5th Grade Astronomy Unit
Unit Blueprint

	Learning Experience	Essential & Unit Questions	Benchmarks	Assessment	Using Assessments to Monitor and Plan for Student Learning
1	**FRAME OF REFERENCE** **FOSS Investigation #1 (Where am I?) Parts 1, 2 and 3** **Pacing Suggestions:** 4 days **Teacher Resources:** 	What are models? Why are models used in science? What are the strengths and weaknesses of the models used to show position?	Introduce: 11B(3-5)#2: Geometric figures, number sequences, graphs, diagrams, sketches, number lines, **maps**, and stories **can be used to represent objects, events, and processes in the real world, although such representations can never be exact in every detail.** *Note: The lesson serves as an introduction to the Astronomy unit.*	Class discussion about models	Do students understand why a map is a considered a model? Are students able to identify some strengths and limitations? (For most students, this may be the first time they think about a map as a model. There ability to think about strengths and weaknesses may be very limited. This is a skill that will improve over time as they are exposed to many more models.)

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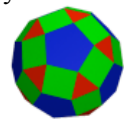
2	**SHAPE OF EARTH** **FOSS Investigation #2 (Round Earth/Flat Earth)** **Pacing Suggestions:** **Day 1 –** Part 1, Steps 1-10 and 12-13 on pages 67-69 **Day 2 –** Part 1, Steps 14-20/21 **Day 3 –** Part 2, Steps 1-10 & 15 on pages 75-77 **Day 4 –** Part 2, Steps 11-14 & 16 (self-assessment only) **Day 5 –** *Shape of the Earth Assessment* **Teacher Resources:** 	What is the shape of the earth?	4B(3-5)#2: **Like all planets and stars, the earth is approximately spherical in shape**. The rotation of the earth on its axis every 24 hours produces the night-and-day cycle. To people on earth, this turning of the planet makes it seem as though the sun, moon, planets, and stars are orbiting the earth once a day. Introduces: 4F(3-5)#3: Light travels and tends to maintain its direction of motion until it interacts with an object or material. Light can be absorbed, redirected, bounced back, or allowed to pass through. 11B(3-5)#2: Geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories can be used to represent objects, events, and processes in the real world, although such representations can never be exact in every detail.	Teacher observation of students completing *Shape of Earth* worksheet and class/individual discussions about activity (See *Conducting Part 1*, Steps 10-12 on pages 68-69 in Teacher Guide.) **Formal Assessment:** *Shape of the Earth Assessment* (Teacher-generated assessment available under "Teacher Resources" on the electronic blueprint.)	Teachers need to listen carefully for students' conceptions about the shape of the earth. While the majority of students state the earth is spherical, some believe otherwise. For example, some students believe the earth has flat spots on it, resembling some type of polyhedron.  Class discussion of *Shape of the Earth* activity/simulation and independent student responses on the *Response Sheet—Round Earth/Flat Earth* provide opportunities to assess students' understanding of the shape of the earth and how they know it. (See the first two paragraphs on page 63 in FOSS Teacher Guide.) Use of models should be incorporated into students' answers of "how they know" the earth is spherical. *Shape of the Earth Assessment* Use the rubric available under "Teacher Resources" on the electronic blueprint.

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3	**LIGHT** **Light Travels in a Straight Line** **Pacing Suggestions:** 1 day (short lesson) **Teacher Resources:** 	In what direction does light travel?	4F(3-5)#3: **Light travels and tends to maintain its direction of motion until it interacts with an object or material.** Light can be absorbed, redirected, bounced back, or allowed to pass through.	Class discussion of activity	• Did students position the index cards with the holes lined up in a straight line? • Did students sketch the path of light moving in a straight line through the holes? • Are the students able to articulate that light travels in a straight line?
			12D(3-5)#2: Make sketches to aid in explaining procedures or ideas.	Journal entry sketch of the flashlight, path of light, and index cards	
4	**DSM Lenses and Mirrors Activity 1 (Mirrors and Reflection)** **Pacing Suggestions:** 1 day **Teacher Resources:** 	In what direction does light travel? What causes the direction to change? When light interacts (hits) an object, what are the different ways it behaves?	4F(3-5)#3: Light travels and tends to maintain its direction of motion until it interacts with an object or material. Light can be absorbed, redirected, bounced back, or allowed to pass through.	Class discussion of activity and Question 7 on revised *Mirrors & Reflection* worksheet (Do not use sheet included in Teacher's Guide. See "Teacher Resources" on electronic curriculum for a copy of revised sheet.)	• Do the students understand that the light is not traveling in a straight line because it has been redirected by the mirror? • When students answer Question 7 on the revised *Mirrors & Reflection* worksheet, are they able to communicate that the light travels in a straight line until in interacts/hits the mirror--then it changes direction and travels in a straight line?

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5	**<u>Light Interaction</u>** **Pacing Suggestions:** 1 day **Teacher Resources:** 	In what direction does light travel? What causes the direction to change? When light interacts (hits) an object, what are the different ways it behaves?	4F(3-5)#3: Light travels and tends to maintain its direction of motion until it interacts with an object or material. Light can be absorbed, redirected, bounced back, or allowed to pass through.	Questions 1-7 on *Light and Liquids* lab sheet and class discussion of activity (See "Teacher Resources" on electronic curriculum for a copy of the lab sheet.)	• In questions 1-6, are students able to articulate that light can pass through, be bent, and be absorbed by materials (liquids and air)? • In question 7 and during class discussion, are students able to generalize the following: o Light travels in a straight line until it interacts with an object o Once light interacts with an object, its path will either pass through the object and continue in the same direction, be bent in a different direction, or be absorbed
			12D(3-5)#2: Make sketches to aid in explaining procedures or ideas.	Drawings on *Lights and Liquids* worksheet	• Did students accurately sketch the path of light through each cup to show its interaction with the liquid? • Are the sketches clear, detailed, and understandable? • Do the sketches feature descriptive labels, appropriate size, and appropriate amount of detail? (The rubric, which is used in Lesson 6, can be shown in this lesson to assist students in reflecting on their lab sketches and understanding the qualities of detailed sketches.)

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6	**Reviewing the Behavior of Light** **Pacing Suggestions:** 1 day **Teacher Resources:** 	In what direction does light travel? What causes the direction to change? When light interacts (hits) an object, what are the different ways it behaves?	4F(3-5)#3: Light travels and tends to maintain its direction of motion until it interacts with an object or material. Light can be absorbed, redirected, bounced back, or allowed to pass through.	Student drawings of lab (See "Tips" for details on lab.) Suggested Journal Entry: Summarize how light behaves when it interacts (hits) another material.	• Did students accurately sketch the path of light through/hitting each material? • Are students able to independently articulate that when light hits an object it either passes through, is absorbed, is bent (redirected), or bounced back (reflected)?
			12D(3-5)#2: Make sketches to aid in explaining procedures or ideas.	**Formal Assessment:** Sketches of experiment setup/results	Student Sketches: Use the rubric available under "Teacher Resources" on the electronic blueprint.
7	**Light Assessment** **Pacing Suggestions:** 1 day **Teacher Resources:** 	In what direction does light travel? What causes the direction to change? When light interacts (hits) an object, what are the different ways it behaves?	4F(3-5)#3: Light travels and tends to maintain its direction of motion until it interacts with an object or material. Light can be absorbed, redirected, bounce back, or allowed to pass through.	**Formal Assessment:** *Light Assessment* (Teacher-generated assessment available under "Teacher Resources" on the electronic blueprint)	Use rubric available on electronic blueprint under "Teacher Resources."

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8	**DAY, NIGHT, AND YEARS** **FOSS Investigation 3 (Day and Night)** **Pacing Suggestions:** **Days 1 & 2 –** Part 1 **Days 3 & 4 –** Part 2 **Teacher Resources:** 	What causes day and night?	4B(3-5)#2: Like all planets and stars, the earth is approximately spherical in shape. The rotation of the earth on its axis every 24 hours produces the night-and-day cycle. To people on earth, this turning of the planet makes it seem as though the sun, moon, planets, and stars are orbiting the earth once a day.	Class discussion and student modeling of day and night (See *Conducting Part 1,* Steps 10-12 on page 93 and *Conducting Part 2,* Step 3 on page 96 in Teacher Guide.) *Day/Night Think Questions* (See page 13 in FOSS Planetary Science Lab Notebook & *Conducting Part 1,* Step 14 on page 93 in Teacher Guide.)	**General Points to Consider:** • Do students understand how the movement of the earth on its axis produces day and night? • Do students know that only half of the earth can be lit by the sun at one time? • Do students know that the sun doesn't actually move?
				Formal Assessment: *Day and Night Written Assessment* (Teacher-generated sheet available on electronic blueprint under "Teacher Resources.")	***Day and Night Written Assessment (teacher generated sheet)*:** Use rubric available on the electronic blueprint under "Teacher Resources."
				Formal Assessment: *Day and Night Performance Assessment* (To be conducted <u>after</u> completing Part 2. (Teacher-generated assessment available under "Teacher Resources" on the electronic blueprint.)	***Day and Night Performance Assessment (teacher generated sheet)*:** Use rubric available on the electronic blueprint under "Teacher Resources."

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9	**<u>DSM SS Activity 9 (Days and Years)</u>** **Pacing Suggestions:** 1 to 2 days **Teacher Resources:** 	What causes day and night? What causes a year?	4A(3-5)#4: The earth is one of several planets that orbit the sun, and the moon orbits around the earth. 4B(3-5)#2: Like all planets and stars, the earth is approximately spherical in shape. **The rotation of the earth on its axis every 24 hours produces the night-and-day cycle.** To people on earth, this turning of the planet makes it seem as though the sun, moon, planets, and stars are orbiting the earth once a day. 4A(3-5)#4: **The earth is one of several planets that orbit the sun**, and the moon orbits around the earth.	Class discussion of activity and *Days and Night* worksheet Class discussion about planets orbiting the sun (Suggested journal entry: What orbits the sun?)	• Are students able to accurately define *day* and *year*? Do they understand the scientific meaning of the words? (See *Guiding the Activity* Steps 1 and 2 on page75 and Step 11 on page 79 in Teacher's Guide.) • Do students understand that rotating the sphere simulates day and night? Do students understand that the lit part of the model represents day and the dark part represents night? (Addressed in Question 3 on *Days and Years Activity Sheet 9*) • Do students know that the nine planets orbit the sun? (Students tend to be aware of the existence of planets. Do they understand that they orbit the sun?)
				Formal Assessment: *Days and Years Assessment* (Teacher-generated assessment available under "Teacher Resources" on the electronic blueprint.)	***Days and Years Assessment*** Use rubric available on the electronic blueprint under "Teacher Resources."

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10	**<u>SOLAR SYSTEM & SCALE</u>** **<u>DSM SS Activity 1 (Meet Our Solar System)</u>** **Pacing Suggestions:** 1 day **Teacher Resources:** 		*Foundational to next lesson.*		
11	**<u>DSM SS Activity 4 (Making Circles)</u>** **Pacing Suggestions:** 1 day **Teacher Resources:** 		Foundational to DSM SS Activity 6.		
12	**<u>DSM SS Activity 5 (Scale and Relative Size)</u>** **Pacing Suggestions:** 1 day		Foundational to DSM SS Activity 6.		

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13	**<u>DSM SS Activity 6 (Modeling Planet Sizes)</u>** **Pacing Suggestions:** 2 days **Teacher Resources:** 	What are models? Why are models used in science? What are the strengths and weaknesses of the models used to illustrate the relative sizes of the planets?	11B(3-5)#2: Geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories can be used to represent objects, events, and processes in the real world, although such representations can never be exact in every detail. 12D(3-5)#3: Use numerical data in describing and comparing objects and events Reinforce 4A(3-5)#4: **The earth is one of several planets that orbit the sun**, and the moon orbits around the earth.	Class discussion of models used in activity (See *Background Information* on page 51 in Teacher's Guide.) *Modeling Plant Sizes* worksheet and scale drawings of the planets Suggested Journal Entry: Why is a model of the planets and sun better than just reading from a chart the size of their diameters? Pick two planets and compare their sizes using numbers.	• Do the students understand how the model of the planets is like the real thing (it represents relative size of the planets)? Do students understand how it is different from the real thing (it's two-dimensional, isn't the actual size ...)? Journal Entry • Do students understand the benefit of modeling the size of the planets? • Can students use numerical data to compare the sizes of two planets?
		If stars are many different sizes, some bigger than the sun, why do they look so small in the sky?	Introduce 4A(3-5)#5: Stars are like the sun, some being smaller and some larger, but so far away that they look like points of light. *Note: The teacher's guide does not discuss the size of the sun relative to other stars. Introducing this benchmark will need to be deliberate on the part of the teacher.*	Suggested Journal Entry: The sun is a medium-sized star. Why does the sun look so much larger than all the other stars in the sky?	Do students understand that the sun is closer than any other star? Do students realize that other stars are much larger than the sun but look tiny because they are so far away?

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14	**<u>Project ASTRO D-2 (Clay Models of Earth and Moon) & Reading "The Moon Book"</u>** **Pacing Suggestions:** 1-2 days **Teacher Resources:** 	What are models? Why are models used in science? What are the strengths and weaknesses of the models used to illustrate the relative size of the earth and moon?	11B(3-5)#2: Geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories can be used to represent objects, events, and processes in the real world, although such representations can never be exact in every detail.	Clay representations of earth and moon size/distance and class discussion of activity	Class Discussion about Clay Model • Do the students understand how the model of the earth/moon is like the real thing (it represents relative size and relative distance)? • Do students understand how it is different from the real thing (it's not in motion--moon orbiting earth, composition is different, it's not the actual size/distance)?
		What orbits the earth?	4A(3-5)#4: The earth is one of several planets that orbit the sun, and the moon orbits around the earth. 4F(3-5)#3: Light travels and tends to maintain its direction of motion until it interacts with an object or material. Light can be absorbed, redirected, bounced back, or allowed to pass through.	Class discussion about the moon Suggested Journal Entry: Describe the orbit of the moon. Does the moon make its own light? Explain.	Class discussion about the moon • Are students showing an understanding that the moon does not produce its own light—it's light reflected from the sun? • Do students know that the moon orbits the earth?

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15	**<u>DSM SS Activity 7 (Scale and Relative Distance) and Toilet Paper Model of Solar System</u>** **Pacing Suggestions:** **Day 1 –** Activity 7 **Day 2 –** Toilet Paper Model **Teacher Resources:** 	What are models? Why are models used in science? What are the strengths and weaknesses of the models used to illustrate the relative distances of the planets?	11B(3-5)#2: Geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories can be used to represent objects, events, and processes in the real world, although such representations can never be exact in every detail. 4A(3-5)#4: **The earth is one of several planets that orbit the sun**, and the moon orbits around the earth.	Students' toilet paper models and class discussion about models *Activity Sheet 7* *Toilet Paper Scale Model of the Solar System* worksheet (Questions 2 & 3 only)	*Toilet Paper Model* Worksheet (Questions 1 & 2): • Do the students understand how the toilet paper model is like the real thing (it represents relative distance of the planets)? • Do students understand how the model is different from the real thing? (Examples: it doesn't show relative size of planets--they are all dots; it has all planets lined up on one side of sun--some students won't know this and will learn about this in later lessons; and it's two dimensional.)
16	**<u>Models of Planets Assessment</u>** **Teacher Resources:** 	What are models? Why are models used in science?	11B(3-5)#2: Geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories can be used to represent objects, events, and processes in the real world, although such representations can never be exact in every detail.	**Formal Assessment:** ***Scientific Models Assessment*** (Teacher-generated assessment available under "Teacher Resources" on the electronic blueprint.)	Use rubric available on the electronic blueprint under "Teacher Resources."

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17	**<u>STARS</u>** **<u>DSM Astronomy Activity 1 (The Sky in Motion)</u>** **Pacing Suggestions:** 2 days **Teacher Resources:** 	How do the patterns of the stars change throughout the night?	4A(3-5)#1: The patterns of stars in the sky stay the same, although they appear to move across the sky nightly, and different stars can be seen in different seasons.	Questions 3, 6, and 7 on *The Sky in Motion* Activity Sheet and class discussion	Do students know that stars appear to move across the sky throughout the night? (See *Teaching Suggestions* Steps 2, 3, and 7 and Questions 3, 6, and 7 on *The Sky in Motion* Activity Sheet.)

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18	**<u>DSM Astronomy Activity 2 (As the Earth Turns) & Reading "National Geographic—Stars"</u>** **Pacing Suggestions:** 2 days **Teacher Resources:** 	Why do patterns of stars in the sky appear to move across the night sky? What causes day and night?	*As the Earth Turns Activity* 4A(3-5)#1: The patterns of stars in the sky stay the same, although they appear to move across the sky nightly, and different stars can be seen in different seasons. 4B(3-5)#2: Like all planets and stars, the earth is approximately spherical in shape. **The rotation of the earth on its axis every 24 hours produces the night-and-day cycle.** To people on earth, this turning of the planet makes it seem as though the sun, moon, planets, and stars are orbiting the earth once a day.	*As the Earth Turns* worksheet, Questions 4, 5, and 7	*As the Earth Turns* • Question 4 on *As the Earth Turns*: As students work with the model and simulate the earth turning, do they understand that the stars *appear* to move to a person on earth? Do they understand that just as in the model, the stars are in fixed positions in the sky? • Question 5: By comparing the two models, do students know that the stars patterns are in fixed positions, but they all appear to move westward throughout the night? • Question 7: Are students able to clearly articulate that the rotation of the earth, not the sun, is producing day and night (sunrise/sunset)?
		If stars are many different sizes, some bigger than the sun, why do they look so small in the sky?	Reinforce through "Star" book: 4A(3-5)#5: Stars are like the sun, some being smaller and some larger, but so far away that they look like points of light. 4A(K-2)#1: There are more stars in the sky than anyone can count, but they are not scattered evenly and **they are not all the same in brightness and color.**	Class discussion/processing of book	Class discussion of read-aloud: Do students appear to be aware of the information contained in the book or do they have many questions related to the specific benchmarks addressed within the book (particularly the last two listed benchmarks)?

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19	**<u>DSM Astronomy Activity 4 (Stars throughout the Year)</u>** **Pacing Suggestions** **Day 1 –** Steps 1-3 on pages 37 & 28 **Day 2 –** Steps 5-6 on pages 38-41 **Teacher Resources:** 	How do the patterns of the stars change throughout the year?	4A(3-5)#1: The patterns of stars in the sky stay the same, although they appear to move across the sky nightly, and different stars can be seen in different seasons. 4A(3-5)#3: Planets change their positions against the background of stars.	*Stars Throughout the Year* worksheet, Questions 2, 3, 4 and 6	• Questions 2-4: Do students know that patterns of stars can be seen in different locations within the sky during different months? • Question 6: As students work through this question, are they observing/understanding how the earth orbits around the sun? • Do they observe different star patterns being visible in different months/seasons?
20	**<u>Stars Throughout the Night and Year Assessment</u>** **Teacher Resources:** 	How do the patterns of the stars change throughout the night? Why do patterns of stars in the sky appear to move across the night sky? How do the patterns of the stars change throughout the year?	4A(3-5)#1: The patterns of stars in the sky stay the same, although they appear to move across the sky nightly, and different stars can be seen in different seasons. 4B(3-5)#2: Like all planets and stars, the earth is approximately spherical in shape. **The rotation of the earth on its axis every 24 hours produces the night-and-day cycle. To people on earth, this turning of the planet makes it seem as though the sun, moon, planets, and stars are orbiting the earth once a day**.	**Formal Assessment: *Stars Throughout the Night and Year Assessment*** (Teacher-generated assessment available under "Teacher Resources" on the electronic blueprint.)	Use rubric available on the electronic blueprint under "Teacher Resources."

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21	**<u>DSM Astronomy Activity 6</u> (Planet Watch)** **Pacing Suggestions:** 1 to 2 days **Teacher Resources:** 	What happens to the position of planets (relative to stars) throughout the year?	4A(3-5)#3: Planets change their positions against the background of stars.	Class discussion of and teacher observation of student groups completing *Planet Watch* worksheet, Questions 3-7	• As students work on Question #5 on the worksheet, do they understand the model illustrates planets changing their position against the background of stars? Teachers most likely need to question students as they are working. Sample questions: *What are you learning from this activity? What does the model show you?* • See class discussion question under *Teaching Suggestions*, Step 6 on page 58. Students should be able to answer the question and generalize to the idea that the planets are continually changing their positions against the background of stars. • See additional information under "Tips" in the "Teacher Resources" section of the electronic curriculum.
22	**<u>Stars and Planets Assessment</u>** **Teacher Resources:** 	What happens to the position of planets (relative to stars) throughout the year?	4A(3-5)#3: Planets change their positions against the background of stars.	**Formal Assessment: *Stars and Planets Assessment*** (Teacher-generated assessment available under "Teacher Resources" on the electronic blueprint.)	Use rubric available on the electronic blueprint under "Teacher Resources."

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23	**<u>Review of "Big Ideas" in Astronomy Unit</u>** **Teacher Resources:** 	How do the patterns of the stars change throughout the night? Why do patterns of stars in the sky appear to move across the night sky? How do the patterns of the stars change throughout the year? If stars are many different sizes, some bigger than the sun, why do they look so small in the sky? What happens to the position of planets (relative to stars) throughout the year? What orbits the sun? What orbits the earth?	4A(3-5)#1: The patterns of stars in the sky stay the same, although they appear to move across the sky nightly, and different stars can be seen in different seasons. 4A(3-5)#5: Stars are like the sun, some being smaller and some larger, but so far away that they look like points of light. 4A(3-5)#3: Planets change their positions against the background of stars. 4A(3-5)#4: The earth is one of several planets that orbit the sun, and the moon orbits around the earth. 4B(3-5)#2: Like all planets and stars, the earth is approximately spherical in shape. The rotation of the earth on its axis every 24 hours produces the night-and-day cycle. To people on earth, this turning of the planet makes it seem as though the sun, moon, planets, and stars are orbiting the earth once a day.	*Astronomy Review* (Teacher-generated sheet available under "Teacher Resources" on the electronic blueprint.)	The review is critical for determining any remaining misunderstandings or misconceptions students have about unit concepts. If students exhibit difficulty answering and/or understanding the questions, additional review and reteaching must occur prior to administering the End-of-Unit Assessment.

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24	**<u>End-of-Unit Astronomy Assessment</u>** **Pacing Suggestions:** 1 day 	How do the patterns of the stars change throughout the night? Why do patterns of stars in the sky appear to move across the night sky? How do the patterns of the stars change throughout the year? Are stars like the sun, Earth, and/or planets? Are all stars the same size? What happens to the position of planets (relative to stars) throughout the year? What orbits the sun? What orbits the earth?	4A(3-5)#1: The patterns of stars in the sky stay the same, although they appear to move across the sky nightly, and different stars can be seen in different seasons. 11B(3-5)#2: Geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories can be used to represent objects, events, and processes in the real world, although such representations can never be exact in every detail. 4A(3-5)#5: Stars are like the sun, some being smaller and some larger, but so far away that they look like points of light. 4A(3-5)#3: Planets change their positions against the background of stars. 4A(3-5)#4: The earth is one of several planets that orbit the sun, and the moon orbits around the earth. 4B(3-5)#2: Like all planets and stars, the earth is approximately spherical in shape. The rotation of the earth on its axis every 24 hours produces the night-and-day cycle. To people on earth, this turning of the planet makes it seem as though the sun, moon, planets, and stars are orbiting the earth once a day.	**Summative Assessment:** A copy of the *Astronomy Assessment* is available under "Teacher Resources" on the electronic curriculum.	See *Astronomy Assessment Answer Key* and rubric under "Teacher Resources" on the electronic curriculum.