? ***Sharing Ideas*** • Do students describe the wearing away and movement of sand? ***Checking Understanding*** • Do students state that flowing water breaks down the surface of the earth and deposits materials in other areas?
	How does the model show how the real thing works?	11B(3-5))#1: Seeing how a model works after changes are made to it may suggest how the real thing would work if the same were done to it.	*Sharing Ideas* discussion about strengths and weaknesses of stream models (See page 106 in Teacher's Edition.) *Checking Understanding* (specifically the last bullet point) on page 78 in Student Guide	***Sharing Ideas*** • Do students recognize that the stream model represents parts of a true stream (source, ending, banks, sand, water, etc.)? • Do students recognize the limitations of the stream model (it did not contain various earth materials to help it retain its shape, it was shallow, the sand becomes too saturated, etc.)? ***Checking Understanding*** • Do students recognize that the stream model represents parts of a true stream (source, ending, banks, sand, water, etc.)?

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Teacher Resources:  Tips  Video Clips: •*Directions for Making a Stream Model* •*Directions for Testing Your Stream Model* •*Directions for Forming a Stream*		12D(3-5)#2: Make sketches to aid in [describing observations and] explaining procedures or ideas. 12C(3-5)#3: **Keep a notebook that describes observations made**, carefully distinguishes actual observations from ideas and speculations about what was observed, **and is understandable weeks or months later.**	Students make written observations and draw before and after pictures of Events 1, 2, and 5 (*This is not specifically noted in the Teacher's Guide.)* Click to view a sample of student work	Do students' drawings include the following: • Detailed pictures • Clear labels • Logical sequence • Adequate space and size • All parts of the system are included in the drawing

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<u>Lesson 6: Stream Explanations</u> **Teacher Resources:**  Tips  Video Clip: *Directions for Setting Up and Using Stream Tables*	How does nature cause the surface of the earth to change?	4C(3-5)#1: Waves, wind, water and ice shape and reshape the earth's land surface by eroding rock and soil in some areas and depositing them in other areas, sometimes in seasonal layers.	Optional assessment strategy provided on page 128 in Teacher's Edition. Class discussion about *The Changing Surface of the Earth, Niagara Falls,* and *What are Waterfalls?* readings in Student Guide on pages 88-92 (See the discussion question suggested on page 129 in the Teacher's Edition.) *Checking Understanding On Your Own* section (See *Checking Understanding* directions on pages 132 & 133 in Teacher's Guide.)	**Class Discussion of Readings** • Are students able to identify some slow occurring changes to Earth's surface? (Ex: changes in rivers) • Are students able to explain how erosion is involved in changing rivers and waterfalls? • Are students able to explain why waterfalls are temporary? ***Checking Understanding On Your Own* section** Examples: The change in position of Niagara Falls—it has moved 7 miles; water weathers items, such as rocks; water causes rivers to change their shape and carries items, such as rocks; wind and sand together can break/weather rocks; gravity pulls rocks down slopes/hills/mountains; and people change the surface of the earth by making roads and cutting into hillsides.
		12D(3-5)#2: Make sketches to aid in [describing observations and] explaining procedures or ideas.	**Summative Assessment:** Student sketches of stream table with labels in Student Journal—Steps 1 & 6 of *Fast or Slow Water* activity on page 82 in Student Guide.	Do students' drawings include the following: • Detailed pictures of "Level" and "Steeper" stream tables • Clear labels • Logical sequence (Before and After pictures for each scenario) • Adequate space and size • All parts of the system are included in the drawing

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		3A(3-5)#3: Measuring instruments can be used to gather accurate information for making scientific comparisons of objects and events and for designing and constructing things that will work properly. 12D(3-5)#3: Use numerical data in describing and comparing objects and events.	• Class discussion about measuring the speed of the water in the *Fast or Slow* activity (See Step 3, bullet point 4 on page 81 in Student Guide and page 124 in Teacher's Guide.) • Collection of time data using stopwatch and recording of data in Student Stream Speed and Stream Load Data Tables	• During class discussion about measuring the speed of water, do students suggest using equipment, such as a stopwatch? • Do students recognize that quantitative data (speed of water) provides accurate information and is better for making comparisons than describing water speed as fast or slow?
	Why do results of experiments rarely turn out exactly the same?	1B(3-5)#2: Results of similar scientific investigations are seldom exactly the same, but if the differences are large, it is important to try to figure out why. One reason for following directions carefully and for keeping records of one's work is to provide information on what might have caused the differences.	Class discussion of Step 5 on page 82 in Student Guide (See page 125 in Teacher's Edition.)	• Do students recognize that the results will not be exactly the same for every trial? • Do students know they should try to determine the reason for large differences in results? • Do students recognize that following directions minimizes the chances of large differences in results occurring?
		12E(3-5)#2: Recognize when comparisons might not be fair because some conditions are not kept the same.	Class Discussion about requirements for fair test and general class discussion about results in Stream Load Data Table (See *Determining Stream Load,* second arrow on page 125 in Teacher's Edition.)	• Are students able to identify what needs to stay the same between the two experiments so that it is a "fair" comparison?
	What is the nature of science and who "does" science?	1C(3-5)#3: Doing science involves many different kinds of work and engages men and women of all ages and backgrounds.	Class discussion about Ms. Del Toro, a stream scientist, and comparisons between her work and student investigation in this unit	See page 127 in Teacher's Guide for discussion questions. Students' responses to bullet points 1 and 4 should reveal their conceptions about scientists and the nature of science.

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Lesson 7: Recycling Rocks **SKIP LESSON**		Lesson addresses (6-8) benchmarks		
Lesson 8: Changes that People Make **SKIP LESSON**		Lesson contains excessive technical vocabulary and long, difficult reading passages.		
Lesson 9: Before and After **Teacher Resources:**  Tips	How does the surface of the earth change?	4C(3-5)#1: Waves, wind, water and ice shape and reshape the earth's land surface by eroding rock and soil in some areas and depositing them in other areas, sometimes in seasonal layers. 3A(3-5)#4: Technology extends the ability of people to change the world: to cut, shape or put together materials; to move things from one place to another; and to reach farther with their hands, voices, senses, and minds. The changes can be for survival needs such as food, shelter, and defense, for communication and transportation, or to gain knowledge and express ideas.	Class discussion/revision of *Earth Materials That Change* chart *Ways the Surface of Earth Changes* class list (See page 170 in Teacher's Edition.) **Summative Assessment:** *Before and After Project*	***Earth Materials That Change* Chart** • Do students correct misinformation on the chart and add new information they learned from the unit? ***Ways the Surface of Earth Changes* Chart** • Do students generate a list of changes caused by wind, water, ice, and humans? ***Before and After Project*** Do students' reports include the following: • Clear explanation of the change to the earth's surface • Clear explanation of what caused the change (wind, water, ice, and/or humans)