LESSON 1: What patterns in the sky set the rhythms for our lives?

PREVIOUS LESSON *There is no previous lesson.*

THIS LESSON

ANCHORING PHENOMENON

4 days

We consider how changes in sunlight can impact our daily lives and then brainstorm other interesting patterns in the sky. We bring in stories from family or community members about patterns in the sky they have seen or heard about and how these might be connected to the rhythms of human life. We use a jigsaw strategy with a series of podcasts to learn about ways that humans across cultures and throughout time have relied on and made connections to the sky and identify additional patterns. We model some of the patterns we have identified, develop questions for the Driving Question Board, and then brainstorm ideas for where to go next.

NEXT LESSON *We will use planetarium software to observe the motion of the Sun through the sky over a year. We will model the system in small groups to explain the patterns we noticed. We will also use our models to explain seasonal temperature variation. We will come to consensus on why Earth has seasons.*

BUILDING TOWARD NGSS

MS-ESS1-1, MS-ESS1-2, MS-ESS1-3, MS-PS2-4, MS-PS4-2

WHAT STUDENTS WILL DO

1.A Develop an initial model of systems in space to describe patterns we observe in the sky.

1.B Ask questions about systems in space that arise from observations of patterns in the sky.

WHAT STUDENTS WILL FIGURE OUT

- Patterns in the sky set the rhythms for life on Earth.
- Stories and analogies related to the sky are legitimate ways to preserve knowledge about the stars and planets and aid in observing and decision making.
- Taking some perspective might help us better understand our own planet.

Lesson 1 • Learning Plan Snapshot

Part	Duration	Summary	Slide	Materials
1	20 min	**NAVIGATION** Introduce a new phenomenon--the changing times of sunrise and sunset--and consider how this pattern affects our daily lives.	A-D	
2	15 min	**CONNECT THIS PATTERN TO THE SKY** Students brainstorm other patterns that they have experienced or heard about related to the sky.	E-F	pad of sticky notes, chart paper labeled "Patterns in the Sky", markers
3	10 min	**NAVIGATION AND HOME LEARNING** Ask students to bring in stories from family or community members about patterns in the sky they have seen or heard about.	G	a blank sheet of paper (optional, use if you choose not to let students bring their science notebooks home)
				End of day 1
4	8 min	**NAVIGATION AND RETURN TO HOME LEARNING** Students share ideas they got from family and community members.	H-I	home learning (notes from interviews with friends and family), pad of sticky notes, Patterns in the Sky poster
5	20 min	**PODCAST JIGSAW** Use a jigsaw strategy for podcasts to learn about ways that humans across cultures and throughout time have relied on and made connections to the sky.	J-K	*Making Sense of the Podcast Jigsaw*, 1 copy of 1 of the following handouts: *Gerardo Aldana: The Descent of the Feathered Serpent* or *Jessie Ferrari: Wombat Season* or *Thebe Medupe: Rebirth of Selemela* or *Annette Lee: As It Is Above, It Is Below*, headphones (optional), *Listening Group Roles Reference*, audio player, podcast links or files
6	14 min	**MAKING SENSE OF PODCASTS AS A CLASS** Facilitate a Building Understandings Discussion to generate ideas about why studying the sky is relevant and about specific patterns in the sky.	K-L	*Making Sense of the Podcast Jigsaw*
7	3 min	**NAVIGATION AND PERSONAL REFLECTION** Give students a chance to reflect on the podcasts before we begin modeling the next time we are together.	M	
				End of day 2
8	15 min	**MODEL PATTERNS INDIVIDUALLY** Students choose a pattern to model on their own and then present their models in small groups.	N-O	*Initial Models of Patterns in the Sky*, *Systems Modeling Scaffold* (optional), Patterns in the Sky poster

Part	Duration	Summary	Slide	Materials
9	25 min	**BUILD A CONSENSUS MODEL OF SYSTEMS IN SPACE** Conduct a gallery walk. Build an initial consensus model of systems in space that can explain patterns that we see.	P-R	*Initial Models Gallery Walk*, *Systems Modeling Scaffold* (optional), chart paper labeled "Initial Consensus Model", markers
10	5 min	**NAVIGATION AND STOP AND JOT** Give students a chance to pre-think of some questions for the DQB with a Stop and Jot.	S	
				End of day 3
11	27 min	**BUILD THE DRIVING QUESTION BOARD (DQB)** Navigate into the day and create the Driving Question Board.	T-W	marker, pad of sticky notes, DQB, markers, pad of large sticky notes
12	14 min	**BRAINSTORM NEXT STEPS** Brainstorm investigations we want to do and data we think we will need in order to answer the questions on our DQB.	X	chart paper labeled "Ideas for Future Investigations and Data We Need", markers
13	4 min	**NAVIGATION AND OPTIONAL HOME LEARNING** Consider where we should go next. Introduce planetarium software.	Y-Z	
				End of day 4

Lesson 1 • Materials List

	per student	per group	per class
Lesson materials	• science notebook • a blank sheet of paper (optional • use if you choose not to let students bring their science notebooks home) • home learning (notes from interviews with friends and family) • *Making Sense of the Podcast Jigsaw* • 1 copy of 1 of the following handouts: *Gerardo Aldana: The Descent of the Feathered Serpent* or *Jessie Ferrari: Wombat Season* or *Thebe Medupe: Rebirth of Selemela* or *Annette Lee: As It Is Above, It Is Below* • headphones (optional) • *Initial Models of Patterns in the Sky* • *Systems Modeling Scaffold* (optional) • *Initial Models Gallery Walk* • marker	• pad of sticky notes • *Listening Group Roles Reference* • audio player • podcast links or files	• chart paper labeled "Patterns in the Sky" • markers • Patterns in the Sky poster • chart paper labeled "Initial Consensus Model" • pad of sticky notes • DQB • pad of large sticky notes • chart paper labeled "Ideas for Future Investigations and Data We Need"

Materials preparation (40 minutes)

Review teacher guide, slides, and teacher references or keys (if applicable).

Make copies of handouts and ensure sufficient copies of student references, readings, and procedures are available.

Test the podcasts www.teachersopensciedfieldtest.org/space , www.teachersopensciedfieldtest.org/space , OP.SS.VID.L1.003 , and www.teachersopensciedfieldtest.org/space ahead of time and decide how students will listen to them in small groups. See guidance callout below for suggestions.

Review the unit front matter for an overview of how systems and systems models, scale proportion and quantity, and patterns are scaffolded in this unit.

Review the unit front matter for an overview of how this unit is designed to help students see why the patterns in the sky are relevant to their lives, their communities, and life on Earth.

Prepare chart paper for posters. The posters you will make in this lesson are as follows:

- Patterns in the Sky
- Initial Consensus Model
- Ideas for Future Investigations and Data We Need

Download the *Communicating in Scientific Ways* file from the website, print it, and post it in your classroom or add to students' notebooks. The file can be used as a poster or a handout.

Be sure you have materials ready to add the following word to the Word Wall and/or a personal glossary: *perspective*. Do not post this word on the wall until after your class has developed a shared understanding of its meaning.

Lesson 1 • Where We Are Going and NOT Going

Where We Are Going

In this lesson, students begin with a phenomenon that is directly connected to their experience: waking up in the morning when it is dark outside in the winter versus waking up when it is already light in the summer. But we quickly expand away from this phenomenon to think about other patterns in the sky. By the time students develop models on day 3, they should be thinking about any and all patterns in the sky that they think might be connected to systems in space. In Lessons 2, 3, and 4, students will get a chance to model and explain (1) seasonal patterns of the Sun's path and the related phenomenon of seasonal temperature changes, (2) lunar phases, and (3) eclipses. Students will also get a chance to explain changing constellations as part of the embedded assessment materials at the end of Lesson 8.

Where We Are NOT Going

Students may suggest sudden events like asteroid collisions or supernovae. The focus of this unit is explaining patterns, so while there may be the opportunity to read about these events over the course of the unit, students will not be modeling or explaining them.

Students may also broaden their questions on the DQB to include things they have heard about in space, like black holes, nuclear fusion, or supernovae. Stars and stellar evolution are high school grade band, and are not covered in this unit. Put these questions up on the DQB now, but know that they may end up unanswered. Encourage interested students to research unanswered questions at the end of the unit.

The word *perspective* is introduced formally in this lesson. In future lessons, there will be more vocabulary to add to a Word Wall and/or personal glossary. But other than *perspective*, in this lesson, accept and build on students' everyday words, using scientific vocabulary like *lunar* or *annual* only if students are using these words fluently already.

LEARNING PLAN for LESSON 1

1 · NAVIGATION

20 min

MATERIALS: science notebook

ADDITIONAL GUIDANCE

Connections to Me and My Community
In this lesson, we begin by considering how changes in when the Sun rises and sets can impact our daily lives in very real ways, by affecting what we can do after school, what we wear at certain times, how we feel when we wake up and go to bed, and much more. Support is provided for how to highlight local manifestations of this phenomenon. Students consider how changes in the Sun is one of many changing patterns in the sky and brainstorm other patterns that they have experienced or heard about. Expanding outward from their own experience, students draw on funds of knowledge to bring in stories from family or community members about patterns they have seen or heard about in the sky and how these might be connected to the rhythms of life on Earth. Expanding outward from our local community, we then listen to a series of podcasts to learn about ways that humans across cultures and throughout time have relied on and made connections to the sky. Support is provided for how to help students make connections and build on their own cultural resources in processing these podcasts.

Review the front matter for the unit for an overview of how this unit is designed to help students see why the patterns in the sky are relevant to their lives, their communities, and life on Earth.

Introduce a new phenomenon. Present **slide A**. Say, *I had a lot of trouble getting up this morning; it was dark out, and I don't like getting up when it's dark. Did anyone else notice that?* Take a show of hands.

ADDITIONAL GUIDANCE

This was written on the assumption that the unit is being taught in fall or winter. Note that in spring you might need to adjust this introduction to focus on how much brighter it was when you woke up, or how difficult it is to go to bed when it is still light out. This will also vary by location.

Pose the questions on the slide, *How does it affect you when the time the Sun rises changes? What about the time the Sun sets?* Look for suggestions like clothing or accessories changes, street lamps going on, difficulty or ease of going to sleep, activities that we can do when it stays lighter longer, turning on the lights for after-school sports games, the danger we might feel when it is darker, animal behavior changes, and so forth. When a student makes a suggestion, ask the rest of the class if they have experienced the same thing (as a show of hands) in order to highlight how universal these experiences are for our class.✱

Present **slide B**. Pose the questions on the slide as a Stop and Jot activity: *What is going to happen to the time when the Sun rises and sets in a couple of months? What about in a year?* Ask students to record these questions in their science notebooks and then write their ideas underneath.✱ After two minutes, ask students to share their predictions. Look for students to suggest that the number of hours of daylight will increase more and more (or decrease more and more) or that sunrise will get earlier and earlier (or later and later) or that sunset will get earlier and earlier (or later and later). If students don't suggest that this pattern will end, challenge students by asking questions like these:

- *Will this pattern keep happening forever?*
- *Could the day or night just disappear?*
- *Will the Sun ever rise so early that it rises at midnight?*

Look for students to say that if the number of hours of daylight is increasing, it will eventually stop and start decreasing or vice versa. Students might also say that this change corresponds to certain seasons and that it repeats every year.

✱ ATTENDING TO EQUITY

Encourage your students to consider impacts that are specific to your local community or region. For example, in a farming community day-length changes might affect hours that parents are working in the field, crop growth, and levels of milk or egg production; in a tourist-driven community day length might seasonally affect the local economy as people are less likely to visit local shops after the Sun goes down; or in a coastal community, day-length changes might affect hours for surfing, skating, or sunbathing. Considering local wildlife might also be interesting for some students; for example, for many mammals (including humans) less daylight leads to lower production of certain hormones (serotonin and melatonin), which can change behavior.

✱ ATTENDING TO EQUITY

Supporting emergent multilinguals
Keeping a science notebook allows students a space in which to reflect and communicate their developing understandings about science ideas and to track changes in their understandings. Students should be encouraged to record their ideas using linguistic (e.g., written words) and nonlinguistic modes (e.g., photographs, drawings, tables, graphs, mathematical equations, measurements). This is especially important for emerging multilingual students because making connections between written words and nonlinguistic representations helps students generate richer explanations of scientific phenomena.

SCIENCE NOTEBOOK

This is the first use of the science notebook for the new unit. You may need time to organize a new section in the notebook. How to set up the section will vary depending on how you've structured the components of your notebooks, such as the table of contents and how to note the start of a new unit. We recommend students do the following:

- Reserve a blank page at the start of the unit, to be titled on day 4 of this lesson when students are given the unit question.
- After the title page, reserve 2 pages (4 pages front-to-back) for the table of contents (unless all tables of contents are at the front of the notebook).
- Reserve 10 pages (20 pages front-to-back) for the Progress Tracker pages.
- Number the pages so everyone begins the first investigation of the unit on the same page number.

For more information on *Science Notebook Management*, refer to this section of the *OpenSciEd Teacher Handbook*.

Elicit students' initial ideas by asking the class to discuss the question on **slide C**: *How did you make your predictions? What evidence do you have? Turn and talk to a partner.* After 30 seconds of partner talk, solicit ideas. Look for students to suggest that the length of daylight changing is a pattern. Students might not use the word *pattern* but may say that it happens every year or that they have seen it happen over and over. Get agreement from the rest of the class on this being something that happens every year by asking for a show of hands. Then say, *Something that happens over and over is called a pattern.*

Present **slide D**. Ask, *Is this pattern the same everywhere? Does everyone on Earth have the same length of day and night that we do? Do the days grow longer and shorter in the same way they do for us every year?* Look for a student to say "no" and then push that student to give reasons and examples from their own experience to prove that this is true. Ask 3-4 other students to join in with additional evidence from their experience.✱

✱ STRATEGIES FOR THIS INITIAL IDEAS DISCUSSION

Middle school students are learning a lot about science, but it is important to honor the fact that they are already experts in their own experiences and that these are legitimate ways of knowing about the world. During this discussion, validate and encourage students as they share meaningful observations from their own lives by saying things like, *That is very perceptive, has anybody else noticed that?*

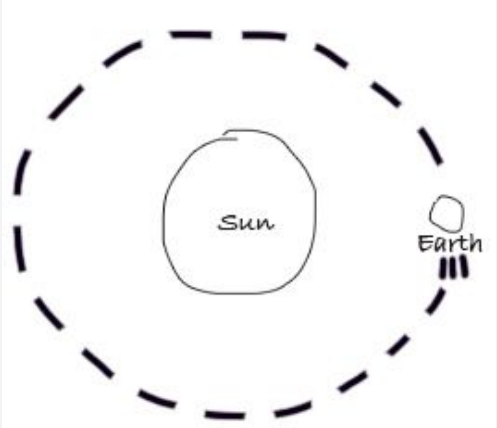
2 · CONNECT THIS PATTERN TO THE SKY

15 min

MATERIALS: pad of sticky notes, chart paper labeled "Patterns in the Sky", markers

Present **slide E**. Say, *We noticed a pattern, and it makes me wonder what is causing this. What do we think is causing day and night to change in this predictable pattern every year?*✱ Have students turn and talk with a partner for 30 seconds before eliciting ideas.

Look for students to mention the Sun, light, or sunlight and Earth. Highlight any of these ideas that are related to the Sun. When students mention the Sun, draw a circle at the front of the room on a whiteboard, document camera, or chart paper to represent the Sun, and label it. Ask students, *Why do you think the Sun is involved?* Look for students to say that the Sun gives light or energy or radiation and that when they see it set, the light goes away. Then add a smaller circle near the Sun at the front of the room to represent Earth and say, *Some of you also mentioned Earth. Why is it important to include Earth as part of this system?* Accept a couple of students' ideas and move on.



Say, *So we think that Earth and the Sun are working together to create this pattern, the changes in this twenty-four-hour rhythm in our lives every day that determines when we sleep, when we eat, when we go to school, and how long the day and night are over the course of the year. First, let's think about the 24-hour pattern. So what exactly is happening to the Earth that would explain why we change from night to day over 24 hours.* Look for students to suggest that the Earth spins. Indicate this on the sketch with a circular arrow above the North Pole of the Earth.

✱ SUPPORTING STUDENTS IN DEVELOPING AND USING PATTERNS

If your students have completed *OpenSciEd Unit 8.3: How can a magnet move another object without touching it? (Magnets Unit)*, explicitly make the connection here between cause-and-effect relationships and patterns. Consider engaging students in making these connections by asking, *How does cause and effect relate to patterns? How could you use the cause-and-effect sentence frames that we used to explore the speaker to talk about patterns in the sky?* Students might suggest (or you might introduce) a modified sentence frame such as this: When *something in space happens*, we will observe *this pattern*. Review the unit front matter for an overview of how to scaffold crosscutting concepts in this unit.

Say, *But this 24 hour cycle changes over time. How are the Sun and the Earth moving with relation to each other that could help us explain this?* Look for students to suggest that the Earth is moving around the Sun. Indicate this on the sketch with an arrow or three lines on the earth, along a dotted line to indicate the path of a circular orbit around the sun. The spin of the Earth, and the orbit of the Earth around the Sun are both fifth grade standards, so do not spend too much time on this, but make sure that the class agrees before moving on.

Point to the diagram you have just made at the front of the room of Earth and the Sun and say, *That is pretty wild that we can connect this important pattern to this system in space. We've already moved to visualizing this system from a perspective that is way bigger than what we can see from where we are located right now.*✱

ALTERNATE ACTIVITY

You can use a simple prop to illustrate how perspective changes, and reinforce the idea that the Earth's orbit is nearly circular. Tape a penny to the center of a paper plate, and hold it up for the class so that they can see the full circle of the plate. Tell students that the plate represents the orbit of the Earth, and the penny the Sun. Then tip the plate slightly to show how this circle appears to be oblong when we look at it from a different perspective. You can refer back to this example later to support interpretation of representations of the Earth-Sun system that appear elliptical.

Brainstorm patterns in small groups. Organize students into groups of 4-5. Present **slide F** and ask, *So is there anything else like that, where something happening way out in space is changing the patterns of what we see in the sky either during the day or during the night? Discuss this in your table group.* As you circulate the room, accept all responses but encourage students to focus on patterns that they have seen or experienced. Don't worry if this list is not exhaustive; students will return to it twice in the next few days with new information.

After discussing in small groups for a couple of minutes, have students record their ideas on sticky notes. As students work, make sure that a piece of chart paper labeled "Patterns in the Sky " is hung near the front of the room.

Ask each group to put their stickies on this poster. Accept all ideas.✱ You may hear things like these:

- different shapes of the moon
- eclipses
- tides
- astrology, zodiac, star signs
- holidays
- meteor showers

ASSESSMENT OPPORTUNITY

Building towards: 1.B Ask questions about systems in space that arise from observations of patterns in the sky.

What to look/listen for: Use this as a pre-assessment to gauge how much your students already know about space. Some students may be suggesting comets and galaxies, while other students might suggest that the Sun goes around the Earth.

What to do: Accept all ideas. If your students need support with foundational understandings about the motion of objects, make sure to pause and establish these ideas when we model the Sun-Earth system in Lessons 2-4. If your students are eager to know more about black holes, there are a number of optional readings and podcasts throughout this unit to connect students to myriad related space phenomena.

✱ SUPPORTING STUDENTS IN DEVELOPING AND USING SCALE, PROPORTION, AND QUANTITY

The crosscutting concept of Scale, Proportion, and Quantity is central to this unit and to understanding space systems. Because our perspective on Earth is limited, phenomena that can be observed at one scale, for example by simulating the whole solar system at once from a perspective above the system, may not be observable from our perspective. Many of the familiar patterns we see on Earth are a symptom of this limitation of perspective and our inability to observe the system at scale.
Review the unit front matter for an overview of how to scaffold crosscutting concepts in this unit.

✱ ATTENDING TO EQUITY

Supporting emergent multilinguals
During moments when students are tasked with expressing their ideas, allow them to do so through linguistic (oral and written language) and nonlinguistic (e.g., drawings, graphs, symbols, gestures) modes. For example, you might suggest sketching a picture on the sticky note to a student who is having trouble articulating a pattern they have observed related to the Moon. Providing emerging multilingual students with such opportunities allows them to use all their resources to express meaning.

3 · NAVIGATION AND HOME LEARNING

10 min

MATERIALS: science notebook, a blank sheet of paper (optional, use if you choose not to let students bring their science notebooks home)

Assign home learning. Present **slide G**. Say, *We have seen a lot of stuff in the sky, but you all have only been around for, like, twelve to fourteen years. Our friends and family may have seen things or heard about things that we haven't experienced. There might be stories our family or community knows about things in the sky that go back even longer in time. Let's pull in those resources.*✱

Say, *Tonight, go home and poll your friends and family members. First, share with them what we have been talking about and share an example of a pattern. Let them know that this is not about weather but about patterns we think are connected to space. Then ask them these questions:*

1. *What patterns have you seen in the sky?*
2. *What stories have you heard from family or the community about patterns in the sky or things on Earth that are connected to patterns and objects in the sky?*

Have students copy these questions down in their notebooks or on a piece of paper where they can take notes on their conversations to bring back to class.

✱ ATTENDING TO EQUITY

Framing students' families and communities as legitimate funds of knowledge can serve multiple purposes. It can (1) help students feel like they belong in the science classroom by situating their family and community knowledge as productive resources for science, (2) engage students' families in conversations about what is happening in the classroom, and (3) help students make connections between the science classroom and their everyday lives.

End of day 1

4 · NAVIGATION AND RETURN TO HOME LEARNING

8 min

MATERIALS: home learning (notes from interviews with friends and family), pad of sticky notes, Patterns in the Sky poster

Return to home learning. Display **slide H**. Have students share the ideas they got from their family with the people at their table and then record at least one new idea per table on a sticky note. Students should then add their sticky note(s) to the Patterns in the Sky poster. Look for students to add things like these: Moon phases, star patterns, shooting stars, eclipses, comets, satellites, jet streams, airplanes, sunsets, green flash, clouds, planets, Milky Way, other galaxies, days, nights, moonlight, UFOs, flying saucers, origin stories, celestial navigation.✱

Say, *Wow, we got a lot of new ideas by polling our friends and families. Even though our friends and families have more experience than we do, they haven't been around for that long when we think about how long humans have been observing the sky. How could we find out more about what patterns people across the world have observed in the sky over human history?* Present **slide I** and have students turn and talk.

Forecast the podcast jigsaw as a way to further expand our pool of experiences. Say, *We can't go back in time, but people from every culture have been observing the sky from all over the globe for thousands of years. Maybe they saw other patterns connected to the sky that we could add to our Patterns in the Sky poster.*

ADDITIONAL GUIDANCE

To keep the focus on space rather than on clouds and weather, you can respond to such suggestions by saying, *Wow, that's an interesting pattern! What about patterns that we think are connected to systems in space?*

✱ ATTENDING TO EQUITY

Supporting emergent multilinguals
Allow and encourage students to speak using both content-specific and everyday words and phrases when expressing their ideas. This helps students fully express themselves, allowing others to question, evaluate, and build off their ideas. Switching back and forth between different registers is especially important for emerging multilingual students because it helps them draw on their full range of meaning-making resources.

5 · PODCAST JIGSAW

20 min

MATERIALS: science notebook, *Making Sense of the Podcast Jigsaw*, 1 copy of 1 of the following handouts: *Gerardo Aldana: The Descent of the Feathered Serpent* or *Jessie Ferrari: Wombat Season* or *Thebe Medupe: Rebirth of Selemela* or *Annette Lee: As It Is Above, It Is Below*, headphones (optional), *Listening Group Roles Reference*, audio player, podcast links or files

Prepare for podcast jigsaw.✱ Present **slide J**. Introduce the podcasts and the close listening protocol using the slide. Walk through the close listening protocol below and field any questions students have. Depending on how much time you have, warn students to keep pauses short.

Before	• Look at the title of your podcast and discuss with your group: What does the title tell you about what will be in the podcast? • What is a question that you have that you hope the podcast will help answer?
During	• Listen carefully, following along with the transcript. • Highlight or underline words, phrases, and ideas as you hear them that you have never heard before or that you want to know more about. • Each person in your group will be allowed one **pause request**. When you hear something that you want to discuss or clarify more, raise your hand to use your pause request.
After	• Look at the title of your podcast again. Now that you have heard the podcast, why do you think the podcast producers chose this title? • Respond to these questions on the handout and be ready to share with the class.

Organize students into small groups of 4-5 and assign them one of the following podcast links. Make sure that you distribute to each group the appropriate handout with the podcast transcript and accompanying images. If your class is larger than 25, you can choose to assign two groups to a podcast or increase the group size, depending on the number of audio players you have available.

- www.teachersopensciedfieldtest.org/space - *Gerardo Aldana: The Descent of the Feathered Serpent* (grade level 8)
- www.teachersopensciedfieldtest.org/space - *Jessie Ferrari: Wombat Season* (grade level 8)
- OP.SS.VID.L1.003 - *Thebe Medupe: Rebirth of Selemela* (grade level 7)
- www.teachersopensciedfieldtest.org/space - *Annette Lee: As It Is Above, It Is Below* (grade level 9)

ADDITIONAL GUIDANCE

Some of the podcasts are more concrete, while others require more careful listening. Consider intentionally putting students who may need more support with listening comprehension in mixed-ability groups listening to the grade 7 level podcast. You can place students who thrive off challenge in the grade 9 level podcast group.

Decide ahead of time how you want students to listen to the podcasts. Here are some possible options:

- Each student with their own device and a pair of headphones
- Groups each gathered around a computer or music player with the volume low in different parts of the classroom
- Groups each gathered around a computer or music player at their table with a splitter that allows them to connect multiple pairs of headphones
- Groups each gathered around a computer or music player in separate rooms

✱ ATTENDING TO EQUITY

These podcasts were chosen to begin this unit for a variety of reasons.

- **Motivation:** Understanding how humans across time and space have articulated the relationships between our lives and the sky can help students form connections about why the content matters to them.
- **Understanding:** Considering more than one perspective on a phenomenon makes our understanding of that phenomenon more robust.
- **Identity:** Highlighting more than one legitimate cultural way of knowing helps students from all backgrounds see an identity for themselves in science.

Please present these podcasts to students not as stories about ancient or outdated ways of thinking about the world, but as legitimate, living bodies of knowledge. This knowledge is not lesser than but rather a complement to Western scientific ways of knowing. Humans have always been driven by noticing, recording, and understanding patterns and by understanding our perspective and belonging within a larger system. Building telescopes and spectrometers to gather data is just one of the ways that humans have responded to that drive.

In addition, whenever we consider cultural identity in the classroom, it is important to avoid framing this identity as static and homogenous and instead to recognize all people as having multilayered and multicultural identities. It is easy to tokenize cultural stories. The goal is to respect but not oversimplify difference.

Consider assigning students roles to keep every student on task and enforce the use of the close listening protocol. We suggest the following roles for a group of 5:

- **Progress monitor.** This person periodically asks others to take the measure of the group's progress. This includes watching the time to keep the group on track. Some questions the progress monitor might ask are the following:
    - "What can we say we've accomplished so far?"
    - "What do we still need to know or do to accomplish this task?"
    - "We have _____ minutes left. What can we do in that time to accomplish our task?"
- **Big ideas person.** The role of this student is to relate the podcast to the question we are trying to answer.
    - "How does what you said relate to _____?"
    - "How does this change the way we're thinking about _____?"
- **Clarifier.** This is a role of monitoring everyone's comprehension about one or two key science terms. The clarifier might ask questions such as these:
    - "Do we know what the word _____ refers to?"
    - "Can we put it into our own words?"
- **Questioner.** This person asks probing questions during the activity. The questioner listens for questions posed by other group members and then revoices the questions to make sure that the whole group takes a moment to hear and entertain questions from everyone. This is not a role that students find easy, so it helps to provide them with question stems such as these:
    - "What does it mean that _____?"
    - "How do we know that_____?"
    - "So, what I think you are saying is .... Is that right?"
- **Peacekeeper.** This role might not exist in a group of 4. This person monitors airtime of people in the group. The peacekeeper is allowed to control who has "the floor" with the goal of ensuring that everyone gets a chance to talk and that everyone takes time to listen. The peacekeeper will also be in charge of playing/pausing the podcast when requested.

If you choose to assign roles, use *Listening Group Roles Reference* to help students understand their roles in the group.

Listen to the podcasts. Pass out *Making Sense of the Podcast Jigsaw* and/or display **slide K** and have students work on the questions in their small, expert groups after they listen to the podcasts. Students can respond to these questions in their notebooks, on the handout, or as part of a verbal discussion:

1. How did the people you learned about
    - observe the sky and keep track of what they saw?
    - use their observations of the sky?
2. What patterns in the sky did you hear about in the podcast? Why did the people you learned about observe those patterns?
3. How can observing the sky help us better understand our own planet and our own lives?
4. How do the patterns that we see in the sky help set the rhythms of our lives?

ALTERNATE ACTIVITY

These podcasts represent just a tiny glimpse into some of the ways that patterns in the sky have set the rhythms for human life across time and space. This is an opportunity to localize this phenomenon for students. Consider inviting a local expert (or several) to come in and give a live interview to the class as an additional point of data. Ask students if they know anyone in their family or community who might be interested. Consider reaching out to local astronomy clubs, universities, community leaders, and/or indigenous elders. The goal is to help students make connections about why humans study the sky and to build on their own multicultural resources to process the information in the podcasts.

If you go this route, have students prepare a list of questions beforehand and make a plan for how to distribute the work of asking the questions among students. Consider recording the interview and making the file available online as a podcast that the class can share with friends and family. One resource that could support this is at https://www.npr.org/2018/10/30/662070097/starting-your-podcast-a-guide-for-students#structure . Students will get another opportunity to make their own podcasts later in the unit.

6 · MAKING SENSE OF PODCASTS AS A CLASS

14 min

MATERIALS: *Making Sense of the Podcast Jigsaw*

Present **slide K** again. Facilitate a Building Understandings Discussion by asking students to share some of the things they discussed in their groups. Ask each group, *Why was it important to the people you learned about to study the sky?* Encourage students to draw on their responses to the questions on the slide (and on *Making Sense of the Podcast Jigsaw*) to answer this question.

KEY IDEAS

Purpose of the discussion: There are two goals of this discussion: (1) to generate ideas about why studying the sky is relevant for humans and (2) to generate new ideas about specific patterns in the sky.

Listen for these ideas

- People across time have been interested in the sky because patterns in the sky set the rhythms for life on Earth.
- Observing and keeping track of patterns in the sky can be useful and fulfilling (i.e. for making connections, maintaining power, navigation, farming, and maintaining a spiritual connection to the sky).

Other ideas to highlight if they come up:

- Stories and analogies related to the sky are legitimate ways to preserve knowledge about the stars and planets.
- A connection to the sky is a connection to the larger universe.
- Taking some perspective can help us better understand our own planet and our own problems.

If there is more than 5 minutes left in class, present **slide L**. Ask, *Are there any new patterns we want to add to our Patterns in the Sky poster? If so, let's add them now.* Give students a couple of minutes in their groups to discuss and create new stickies and add them to the poster. Reserve at least three minutes at the end of class for the navigation.

7 · NAVIGATION AND PERSONAL REFLECTION

3 min

MATERIALS: science notebook

Reflect on the podcasts individually. Present **slide M**. Ask students to respond to the personal reflection questions on the slide as a Stop and Jot in their notebooks:

- How are your views about space and science similar to the views you heard about in the podcast? How are they different?
- Did listening to the podcast change any of your views about space and science? If so, how? If not, why not?

If there is time, ask for 2-3 volunteers to share something they wrote.

Forecast what comes next. Say, *Next time, let's spend some time making initial models and see if we can explain some of these patterns.*

End of day 2

8 · MODEL PATTERNS INDIVIDUALLY

15 min

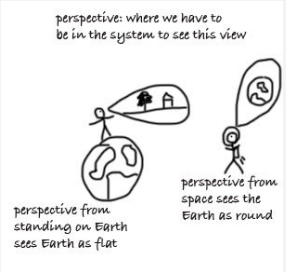
MATERIALS: *Initial Models of Patterns in the Sky*, *Systems Modeling Scaffold* (optional), Patterns in the Sky poster

Orient students to where we have been and where we are going. Organize students into groups of 2-3 to prepare for this activity. Larger groups will increase the time you will need to spend. Display **slide N**. Point to the Patterns in the Sky poster. Say, *Wow, we have a lot of patterns we are interested in. Choose a pattern that you want to explain today and share that pattern you chose with a partner.*

Give students a minute to do this and then say, *On day 1 of this lesson, when we were talking about day and night patterns, we ended up sketching a diagram showing the Sun and Earth as a kind of model. It seems like what you include in your model is going to be different depending on what the pattern is you decide you are going to try to explain. Tell your group what parts you think will need to be in the system you model to help explain your pattern.* Give students a minute or two for this.

Model the system individually and then present to small groups. Display **slide O**. Say, *Remember to label the parts of the system and the interactions.*✱ Then say, *I also included an additional factor to pay attention to, and that is: Where in the system would we have to be to see this view? We call this perspective.*✱

Take this opportunity to add the word *perspective* to the class Word Wall, and/or to students' personal glossaries. Include a quick definition and/or a drawing to help students understand the word in context. If you have not taught systems before, you may need to add parts and interactions as well. For more information on tools for *Developing Scientific Language*, refer to this section of the *OpenSciEd Teacher Handbook.*



Have each student choose one pattern that is listed on the Patterns in the Sky poster and individually develop and use a model to help explain it using *Initial Models of Patterns in the Sky*. At the top of the page, students should label the pattern they chose. On the left side, they should describe and/or show what the pattern looks like for a person on Earth, including a reference to the length of time over which this pattern occurs. On the right side of the page, they should model the larger system that causes that pattern. At the bottom of *Initial Models of Patterns in the Sky*, ask students to label and describe the perspective they are taking in the system drawing. The perspective is the place where one would have to be in order to see that view. At this point, accept almost every idea students have. They will have more time in this unit to develop ideas and vocabulary about perspective. Some examples of anticipated responses about the perspective at this point might include the following:

- Really, really far out in space
- Above Earth
- On Earth
- From the Moon
- From a spaceship in space
- Next to Earth

Then use **slide O** to guide the following 3-step process:

- Take 5 minutes for individual work, then be ready to share your model with your small group.
- In groups: Each person gets two minutes to present their model.
- In the last 5 minutes of this time, students should go back and make any changes that they want to make to their model after hearing about other people's models.

Prepare for a gallery walk. Ask students to post their models on *Initial Models of Patterns in the Sky* around the room for a gallery walk. One way to do this is to tape the handouts to a wall. Another is to ask students to leave their notebooks open on the table to the page where they have pasted in the handout.

✱ SUPPORTING STUDENTS IN DEVELOPING AND USING SYSTEMS AND SYSTEM MODELS

If you haven't taught systems before, you may need to provide additional scaffolding for students here. Consider using *Systems Modeling Scaffold* to lead a discussion about systems. The goal is for students to get more comfortable with figuring out which parts of the system need to be included in the model versus which parts are irrelevant and to get a sense of what it means for those parts to interact. To scaffold the idea of *perspective*, consider asking students to imagine what the Goldberg system might look like from another point of view, for example, that of the bird or that of the man. Note that the words *parts* and *components* are used interchangeably in the NGSS and in OpenSciEd. Using both words can be confusing for students, particularly emergent multilinguals, so be explicit when you use a synonym. Now might be a nice time to remind students that *parts* and *components* are different ways to refer to the things in a system that work together, but they can be used interchangeably.

✱ ATTENDING TO EQUITY

Supporting emergent multilinguals
Provide opportunities for emerging multilingual students to break down the meaning of scientific words that are central to the lesson, such as *perspective*. *Perspective* might mean one thing to students in everyday talk that is slightly different from how we are using it here. Highlighting how words can have different meanings in different contexts can provide emerging multilingual students the chance and space in which to discuss any preconceptions about the meaning of the word(s) and to draw upon their personal experiences.

9 · BUILD A CONSENSUS MODEL OF SYSTEMS IN SPACE

25 min

MATERIALS: *Initial Models Gallery Walk*, *Systems Modeling Scaffold* (optional), chart paper labeled "Initial Consensus Model", markers

Present **slide P** and read the questions aloud to students:

- *What similarities did you see among parts of the systems? What about differences?*
- *What similarities did you see among motions and interactions? What about differences?*
- *What similarities did you see among perspectives? What about differences?*

Distribute the *Initial Models Gallery Walk* handout. Have students move from model to model, recording on *Initial Models Gallery Walk* the similarities and differences that they notice. As students move around the room, take this time to look at some of the models and use them as a pre-assessment. Give them about five minutes. Then bring students back together in a Scientists Circle.

ASSESSMENT OPPORTUNITY

Building towards: 1.A Develop an initial model of systems in space to describe patterns we observe in the sky.

What to look/listen for: Look for students who are including parts or interactions in their system that might not be necessary to explain the pattern they chose. For example, a student might have chosen to model seasons but included all eight classical planets in orbit around the Sun in their model.

In addition, look for students who are representing scale in their models by indicating "zooming" of perspectives. This is a very sophisticated way to represent scale and will become part of our consensus model later in the unit. Make note of these models to highlight in Lesson Set 3.

What to do: If students need support choosing what to put in their models, begin the Scientists Circle with a review of bounding systems. Consider using *Systems Modeling Scaffold* to lead a discussion about systems. Remind students that we bound the system around the parts that are interesting to us or potentially relevant to explain something.

1. What is the function (or effect) of the system? (*to wipe the man's chin*)
2. What are the important parts (or components) of the system? (*everything labeled with a letter, for example, the spoon, the string, and the cracker*)
3. How do these parts interact? (*look for students to describe how, for example, when the man lifts the spoon, the string pulls the end of the ladle, throwing the cracker up into the air*)
4. What do you see that are not important parts of the system? (*the unlettered parts, for example, the wine glass, the plant, the fork, or the man's shirt*)
5. From what perspective has Rube Goldberg modeled the system? (*from someone sitting on the other side of the table*)

If most students are not modeling interactions, push students to think more about the interactions (i.e., forces, sunlight, movement) among the parts as the class develops a consensus model. Make note of the students who are representing interactions between parts and bring attention to their representations as the class builds their initial models.

Take this opportunity to remind the class how we listen to one another, press on one another's ideas, and ask questions of one another and that it's OK to disagree with ideas but it's important to be respectful. You can use **slide Q** to remind students of the classroom norms (if you have developed your own set of norms, replace this slide with your norms).✱

✱ ATTENDING TO EQUITY

Universal Design for Learning
Use classroom norms to support *engagement* by fostering an equitable learning community that promotes trusting and caring relationships. The norms should reinforce to students the value of (1) the diversity of thought among all classroom community members in pushing our learning forward and (2) providing a safe learning environment that ensures fair participation. In addition, classroom norms should interrupt cultural norms or stereotypes that could make science experiences feel uncomfortable for some students (e.g., as being someone who is not intelligent enough to think like a scientist, who cannot do the relevant math, who cannot share their thinking).

Remind students of the Communicating in Scientific Ways sentence starters.✱ Make certain a Communicating in Scientific Ways poster or handout is visible. Emphasize that each individual has contributions to make to their community of learners. Ask them which sentence starters they might want to use to help them talk to one another. Examples include these:

Think of an idea, claim, prediction, or model to explain your data and observations:

- My idea is ....
- I think that ....
- We could draw it this way ... to show ....

Give evidence for your idea or claim:

- My evidence is ....
- The reason I think that this evidence supports this is ....

Other examples could come from (1) listening to others' ideas and asking clarifying questions, (2) agreeing or disagreeing with others' ideas, and (3) adding onto others' ideas.

ADDITIONAL GUIDANCE

Establishing norms is an important focus early in the school year. The brief reminder about norms that happens in this moment assumes that your classroom norms have already been established in a previous unit. For more information about OpenSciEd norms and how to establish them in your classroom, refer to the *OpenSciEd Teacher Handbook*.

Use **slide R** to remind students that the goal of this Consensus Discussion is to determine areas of agreement and disagreement in our initial models to help us decide how to proceed in figuring out these patterns in the sky.

SCIENTISTS CIRCLE

Your students may be familiar with the Scientists Circle from the previous unit. Remind students of the norms for participation and the logistics for forming and breaking down that space. A Scientists Circle includes these important features:

- students sitting so they face one another to build a sense of shared mission and a community of learners working together
- celebrating progress toward answering students' questions and developing more-complete explanations of phenomena
- focusing on where students need to go next and how they might go about the next steps in their work

The class will be in a Scientists Circle all day today, so you will not need to change the arrangement of chairs between classes.

Ask each of the questions on **slide R** (and in *Initial Models Gallery Walk*).

- *What similarities did you see among parts of the systems? What about differences?*
- *What similarities did you see among interactions? What about differences?*
- *What similarities did you see among perspectives? What about differences?*

Consider using a round-robin format to give every student a chance to either share something they wrote or comment respectfully on something someone else has shared. As students share out, use their ideas to draw an initial consensus model at the front of the room, as in the following descriptions and images.✱

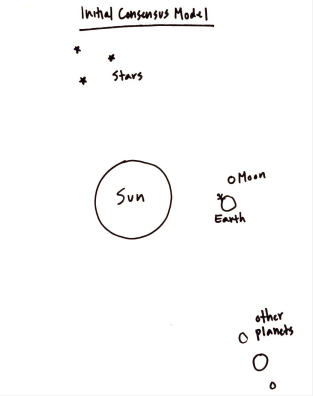
✱ ATTENDING TO EQUITY

Supporting emergent multilinguals
Scaffolds such as sentence starters can model and facilitate particular oral or written language production skills such as formulating questions, hypotheses, explanations, or arguments based on evidence (see Communicating in Scientific Ways poster). Such scaffolds may be of particular benefit for emerging multilingual students to help them develop language skills to write or communicate their ideas to peers. It is important that scaffolds be used purposefully and removed when no longer needed.

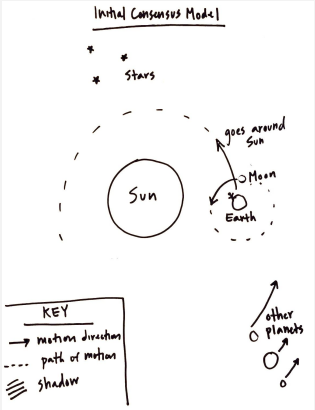
✱ ATTENDING TO EQUITY

Universal Design for Learning: Use *representations* like color coding and/or letter or number coding to foreground parts of the model. Create a key to track what colors, symbols, or letter or number codes represent different parts of the system. While color coding is a useful way to quickly reference the parts of the model, letter or number coding helps ensure accessibility for any student who may be color blind. If color coding is used, consider a color palette that uses orange, blue, black, or dark brown.

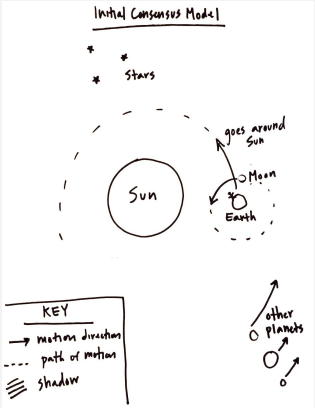
1. As students talk about parts of the system that they saw agreement on in the models, sketch and label them on chart paper at the front of the room. Label the poster “Initial Consensus Model.”



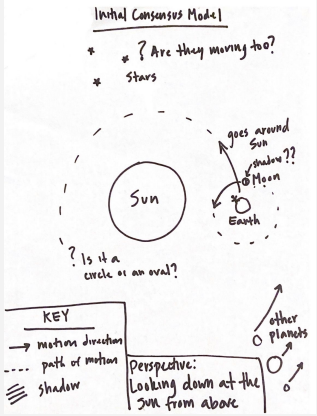
2. As students talk about interactions and motions that they saw agreement on, ask them how they represented these interactions. Use their suggestions to represent these interactions and motions on the poster. Students may suggest motions such as orbits or spin, energy transfer such as light, or forces such as gravity, contact forces, or magnetism.



3. If there is something that students disagree about or something that a student suggests that was really only on a couple of models, you might add it to the poster but label it with a question mark.



4. Look for students to notice that some of the models were drawn from a different perspective. Point this out if it doesn't come up naturally in what students see as similarities and differences. Ask, *Are all of these drawn from the same perspective?* Indicate perspective at the bottom of the model using words, for example, "Perspective: someone floating above the North Pole of Earth" or "Perspective: someone floating above the entire solar system" or "Perspective: someone looking down on our town." Use the words that students use whenever possible. For example, if students are talking about "zooming out", use that phrasing instead of "floating".



ADDITIONAL GUIDANCE	Indicate multiple scales only if several students draw different scales and point this out. It is unlikely that this will come out at this time, so don't force it. We will add multiple scales to our models in Lesson 8.

10 · NAVIGATION AND STOP AND JOT

5 min

MATERIALS: science notebook

Pre-think questions with a Stop and Jot. Present **slide S**. Say, *Next time, we will build a Driving Question Board, or DQB. What questions do you have about some of the phenomena we have been talking about?* Have students write down some ideas in their notebooks. These will not be the questions that they put on the DQB but instead are a chance for students to begin the thinking they will have to do next time.✱

✱ ATTENDING TO EQUITY

As students learn to go public with their ideas, it can help to give them time to think quietly and individually before having to go public with their questions in a small or large group. Do not bother to collect these Stop and Jots, but instead ask students to hold onto them to inform their work in the next class meeting.

End of day 3

11 · BUILD THE DRIVING QUESTION BOARD (DQB)

27 min

MATERIALS: science notebook, marker, pad of sticky notes, DQB, markers, pad of large sticky notes

Orient students to where we have been and where we are going. Say, *We have been collecting experiences that help us understand how people are connected to patterns in the sky. Last time we were together, we modeled a system in space that can help us explain some of these patterns. Then we started thinking about the questions we have about this. Now that you've had time to think about it, let's start building our DQB.*

Write initial questions for the DQB. Make sure the Patterns in the Sky poster and the class's Initial Consensus Model poster are located at the front of the room where students can see them. Present **slide T**. Say, *We have been looking at patterns in the sky and thinking about the space systems that produce them. What kinds of questions could we ask about these patterns and the systems that we think cause them that we could investigate as a class?* Look for students to suggest asking questions about what the pattern looks like, what causes the pattern, what the parts of the system are, what the interactions are in the system, how perspective makes a difference, and if the pattern is the same everywhere, among others.

Display **slide U**. Then pass out 3-4 sticky notes and a marker to each student. Ask students to write one or two questions on the notes about patterns in the sky. They should record only one question per note. They should write their questions big and bold—we want to be able to see the questions clearly.

ADDITIONAL GUIDANCE	Students may have these kinds of questions: Why does the shape of the Moon change? What is an eclipse? How far away is the Sun? Is there a black hole in our solar system? How big is the universe? Are there aliens? Why do stars move? What do the constellations mean? To keep the focus on natural phenomena rather than airplanes and UFOs, remind students to focus on patterns we see in the sky and that people have seen in the sky over millennia rather than singular events of artifacts of modern technology.

Gather in a Scientists Circle around the DQB. Instruct students to bring their sticky notes with completed questions along with their science notebooks to meet in a Scientists Circle around the DQB. The Initial Consensus Model poster and Patterns in Space poster should be visible.

ADDITIONAL GUIDANCE	The Driving Question Board will be central to the sensemaking that happens in the unit. There are a variety of ways to set up the DQB depending on your classroom resources, use of technology, and the number of students you see each day. What works for some will not work for others. Most important is that the DQB is visible to students each day and represents "our shared mission". Students will be using the DQB to assess what they've figured out and identify next steps.

Remind students how to create the DQB (use **slide V** if needed):

- The first student reads their question aloud to the class then posts it on the DQB.
- Students who are listening should raise their hand if one of their questions relates to the question that was just read aloud.
- The first student selects the next student whose hand is raised.
- The second student reads their question, says why or how it relates, and posts it near the question it most relates to on the DQB.
- That student selects the next student, who may have a related question or a new question.
- We will continue until everyone has at least one question on the DQB.

Organize questions into categories. As students share, questions will naturally cluster into similar areas, such as questions about the Sun and questions about the Moon. Once students have finished their sharing, ask students to look at the questions for any additional organization that can be done. Use larger stickies to label these clusters. Some clusters that may emerge include: "Stars," "Moon," "Sun," "Planets," and "Other."

Develop an initial driving question. Present **slide W**. Say, *Now that we have written our questions, what question should we put at the top of our DQB?*

Look for students to suggest something like these examples:

- *How are we connected to space through patterns in the sky?*
- *Why do we see patterns in the way things look in the sky?*
- *How do things in space create the patterns we see in the sky?*

Push students to suggest questions that address

- patterns (or phenomena or things that happen),
- our experience of those patterns (our connection, that we see them),
- and perhaps even causal mechanisms for those patterns (why do they happen, why do we see them).

Feel free to suggest tweaks to students' wording or combine multiple questions. For example, if one student suggests "Why are there patterns in the sky?" and another student suggests "What does the solar system look like?" you can say, *I heard one person asking about patterns and one person asking about systems in space. Can someone combine these into a single question?* Once an idea is on the table that meets the criteria and/or looks like one of the examples above, revoice this question. Then ask, *Does everyone agree on this for our initial driving question?* Once the class agrees, add the question to the top of the DQB.

ASSESSMENT OPPORTUNITY	**Building towards: 1.B** Ask questions about systems in space that arise from observations of patterns in the sky. **What to look/listen for:** As the class builds the Driving Question Board (DQB), listen for (1) the subsystems and patterns that students are asking questions about and (2) how the questions relate to patterns and systems. **What to do:** It is important that *all* questions posed by students be placed on the DQB regardless of whether they are open-ended or close-ended. As students ask questions, have them reflect on any patterns that have few or no questions posted on the DQB. Prompt students to generate more questions in this space so that we are motivated to investigate several subsystems of the solar system.

12 · BRAINSTORM NEXT STEPS

14 min

MATERIALS: science notebook, chart paper labeled "Ideas for Future Investigations and Data We Need", markers

Develop ideas for investigations. Present **slide X**. Ask, *In order to start answering some of these questions, what investigations could we do and what data do we need?* Give students a couple of minutes to jot down ideas in their notebook (as directed by the slide) before eliciting ideas. Students may suggest things like these:

- naked-eye images of objects in the sky (such as the Moon or planets over time)
- size and distance of objects in the universe
- up-close photos of the Moon, Sun, or planets through a telescope
- dates of comets, eclipses, and other events
- modeling with spheres and lights
- make observations of the sky ourselves (If this doesn't come up, ask students what we could do to provide data about how the Moon changes or where the Sun moves or some other pattern that has been identified.)

Make a public record of our ideas. Keep a record of these ideas at the front of the room on chart paper. Label this poster "Ideas for Future Investigations and Data We Need."

13 · NAVIGATION AND OPTIONAL HOME LEARNING

4 min

MATERIALS: None

Consider where to go next. Present **slide Y** and say, *We had the idea of actually going outside and observing these patterns in the sky. Let's do that, whenever we can!* Encourage students to begin noticing what they see in the sky and keeping notes. If you don't feel comfortable sending students home with their science notebooks, have them keep track of what they see on a piece of blank paper or over some other form of communication (e.g., email, Google Classroom). You might also encourage students to try sketching what they see.

SAFETY PRECAUTIONS

If you feel it is not safe or practical for students to be outside of their homes, especially at night, encourage students to look out a window or skip this activity altogether. It is not fundamental to the unit. Students will have the opportunity to look at data on the changing shape of the Moon in Lesson 3 regardless of what data they have collected in personal observation.

Introduce the software. Say, *We have only a couple of weeks for this unit, and some of these patterns happen over time periods that are much longer than that. To address this, I have another tool that I think might also be useful in our investigations, in addition to the ones you suggested so far. When scientists want to study patterns that happen over really long periods of time, they sometimes make simulations. I have software that will allow us to do that. It will show us what we would see in the sky if there were no clouds, from any location on Earth at any time of day or night. And we can speed up time to watch a whole year pass in only a minute! Let's plan to try it out next time we meet and see what patterns we notice.*

Home learning (optional). If students have access to technology, have them play around with Stellarium online on a computer or using the mobile app before class. (Note that the mobile app is not free.) Ask them to try simulating what the sky will look like tonight. You can have students take screenshots of the software's night sky and bring them into class to fuel discussion next time, or you can ask them to compare the simulation to what they see in the sky. Use **slide Z** to help students access the software if you choose to assign this home learning.