FOSS ® NATIONAL SUN, MOON, AND STARS
TEACHER PREPARATION VIDEO TRANSCRIPT

<Module Introduction>
Narrator: The Sun, Moon, and Stars… Sun and Moon by day. Moon and stars by night. The FOSS Sun, Moon and Stars module consists of 3 investigations that introduce students to these familiar objects and how they move.

Here's the Sun, Moon, and Stars kit. There's enough permanent equipment in this one box for a class of 32 students and enough consumable equipment for at least two classes. You'll need to check the inventory sheet in the Materials folio to see which materials are consumable and which are permanent.

<Teacher Guide Introduction>
Narrator: Before you begin teaching this module, it is important to look through the entire Teacher's Guide.

The FOSS teacher guide for this module includes these folios: Overview, Materials, Investigation Folios, Science Notebook Masters, Teacher Masters, Teacher Answer Sheets, Embedded Assessment, Benchmark Assessment, Assessment Masters, Science Notebooks, Reading Extensions, FOSS Website, and Investigation Outline.

Be sure to read the overview folio before you begin teaching the module. It contains many helpful suggestions for getting started. In it are an overview matrix, the standards that are addressed in this module, background information, ideas on preparing science notebooks, and suggestions for scheduling the activities.

In the Materials folio you'll find an inventory list for the kit, a description of the materials you'll need to provide for the investigations, directions for preparing the materials, and information on ordering any replacements.

Next are the investigation folios. These are the heart of the program and will be described in detail in this video. The first page gives overview information. The At a Glance chart summarizes the investigation and helps you plan for assessments and extension activities. Next you'll find background information specific to the investigation.

There is a section called Teaching Children About, which gives you some insight into the research on how children think and learn. Each investigation has two parts. For each part you'll find a materials list, Getting Ready section, and step-by-step directions for conducting the activity with your students. The interdisciplinary section at the end of each investigation has many ideas for extending the activity into other areas of your curriculum.

The next sections contain the Science Notebook Masters and the Teacher Masters. Here you'll find all of the student sheets used in the investigations. There are also masters for math extensions and Home/School Connections for each investigation.

There are many ways to assess your students' learning as they move through the investigations. Read through the Embedded Assessment folio for more information about FOSS formative assessment. This folio includes tips on what to look for when assessing some of the notebook sheets, a suggested teaching schedule, and an assessment summary for the module. The Benchmark Assessment folio has detailed information on FOSS

summative assessment. Students take a pretest before beginning the module, along with an identical posttest after the module is complete. At the end of each investigation, students also take I-Checks, which assess student understanding of the concepts contained in each investigation. Be sure to read through the ways to involve students in self-assessment of at least some of the items on each I-Check. Scoring guides are included in this folio.

After these two assessment folios, you'll find the Assessment Masters. See the Assessment section of this video for more information.

The Science Notebooks folio describes the benefits of using science notebooks with FOSS. It offers a detailed discussion of using notebooks with your grade level.

Check out the Reading Extensions. This annotated list includes both nonfiction books and fiction books for student reading, along with teacher resources.

The FOSS Website folio introduces you to the interactive, multimedia website for teachers, parents, and students.

In the Investigation Outline folio you'll find a complete outline of the module by session.

In the kit, you'll find the *FOSS Science Resources* book for this module. The articles contained in this book are designed to be read periodically throughout the module after students have had hands on experience with the activities.

<Before You Begin>
Narrator: There are a few preparation steps that need to be completed each time you begin the module. Check the compasses included in the kit to make sure they all work properly. All the needles should point North. Make sure you test them away from any metal objects. Make sure the Moon Calendar is wiped clean and is ready to use. Inventory the sidewalk chalk. Each pair of students will need one piece of chalk. Plan to replenish your supply if there isn't enough available.

Look over the Moon-phase poster to make sure it's complete. It has four sheets.

Look over The NASA lithograph set to make sure it's complete. It has 15 sheets.

Make sure you have an overhead projector available for the activities that require one. It's a good idea to have a replacement bulb on hand.

You'll need to make copies of science notebook sheets before each investigation. You might want to make transparencies of some of the sheets to help your students get oriented.

On large chart paper you'll want to make a word bank, this is where you'll keep all the new vocabulary as it appears throughout the module. Also, you'll make a content inquiry chart. Here is where you'll write statements that summarize what the students have learned. It's also a good place to record any questions that students may have at the end of each part.

You'll want to decide how you will use notebooks before beginning the module. There are two types of Science Notebook Masters. Full-page masters and half-sheet masters. The half-sheet masters are designed to be copied and then cut apart and pasted into composition notebooks you provide. One strategy that works very well is having the students paste the notebook sheets on the left side of the composition books, leaving the right side open for any additional recording.

If your students are ready to take on the responsibility of what, how, and when they record information and process data, you may decide to have them work in blank composition books. Your students are usually ready for this version of a science notebook once they have worked through several more structured versions.

For more information about the use of science notebooks, read through the Science Notebooks folio in the teacher guide.

Make copies of the Letter to Parents teacher master and send them home with your students. The letter describes the module and tells parents how they can help students with the Night Sky Log that you will send home in Investigation 2.

As part of the FOSS assessment system, a pretest should be given to students before beginning the module. You will give the same test as a posttest at the end of the module, so you will be able to assess your students' progress after they engage in the investigations, readings, and other activities. Make copies and administer the pretest before beginning the module.

You'll also want to put the Safety Poster up in your classroom.

<Investigation 1, Part 1>
Narrator: In this part students begin observing objects they can see in the sky, focusing on the Sun.

Here's what you'll need from the kit: 2 compasses for each group of 4. You'll also need a piece of sidewalk chalk. You need to supply masking tape, a transparency, chart paper, a marking pen, and an overhead projector.

A paper fastener or transparent tape are optional teacher-supplied items.

If you haven't already, make copies and send home the Letter to Parents and make copies and conduct the pretest before beginning the module.

For each student, make copies of science notebook sheet no. 1 called Where's the Sun? You can use this sheet as an assessment to check students' ability to record time data, predictions, and the movement of the Sun in drawings. See the Embedded Assessment folio for more information about using this sheet as an assessment.

Assessment opportunities are embedded throughout the module. Be sure to read the note about assessment in each Getting Ready section.

Make one copy each of the Cardinal Directions teacher sheets numbers 3, 4, 5, and 6.

Copy teacher sheet no. 2, called Demonstration Compass, onto a transparency.

Cut out the dial and the needle. If you're not using a new kit, this may already be in the kit.

Find a location outdoors for this activity. A good choice is a leveled, paved location away from student traffic and far enough away from buildings to avoid shadows during the day.

Find or create a line with an East-West orientation for the Sun-tracking activity. If there is no such line in the schoolyard, use a compass and masking tape or sidewalk chalk to make a line long enough for students to stand on about a meter apart.

Look around for landmarks or buildings that are North, South, East and West from your central location.

Consider the timing of the observations you will make outside. Sun tracking requires a clear or slightly overcast day. Students need to go out at least three times to follow the Sun, once early in the morning, once around noon, and once more toward the end of the school day.

Take some time to practice with the compass. The needle in the compass is a magnet so it will be affected by steel, such as the steel in some scissors and the steel frames of desks. You will get inaccurate readings if you use the compass near steel.

To use the compass, place it on a flat surface that's not made of or near steel. After a few seconds, the needle will come to rest pointing North. The painted end of the needle indicates North. Rotate the compass under the needle until the North-South line on the compass rose is lined up with the needle, with the letter N under the painted end. You can now determine the four cardinal directions in your classroom, North, South, East and West.

Teacher: Turn to your partners…

Narrator: Begin this part by asking students what they see in the sky during the day.

Teacher: …sky during they day?

Student: You see like the clouds, like in the day; and the Sun and birds.

Student: In the morning I always see a Moon, actually half a Moon.

Teacher: Alright, tell me something your table found that you see in the sky during the day. Christopher.

Student: The sky and the Sun.

Teacher: OK, the sky and the Sun. Arianna.

Student: Clouds.

Teacher: Clouds. Dustin.

Student: The planes.

Teacher: Airplane. Sean.

Student: The Moon.

Teacher: The Moon is sometimes in the sky even during the day.

Narrator: Record student's ideas and determine what qualifies as being in the sky.

Teacher: …in the sky. And you guys did a really good job at naming all things that are in the sky that are not touching the ground. So when we look up sometimes we see trees, but they're not in the sky; they're touching the ground. So you guys did a really good job with that. Which of the things on this list are natural? They just happened in the sky. Christian.

Student: Birds.

Teacher: Birds are in the sky naturally.

Narrator: Record students' ideas about which items are natural and which are made by humans. Continue by focusing students' attention on the Sun.

Teacher: Is the Sun always in the sky?

Class: Yes.

Teacher: Some people say yes; some people say no. Is the Sun always in the sky during the day?

Class: Yes.

Teacher: When does day start? Noemi?

Student: By the light coming up.

Teacher: What's the light that's coming up? The Sun comes up; that's morning. So, what is the whole day? So when what Travis? Tell me now what day is.

Student: Like when morning Sunrise…

Teacher: …to…when is it over?

Student: Night?

Teacher: And how do we know its night?

Student: When it's dark.

Teacher: And how do we know—what happens to make it dark?

Student: The Moon comes up?

Teacher: The Moon comes up, but what—remember we're talking about the Sun—so what happens to the Sun?

Student: It goes down?

Teacher: So where did the Sun come up this morning?

Narrator: Encourage students to start thinking about the Sun's movement.

Teacher: Can you guys point, from sitting in the classroom? Where does the Sun come up in the morning? Everybody point at where the Sun comes up in the morning. OK. Where is the Sun when you're out on the playground at lunch time? Who knows what directions are when we look at a map—what do we see on the map? Sean.

Student: When you see a map you see a little tiny compass that says North, South, West, and East.

Teacher: And East. And you said the word compass that is a drawn compass and what I have to give you today that we're going to look at is also called a compass. OK, and it's a tool that let's you know what direction you're going if you're going somewhere.

Narrator: Have students place the compasses flat on their desks.

Tell students that the red end of the needle always points North. Have them slowly turn the compass body until the letter N is under the red end of the needle.

Teacher: Cause we need to find where North is.

Narrator: Have everyone point North.

Teacher: I have this sign here that says North or has an N and this is called—those directions North, South, East, West—are called cardinal directions. Can you guys say that? Cardinal directions.

Class: Cardinal directions.

Teacher: Cardinal. So, North if we want to label the classroom where North is we're going to put it right here where you guys are all pointing. OK? We're going to put it up here and hope…

Narrator: Use the demonstration compass to introduce the cardinal directions.

Teacher: And it's under that, so the opposite direction would be South. Face the North. So opposite, you're going to turn all the way around and now you're facing…South.

Class: South.

Narrator: Post the remaining cardinal direction sheets in the correct places in the classroom.

Take your students outdoors. Each pair of students shares a compass.

Have them line up facing South on the East West line you created earlier.

Teacher: Where is South?

Narrator: Students identify each of the four cardinal directions.

Teacher: So this is South. So where is West?

Narrator: Mark each direction with chalk.

Teacher: OK, there's West and where is East?

Class: That way.

Teacher: East. So, it came up in the…

Narrator: Ask students to think about the path of the Sun from Sunrise to Sunset.

You can continue this part the next morning. Show students the "Where's the Sun?" notebook sheet and explain how to use it. Each student will get a copy of the sheet.

Teacher: And Tyler's going to stand on a line that goes from East to West. So she's going to stand facing South. Which way is South? OK stand with your feet together, facing South and Sean is her partner he's going to have one of these papers. OK? OK, what Tyler's going to do standing on the line from East to West is she is going to point at the Sun.

Narrator: Remind students never to look directly at the Sun. Return to the East-West line.

Teacher: You're going to face your partner and your partner is going to point at the Sun. So where is the Sun? Point with your hand, all the way out. Point with this hand, so you don't have to cross your body. There you go.

Narrator: The pointers stand on the line facing South. The observers face the pointers. When everyone is in place, the pointer points to the Sun.

Teacher: It's OK, just draw his hand pointing.

Narrator: The observer draws the pointer's arm on the notebook sheet and labels the arm with the time of day. Students switch places and repeat.

Students draw an arrow on the sheet to predict the direction the Sun will move between now and noon.

Teacher: Where do you think your arm will be at 12:00? And what I want you to do is draw an arrow from where that hand is; where do you think the Sun is going to go? Remember this is the morning, so it's going to go higher in the sky. So where will it be Travis at noon, if it's going up higher in the sky? So draw an arrow from here to where you think it will be at noon.

Narrator: Go back outside around noon. Students repeat their observations and label their sheets.

Have them predict where the Sun will be at the end of the school day.

Students go back outside once more before the end of the school day and make their final drawing.

Discuss the results of the Sun observations to verify that the Sun moves in the sky from the East to the West.

Use the notebook sheets to see how well students recorded time data and predictions and represented the Sun's movement in the drawings.

At the end of each part, you'll add new words to the Word Bank. You'll also add new concepts to the content chart.

1.1 Reading in Science Resources

At the end of Part 1, introduce the FOSS Science Resources book and draw students' attention to the article called Sunrise and Sunset. Have the students read the article on their own at home or in class, or have them read along while you read the article aloud. Introduce the Glossary, and show students how to identify the boldface words as glossary words. Review questions are included at the end of the article. You can discuss these questions after you've finished reading the article.

<Investigation 1, Part 2>

Narrator: In part 2 students explore what makes shadows and observe how their shadows change over a day as the Sun's position changes.

You will need the sidewalk chalk from the kit for this part. Make sure your supply is adequate. You will need to provide a globe, scissors, masking tape, and an overhead projector.

For each student, make copies of science notebook sheet no. 2, called Sun and Shadows. You can use this sheet as well as your observations to assess student understanding of how shadows are created and how they change as the Sun moves across the sky.

Make copies of I-Check 1 to give students at the end of this part. See the Benchmark Assessment folio for information about interpreting student responses.

Make sure you have identified a level, open location on the playground for this part. The area you used in Part 1 should be fine. Make sure that the area is away from buildings and other structures that might hide student shadows during the day. You also want a location that gets the least amount of student traffic.

Review the cardinal directions and introduce shadows.

Teacher: And I want you to talk about two things; I want you to talk about what is a shadow and what do you need to make a shadow. OK, turn to your partner.

Student: Do you make your shadow when you; when the Sun is in back of you? Does your shadow will be long and that's how you make your shadow.

Student: And I think you need the Sun to shine on you, so you can make a shadow. But when it's over there it just goes um longer, when it's over here it goes shorter.

Student: Like yourself is blocking the Sun and that's why you have the shadow. If it's over here and you're right here it blocks right there.

Student: And the shadow looks like yourself when you block the Sun.

Teacher: OK, tell me what you found in your group. What did you decide on in your group? What—what is a shadow? First, what is a shadow? Christian?

Student: A shadow is…

Narrator: Listen to student responses and then ask for a volunteer to help you create a shadow.

Teacher: We see light on this side; what do we see on the other side of Destiny? What do you see? Do you see the light? Shining on you?

Student: No.

Teacher: No. OK, so turn sideways. Turn this way. Yeah, face me that's good. Face me. Face me. What is this side of her body? Is it lit?

Class: No.

Teacher: So it's not light, it is…dark. This side is dark and this side is light. Whichever way she turns does this side stay light? Let me move this down a little bit, so we get her cause I'm taller than she is. OK, so when she turns—I want you to turn slowly all the way around, come back to me—watch this shoulder, cause this shoulder has light, right? See if it stays light or does it get dark? Ok go real slow. Real slow. All the way around. Does it stay in the light? So when it turns away from the…

Class: light.

Teacher: it gets…

Class: dark.

Teacher: So we call it the…dark side and the light side. OK, have a seat. OK [name] face that way, so the lights not in your eyes. Does she have a shadow?

Class: Yes.

Teacher: Why does she have a shadow everybody?

Class: She's blocking the light.

Teacher: She's blocking the light. If I turn off the light, does she still have a shadow?

Class: No.

Teacher: Why not? Let's have a hand. Why is there no shadow now? Tyler.

Student: There is no light.

Teacher: OK, if there's no light to block you can't have…a shadow.

Student: shadow.

Narrator: Have students use the overhead to practice making other shadows.

In the morning go outside and have students work in pairs, taking turns tracing the outline of their partner's shadow and feet. They label the shadows with the owner's name and the time of day it was drawn. Have them predict which directions their shadows will point in the afternoon.

If there is time, issue some shadow challenges to your students.

About three or four hours later, take students outside to trace their shadows again.

Teacher: Put your feet in the same place. It's different isn't it? So I want you to think about what we talked about when we were outside and what you saw when you were outside. What can you tell me about the changes in your shadow throughout the day? Tyler.

Student: When the Sun moved your shadow moved with you.

Teacher: OK, so your shadow; did your shadow move in the same direction as the Sun?

Student: No, cause the Sun was like right there and gets higher and comes down. Their shadow changes like—it moves because the Sun moves.

Teacher: OK. Geraldine.

Student: The shadows got smaller and bigger.

Teacher: When did they get smaller and when did they get bigger?

Student: When the Sun was high and when the Sun was low.

Teacher: And what was your shadow like when the Sun was high in the sky?

Student: Small.

Teacher: And what was the shadow like when the Sun was lower in the sky?

Student: It was bigger.

Teacher: And what do you mean by bigger? Was it wider?

Student: Taller.

Teacher: Taller or longer?

Student: [shook her head yes]

Teacher: OK, the overhead projector is going to be our Sun. The globe is going to be the Earth. It's a model of the Earth that shows all of the continents on our planet. And it turns this direction. What happens to the light when I turn the globe?

Class: Stays in the same place.

Teacher: It stays in the same place. One side of the globe is dark and one side is…

Class: Light.

Teacher: Just like the person that was standing at the front of the room. Dark side and the light side. So the side of the globe that is light—what—how would you describe what would be happening for the people on that side of the globe Junior.

Student: Its there morning.

Teacher: Its there morning and their…is it just morning?

Student: Daytime.

Teacher: It's there daytime. What's happening for the people on the dark side of the Earth Christopher?

Student: It's nighttime.

Teacher: It's nighttime. So this side is day; this side is night. So I have a little flag here that I'm going to put on our state.

Narrator: Use a sticky note or a piece of masking tape trimmed into a triangle. Be sure to rotate the globe in a counterclockwise direction.

Teacher: Think about daytime and think about nighttime to see what's happening. We're going to try and observe what's happening because this is what scientists do. They make a model Christopher to show what something looks like because we can't all go out in space and watch the Earth. We have to make a model. Alright, so let's watch. As I turn the Earth, what's happening in our state right now?

Student: It's dark.

Student: It's nighttime.

Teacher: It's nighttime great. OK we're going to keep turning, keep turning. What's happening in our state right now?

Student: It's going to be morning.

Teacher: How do you know it's going to be morning Christian?

Student: It's close to being right next to the Sun.

Teacher: How do you know by looking at the flag that it's morning? You can step back and look—how do you know? How did you know it was morning?

Student: Cause on top there's light.

Teacher: There's light. It's starting to be in the light. So daytime is starting. So we're going to keep turning. What is happening—someone that's on this side that can see Junior—what's happening with the flag now?

Student: It's getting more Sun?

Teacher: It's all in the Sun now. So remember what we talked about before when the Sun shines and something gets in the way, what happens?

Student: It makes a shadow.

Teacher: It makes a shadow, great. Angel, what can you say about this shadow? How could you describe that shadow?

Student: It's dark.

Teacher: It's dark. OK. Watch as it turns. Tell me how it changes. What's changing to it?

Student: It's long.

Teacher: It's getting…

Student: It's getting smaller.

Teacher: It's getting smaller. OK, let's turn it a little bit more. Now what's happening? When the Sun's right in front of us.

Student: Noon.

Teacher: Noontime. OK, let's keep turning. And you guys are going to watch the shadow. Do you see the shadow yet? OK, we're going to keep turning. Now our shadow's so short we can barely see it. So we're going to continue to turn. OK, Gally I want you to watch that shadow. What's happening to the shadow now?

Narrator: Make sure students understand how shadows change as the Earth rotates.

Student: Going more than the back.

Teacher: OK, remember here it was short and as I turn it now it gets…

Student: Bigger.

Teacher: And remember over here we said it was long and then it got short. And now what is it?

Student: Longer.

Teacher: It's getting longer. What time of day is it now? Geraldine.

Student: It's like afternoon.

Teacher: Late afternoon right?

Narrator: Have a few students practice rotating the globe and identifying the time of day.

Teacher: What do you think?

Student: Late afternoon?

Teacher: It's late afternoon and what's happening to your shadow?

Student: It got a little bit longer.

Teacher: It's getting longer. Keep going.

Narrator: Add new words to the Word Bank. Add new concepts to the content chart.

1.2 Reading in Science Resources

Have students read the article called Changing Shadows in the Science Resources book. This is an expository article that discusses what shadows are and what they tell about the apparent motions of the Sun over a day and over a year. You may want to have them read this twice, once on their own and then once as a class.

Have students answer the review questions at the end of the article. Then discuss the questions as a class.

Have students read Summary: The Sun. This article reinforces the concepts covered in the investigation.

Students answer the review questions at the end of the article on notebook sheet 2, called Sun and Shadows. Collect the sheet and review student answers before discussing the questions. Discuss the questions as a class.

Give students I-Check 1. After you have reviewed the papers, return them for self-assessment and discussion.

At the end of each investigation, you'll find the interdisciplinary extensions. The interdisciplinary extensions include science extensions, language extensions, and math extensions.

You'll also find the home/school connection at the end of each investigation. The home/school connections provide activities for use at home. You'll want to look ahead to the home/school connections before beginning an investigation for notes on when each activity should go home. Parents can also download these home/school connections from FOSSweb.

<Investigation 2, Part 1>
Narrator: In this investigation, students observe the Moon during the day and at night and discover the lunar cycle.

In Part 1, students begin their Moon observations.

Here's what you'll need from the kit: the Moon Calendar poster, a dry-erase marking pen, and the 1-liter zip bags. You will need to provide scissors, a transparency, transparent tape, and an overhead projector with an overhead-transparency marker.

You may also want to have some chart paper and a marker available.

For each student, make copies of science notebook sheets no. 3, called Night-Sky Log, and no. 4, *The Night Sky* Review. You will use notebook sheet no. 4 as an assessment to check students' understanding of objects that can be seen in the night sky.

For the class, make a copy of teacher sheet no. 8, Night-Sky Questions on to a transparency to use in Step 7 of Guiding the Investigation.

This investigation takes a month, enough time to progress through one complete lunar cycle. In Part 1, plan one session to introduce students to the Moon and set up the home-observation activity. Plan another session to start displaying Moon-observation data on the class Moon Calendar. Reading in the Science Resources book will take one more session. Then, you can move on to Investigation 3, while you continue making Moon observations and recording on the Moon Calendar for another 3 weeks. Once four weeks of data is collected, you can come back to Part 2 of Investigation 2 to complete analysis of the Moon data.

It's best to start the investigation just before the Moon is in first-quarter phase, when it will be visible between noon and midnight. Determine the date of the new Moon, either by going online to FOSSweb and reviewing

the Lunar Calendar or by checking your local newspaper for new-Moon information. Once you have determined the date of the new Moon, plan to go outside with you students 5 or 6 days later to start observing.

If at all possible begin this investigation on a Monday. Students will record their observations on the Night-Sky Log, for 4 nights, focusing on the Moon and stars. Students will return their logs to class on Friday.

If you need to make a new cut-and-stick Moon set, make one copy of teacher sheet no. 7, called "Cut-and-Stick Moons."

Cut the individual Moon pictures apart and sort them by the 7 different phases. Put each phase in its own zip bag. Use transparent tape to attach these pictures to the Moon Calendar.

Teacher: It looks like the Sun moves…

Narrator: Begin this part with a short review of the Sun's movements in the sky.

Teacher: So now in this next section, we're going to talk about the Moon. And we're going to observe changes in the Moon. Sometimes you can see the Moon during the day. How many people have ever seen the Moon in the sky during the daytime? OK. That doesn't happen today.

Narrator: If the Moon isn't visible, you can use the Lunar Calendar activity on FOSSweb to show students the Moon's current phase. If at all possible, take your students outside, following the instructions in the teacher guide.

Teacher: So take a look at that. So pretend you're with someone that can't see the Moon. How would you describe that to somebody that can't see it? What would you say the Moon looks like, Alyssa?

Student: A half-circle?

Teacher: Shaped kind of like a half-circle. OK, so we just see this light part. Tyler.

Student: It's like a curve from half-circle.

Teacher: OK, it's the curve of part of a circle. Galley?

Student: Um, it looks like a banana.

Teacher: Excellent.

Narrator: Introduce the Moon Calendar, writing in the appropriate month and date using a dry-erase pen. Have the class choose the Moon picture that most closely matches the shape they observed and attach it to the calendar.

Ask students whether the stars and Moon change position or stay in the same place every night.

Teacher: Does anyone know? Anyone have a prediction? Alyssa?

Student: No.

Teacher: No? You think it's going to be in a different place? Or is it going to move throughout the day? Throughout the night?

Student: Yes.

Teacher: It's going to move throughout the night? Is it going to come up in the same place every night?

Student: No.

Teacher: No.

Narrator: Introduce the Nigh-Sky Log and model how to fill in an observation.

Teacher: Then you have the Moon. So we just looked at the computer…what I want you to do in this circle is draw what you saw. Galley told us it looked kind of like a banana. So where are you going to put that line to show that shape? Starting at the top you're going to write that shape in. One side of the Moon is dark and one side of the Moon is light. What do we see more of when we looked at the Moon? The light side of the Moon or the dark side of the Moon? Junior?

Student: Dark.

Teacher: We saw more of the dark side. So when we draw this picture in what side are we—we can't color light, right? Because that's white and our paper's white. So we're going to color in with our pencil the dark side. So what side is dark, Eduardo? Where're you going to color? That's right. So let's color this side in.

Next we're going to do some observations. Let's think about what people said—cause we all looked at the Moon on the computer—what were some of the observations that we heard? Christian?

Student: It's shaped like a banana.

Teacher: It's shaped like a banana, so let's write that up. Alright, what you're going to do tonight is find this Moon in the sky, fill in the time when you saw the Moon, and you might want to add to your observations if you saw any stars in the sky or anything else you might have seen in the sky. We're going to continue observing the Moon every night this week.

Narrator: Remind students to bring their Night-Sky Logs back to school on Friday.

Teacher: Put the date and time and any observations you have about the Moon for Tuesday, Wednesday, and Thursday.

Narrator: On Friday, use a transparency of teacher sheet no. 8, Night-Sky Questions to discuss students' observations. Students discuss the questions in small groups and report their responses to the class.

After the general discussion, focus on the Moon's daily changes and record the first week's data on the Moon Calendar. If you are missing any data because of cloudy skies, check the teacher guide for suggestions on how to fill in the gaps.

Add new words to the word bank. Add new concepts to the content chart.

2.1 Reading in Science Resources
Have students read the article called The Night Sky in the *Science Resources* book. This article describes the objects that can be observed in the night sky.

Have students answer the review questions at the end of the article on notebook sheet no. 4, *The Night Sky* Review. Discuss the questions as a class. Collect the notebook sheets to use as an embedded assessment.

<Investigation 2, Part 2>
Narrator: In Part 2, students review the Moon calendar and learn about Moon phases.

Here's what you'll need from the kit: white polystyrene spheres, slim straws, the lamp base and lightbulb, the set of Moon-phase posters, and the Video called All about the Moon. Your kit will contain one of these formats. You'll need to provide a way to view the video. You'll also need the Moon Calendar with four weeks of data. You'll need to provide scissors, transparent tape, glue, and an overhead projector.

Make copies of science notebook sheet no. 5a Phases of the Moon-1 or sheet no. 5b Phases of the Moon-2. You will use one of these sheets as an assessment to check students' ability to accurately assemble representations of Moon phases into a lunar cycle and to associate the phase names with the Moon's appearance.

See your teacher guide for more information on choosing which sheet to use. You may decide to use both.

You should also make four copies of teacher sheet no. 13, called Moon-Phase Representations. Cut the sheets into 8 horizontal strips so you will have one for each student. Make copies of I-Check 2, which you will give at the end of this part.

To prepare the Moons, you will insert the straws into the spheres. Cut about three inches of tape and wrap it around one end of each straw…to ensure that it fits snuggly.

Before starting this part, practice modeling Moon phases. The room should be dark, so if you can't darken your classroom, you should find another suitable space. Place the lamp base and lightbulb in the center of the room and use one of the spheres on a straw to represent the Moon. Hold the Moon ball at arm's length in front of your face and rotate your whole body in a counterclockwise direction. Practice observing the phases of the Moon as you turn.

This picture shows where to place the ball to view the different Moon phases.

Take some time to preview the 23-minute-long video called All about the Moon. The video can be viewed with closed captions.

Use the calendar to guide the discussion. Students should be able to describe the pattern of Moon shapes over four weeks.

Teacher: What are some of the ways you've seen the Moon? How does the Moon look in one of the days that we've seen it?

Student: We've seen it all white.

Teacher: OK. The whole Moon looks like a big white circle. OK.

Student: Yeah.

Narrator: Draw students' attention to the Moon Phase poster. Introduce the phases. Tell students that the shape of the Moon changes in a predictable pattern over and over. It takes 4 weeks, one lunar cycle, for the Moon to go through all the phases.

Teacher: And I went to a first-quarter Moon. But in between…

Narrator: The main phases are the new Moon, the first-quarter Moon, the full Moon, and the third-quarter Moon.

Teacher: Looks like what we call a crescent. Have you ever seen a…

Narrator: After the new Moon, a crescent Moon first appears, getting bigger, which we call waxing. After the first-quarter Moon, the Moon continues to get bigger, and when it is more than half lit, it is called a waxing gibbous Moon. After the full Moon, the Moon begins to wane, which means getting smaller.

Teacher: On the waxing, the black is on the left side Moon and on the waning it's on the right side of the Moon. So they're not the same. We're not seeing the same part of the Moon, are we?

Narrator: Have students watch the video, All about the Moon. After students view the video you might want to take a break.

Teacher: We're going to use this lightbulb to be the Sun and each of you are going to be your own planet Earth. What does the, I mean yeah—what does the Moon go around? Does the Moon go around the Sun?

Class: Yes.

Class: No.

Teacher: No. What does the Moon go around Christopher?

Student: The Earth.

Teacher: The Moon goes around the Earth. So each of you is going to have—you're going to have a partner, you're going to take turns with your partner. You're each going to have your own little Moon. You're going to put it on the end of your pencil like this.

Narrator: This class is using pencils. You can use the slim straws from the kit.

Teacher: I am the planet Earth. I'm going to hold my Moon up…

Narrator: Demonstrate how to perform the modeling activity for the class.

Teacher: What do you think I see on my Moon?

Student: New Moon?

Teacher: All black, so a new Moon. So then I'm going to turn counter clockwise like the Moon revolving around the Earth and when I stop here I see half a light and half dark, which is a…

Student: First-quarter Moon?

Teacher: First-quarter Moon, very good. Now I'm going to continue rotating 'til I get here. And this is where you have to make sure you keep it up high enough so you're head doesn't block it and you look up at the Moon and you guys can see it too. What do you see?

Student: Full Moon.

Teacher: Full Moon is all lit up. So we're going to keep turning, revolving around and when I get here this side of the Moon is light, this side of the Moon is dark, and I'm at a…

Class: Third-quarter Moon.

Teacher: Third-quarter Moon, good. And I'm going to keep going until I get back to here and I see a…

Student: Dark Moon.

Teacher: Dark Moon, which is a…

Class: New Moon.

Teacher: New Moon, so the Moons gone…

Narrator: Use these questions from the teacher guide to orientate students to the relationships between the Earth, the Moon, and the Sun.

Teacher: 30 days, that's about a month.

Narrator: Distribute a ball and straw to each pair. Everyone should have a turn to use the Moon ball to create a phase cycle.

Teacher: Keep turning.

Narrator: Encourage students to call out the names of the phases as they turn.

Teacher: Dark Moon. What is a dark Moon, Angel? Angel. What is a dark Moon called? You remember what it's called when it's all dark?

Student: A new Moon?

Teacher: A new Moon. OK, good. Now turn 'til you see the shadow, half and half, keep going. Do you see it yet? Do you see the shadow on there? Is it half and half?

Student: Yeah.

Teacher: What do you call that?

Student: A quarter?

Teacher: Third-quarter.

Student: Third-quarter.

Teacher: Keep it up above your head Travis. Travis, turn the other way. Good. Good. Stand in your spot with your arm out. Turn your Moon until you see a gibbous Moon. Just a little bit of shadow on it. What do you see now?

Student: All black.

Teacher: All black and that is a…

Student: New Moon.

Teacher: New Moon. Jessie Lyn, do you see a new Moon? Is it all black?

Narrator: Discuss the modeling activity by asking students where they stood and how they held the Moon to observe each of the four main phases.

Give each student a strip of eight Moon-phase representations and a copy of notebook sheet no. 5, Phases of the Moon, or the alternate sheet from FOSSweb California.

Make sure students pay close attention to the placement of the light source on the sheet.

Teacher: The sunlight's at the bottom, the Earth is you. How you just were in the middle of—when you were holding the Moon—with the Moon going around you and you see the arrows that say which direction they turn?

Class: Yeah.

Teacher: OK, everyone trace the direction they go. Trace. Which way is the Moon turning on that paper? On the paper, point to the paper and trace like Christopher's doing. Good Christian. OK that's the way it's going. I'm going to give you the phases of the Moon like this. You're going to cut them apart. They're just like we did on our Moon Calendar and you're going to cut glue them in order that we saw the Moon when we turned in our demonstration. Tyler.

Student: Will we have to put um the line right there what we've seen?

Teacher: On the line you're going to write what phase you saw. So, looking at the bottom spot put your finger on the bottom square. Think about where you were standing if you were; if that was you standing there, what would you see? The Sun is behind you; what are you going to see?

Narrator: Students cut apart the eight Moon-phase representations and place the eight phases on their sheets. When students are satisfied that they have the representations properly placed, they can tape or glue them in place and write the name of the phase with each representation.

Collect the sheets to check how well students are able to identify and position the Moon phases.

Add new words to the word bank. Add new concepts to the content chart.

2.2 Reading in Science Resources

Have students read the article called Changing Moon in the *Science Resources* book. The article describes the phases of the Moon, their names, and some information about the lunar cycle. You may want to have students read and discuss this article a few pages at a time.

Students answer the review questions at the end of the article. Discuss the questions as a class.

Students also read Summary: The Moon. Students should answer the summary questions at the end of the article on a sheet of paper in their science notebooks. Discuss the questions as a class.

Give students I-Check 2. After you have reviewed the papers, return them for self-assessment and discussion.

<Investigation 3, Part 1>

Narrator: In this investigation, students look at the night sky to observe stars and are introduced to the constellations people have named.

In Part 1, students are introduced to constellations as groups of stars in predictable patterns.

Here's what you will need from the kit: the picture of the Sun from the solar system lithograph set, and the lamp base and lightbulb.

You will need to provide an extension cord, a globe, 4 blank transparencies, and an overhead projector.

Make copies of science notebook sheets no. 6, Star Patterns, and no. 7, *Stargazing* Review. You can use sheet no. 7 as an assessment for checking students' understanding of the movements of stars in the night sky.

Copy teacher sheets numbers 14, 15, 16, and 17 onto the blank transparencies.

You need to decide how many constellation drawings you want each student to draw in this part. There are six different constellations on the Star Patterns sheet. You can have everyone draw all six or have different students draw two or three different ones. Be prepared—everyone will want to share their creations.

You will need to set up the lightbulb "Sun" in the center of the room and plan for space for the Earth globe to move around it. Make sure the furniture is organized to allow for this.

A stargazing night or a trip to a Planetarium are great extensions to this investigation.

Begin this part by spending a few minutes reviewing the objects students have observed in the sky in the first two investigations.

Teacher: Sam, where did you see the Sun come up?

Student: At the East.

Teacher: On the East. Everyone point to East in the classroom. OK. Did anyone see the Moon yesterday or today during the—at night or during the day? Christian.

Student: It was a third-quarter Moon.

Teacher: It was a third-quarter Moon. Did you see it last night?

Student: No, I saw it this morning.

Teacher: You saw it this morning. Did anybody see the Moon last night? It was pretty cloudy last night, so we didn't see it. If it wasn't cloudy what else might you see in the sky beside the Moon?

Student: Stars.

Teacher: Christopher.

Student: Stars.

Teacher: We'd see stars. What is a star? What is a star, Tyler?

Student: It's a small burning ball of gas.

Teacher: Small burning ball of gas. Did you guys know that a star lights up because it's burning gas? And the Sun is a star and it's the star that's closest to Earth. So that's why it looks so much bigger. Why do the stars look so small if they're all burning gases in the, in the, in space? Alyssa.

Student: Because, because they're so far away?

Teacher: Because they're far away. I was reading about how far away the stars are and there is a jet airplane that can go 3,000 km per hour. On the freeway we drive about 100 km per hour. So 3,000 km is how fast this jet airplane can go and it would take that airplane a million years to get to the closest star after the Sun. So the Sun is the closest star to us on Earth. And the other stars are farther away, but the closest one to us after the Sun is a million years away in a jet airplane that goes 3,000 miles per hour. So those stars when you say the stars look small cause they're so far away; they're very very far away. That, you can't even think about how far away they are. Christian.

Student: When you get close to them do they look really big?

Teacher: They would be big. Some of them are bigger than the Sun. Some of them are smaller than the Sun. Some of them are the same size. But they all look so small because they're really far away. When you stand on the playground and you look way over at the park and you see the trees over there they might look small. But when you go to the park what do you see?

Class: Big trees.

Teacher: Trees that are big because the farther things are away the smaller they look. Let's talk about the stars. That's what we're going to talk about today. OK? What do you call a group of stars in the sky? What do you call a group of stars in the sky? Gabrielle.

Student: A constellation.

Teacher: Constellation.

Narrator: Introduce constellations. Project the transparency of the Big Dipper.

Teacher: Does anyone recognize this constellation? Christopher.

Student: Big Dipper.

Teacher: The Big Dipper. And it says it right on there, good job. People a long time ago thought that this group of stars look like a dipper. And if you've ever had punch with a punch bowl or soup with a ladle—those big spoons that you scoop up and they have a big handle on it—that's why it's called a dipper. So this is the scooping part and then this would be the handle.

Narrator: Project the transparency called Ursa Major: The Stars.

Teacher: And see the Big Dipper in Ursa Major. Raise your hand when you can see the Big Dipper in this constellation of stars. The scoop and the handle; the scoop and the handle. Can you see it now Alyssa? Alright.

Can you imagine the bear—can you see a bear in there? Can someone come up and show me where the bear's feet might be? Gabrielle.

Student: Right here.

Teacher: And what would that be? That would be his front feet or his back feet?

Student: Front feet.

Teacher: Front feet. And where would his back feet be?

Narrator: Project the transparency called Ursa Major: The Great Bear, and point out all the stars that constitute the Ursa Major constellation. Ask students to look for something odd in the image. The bear has a long tail. Tell students the Ursa Major story in the teacher guide.

Teacher: Bear had a long lovely tail that he was very proud of. He used to wave it around and make the other animals look at it. Fox decided to play a trick on bear.

Narrator: After the story, tell students it's their turn to draw some constellations. The stars on the sheet are real groups of stars but their job is to imagine their own pictures in the stars.

Teacher: Pick any of these six to start with. Six boxes to start with and draw what you see. You can turn the paper and you might see something different. You want to try and find something that's unique or your own imagination.

Narrator: Invite students to share their creations.

Teacher: Bottom box. Does everyone see his box? What did you make in there?

Student: A race car.

Teacher: A race car. So looking at this and look it when you look at yours—whatever even if you have something drawn in there those two big dots are his…wheels. And that race car sure looks like it's taking off.

Narrator: Introduce the idea that constellations don't change, but that they do move across the sky.

Teacher: One of these patterns in the sky. And if you stayed outside all night would that pattern of stars stay in the same place?

Students: No.

Teacher: No. What happens to it over night? It changes place. Does it change its shape?

Student: No.

Teacher: So that group of stars moves all together along with all the other stars. Or they appear to move. Why—you're going to talk to your table in a minute—why do those stars appear to move across the sky?

Narrator: Allow about two minutes for students to discuss the question, and then call upon groups to share their ideas.

Teacher: What did you come up with? Why does it look like the stars are moving? Geraldine.

Student: Because the Earth rotates.

Teacher: The Earth rotates. So the Earth is rotating and the stars are staying where they are. Just like the Sun looks like it comes up and goes across the sky because we turn and the Moon looks like comes up…

Narrator: Reinforce ideas that suggest the rotation of the Earth causes the constellations to move across the sky.

Use the Orion transparency and an overhead projector to simulate stars moving across the sky.

Teacher: Straight hands, like this.

Narrator: Have students use their hands as blinders on the sides of their heads. Keeping their blinders in place, have students turn slowly left. They should see Orion rise. As they continue to rotate left, they will observe Orion pass over their field of vision moving to the right. It will appear as Orion rose above the Eastern horizon, traveled across the sky, and set behind the Western horizon.

Teacher: Turn again. Now we're going to go all the way around. Watch what happens to that constellation. Keep your blinders up. Go all the way around slow. See how it comes into view and then goes out of view. Does it look like the—stop, face front—does it look like the constellation moved when you went by it?

Class: Yeah.

Teacher: But you were the one moving. That's what happens on Earth. The stars are right where they are. They stay in the same place and the Earth turns, so then sometimes we can see it and then it turns and we can't see it.

Narrator: This is a possible place for a break.

Introduce seasonal change.

Teacher: So what I want you to imagine in that on this wall there are millions of stars. OK and if we look this way there's millions of stars, and if we look at that wall there's millions of stars, and if we look at the back wall there's millions of stars and we're right in the middle. OK? If we went outside; this is the Earth, I'm going to be the Earth right here; and we went outside and looked up in the sky because we'd be facing this way in the winter.

I need someone to be my Orion. Christopher. So I want you to stand over there in—everyone see those millions of stars on that wall? OK hold that up, so we can see Orion, just right here. Cause you're going to hold it for

awhile, so make sure you got it. OK, so in the winter this is the part of the sky that we would be able to see and we would be able to see Orion.

But in the summer, when we go out to look at the sky we're going to see this side and we're going to see all these millions of stars. Look at those millions of stars over there. And one of the constellations we might see would be the constellation Aquila. So who's going to be my Aquila? Noami, you go stand with those millions of stars on that wall. So we all remember in the summer we see Aquila.

This is going to be our Sun in the middle of our solar system. We're going to see if we can clip it on here. OK? And we're going to imagine that there's millions of stars on each wall around the room. This is going to be Earth. Does it look like Earth?

Class: Yes.

Teacher: Yeah and its going to orbit the Sun. How long does it take the Earth to go around the Sun, Travis?

Student: 1 year.

Teacher: 1 year. OK…

Narrator: Move the globe to different positions around the classroom, asking students to pay attention to when the constellations Orion and Aquila are visible from the globe.

Teacher: What time of day? And its winter, so what do we see in the sky?

Class: Orion.

Teacher: Orion. OK. Would we see Aquila in the daytime?

Class: No.

Teacher: Why won't we see it?

Student: The Sun's in the way.

Teacher: The Sun is so bright that we can't see Aquila. It's still there, but we can't see it. So we're going to keep going revolving, that's a day; I mean we're rotating that's a day and we're revolving Arianna. Here we are. Here is our state. What time of day is it?

Student: Day.

Teacher: Daytime because…we're facing the Sun and we keep revolving and now it is summer. What time of day is it?

Class: Night.

Teacher: What do we see in the sky?

Student: Aquila.

Teacher: Aquila, the constellation Aquila. Will we be able to see Orion?

Class: No.

Teacher: Is Orion still in the sky?

Class: Yes.

Teacher: Nighttime and its summer, so we can see Aquila, but we can't see Orion because we're all on the other side of the solar system. When we do turn this way; could we see Orion?

Student: No.

Teacher: Because?

Student: Because the Sun is too bright.

Teacher: Because the Sun is shining and it's daytime, so that's why we can't see it. But it doesn't matter. It's still in the sky.

And as the Earth revolves around the Sun our seasons change. So when the Earth was over here we had what season?

Student: Winter.

Teacher: Winter and when we got to the other side we had…

Class: Summer.

Teacher: So what do you think would be up here?

Student: Spring.

Teacher: Spring and what would be when I was on the back of the room?

Student: Fall.

Narrator: Add new words to the word bank. Add new concepts to the content chart.

3.1 Reading in Science Resources

Have students read the article called Stargazing in the *Science Resources* book. The article describes the stars, constellations, naming of constellations, and apparent movement of stars across the night sky.

Have students answer the review questions at the end of the article. They can record their answers on notebook sheet no 7, *Stargazing* Review.

Collect notebook sheet no. 7 and review student responses to assess their understanding of the movements of stars in the night sky. Then discuss the questions as a class.

<Investigation 3, Part 2>
Narrator: In Part 2, students watch a video that shows more information about stars and discusses telescopes and their role in acquiring information about stars, planets, and the Moon.

From the kit, you'll need the video called All about Stars. Your kit will contain one of these formats. You'll need to provide a way to view the video.

Make copies of science notebook sheet no. 8, called All about Stars.

Make copies of I-Check 3 to give students at the end of this investigation. You will also need copies of the posttest to give students when they finish their observations and discussion about Moon phases in Part 2 of Investigation 2.

Take some time to preview the video called All about Stars and the discussion questions before showing it to your students.

Teacher: We've been talking about stars and constellations. What is…

Narrator: Start this part by reviewing what students have learned so far about the stars and constellations.

Student: Constellation is the group of stars that make a pattern or shape.

Teacher: Make a pattern or shape. Do the patterns of those constellations change?

Class: No.

Teacher: They stay the same, right? What is a star? What is a star? Tyler.

Student: A small—it's a small burning ball of gas.

Teacher: Is it always a small ball of gas?

Student: Sometimes it can be a big ball.

Teacher: Usually very big—a large burning ball of gas. When do we see stars and constellations? Rebecca.

Student: At night.

Teacher: At night. Why do the constellations appear to move across the sky? Christopher.

Student: Because the Earth is moving around.

Teacher: And the constellations stay there, so it looks like…

Student: they are moving.

Teacher: Looks like the constellations are moving. Here's a hard one. Who can tell me: why do we see different constellations in the summer than we see in the winter? Why do we see different constellations in the summer than we see in the winter? Geraldine.

Student: Because of the different seasons.

Teacher: So what does that mean—in the different seasons? Where's the Earth in different seasons?

Student: In different places in the solar system.

Teacher: Different places in the solar system. 400 years ago an astronomer, Galileo…

Narrator: Tell students a bit about astronomy and introduce the telescope.

Teacher: stars that were far away. And he used the telescope. So we're going to watch a video about astronomers and how they used telescopes to study the stars and the constellations and the planets and the Moon.

Narrator: Distribute notebook sheet no. 8 called All about the Stars for students to complete after they view the video.

Teacher: The answer to these 7 questions is on the video. So we're going to pre-read the questions, watch the video, and then you're going to be able to answer the questions. Don't try to answer them while we're watching the video.

Narrator: Show the video to your students. After they've watched the video, students answer the questions on sheet no. 8. When they complete the sheet, discuss the questions as a class.

Add new words to the word bank. Add new concepts to the content chart.

3.2 Reading in Science Resources

Have students read the article called Looking Through Telescopes in the *Science Resources* book. The article discusses Earth-based telescopes, the Hubble Space Telescope, and the advantages they provide for astronomers. Then read Star Scientists, the three short biographies of scientist who have devoted their lives to different aspects of astronomy.

Have students answer the review questions at the end of the first article. Then discuss the questions as a class. For the Star Scientists reading, ask each group to prepare a short statement about one of the three scientists and present it to the class.

Then have students read Summary: The Stars and have them answer the summary questions at the end of the article. Discuss their answers as a class.

Give students I-Check 3 and review the papers. Then return the papers to students for self-assessment and discussion.

Once students have completed all of the investigations in this module, including Part 2 of Investigation 2, give students the posttest. Use the scoring guides in the Benchmark Assessment folio to score the student work.

Before you end the module, you might want to check out the interdisciplinary extensions at the end of this investigation. Take some time to assign your students one or two of the math, science, or language extensions to your students.