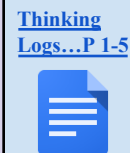


Lesson 1 - Initial Engagement Activity



[1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted.](#)
[1-ESS1-2. Make observations at different times of year to relate the amount of daylight to the time of year.](#)

Materials
Thinking
Logs



At the end of the lesson students will.....Make observations from each station and record them in thinking logs

Instructional Slides	Science and Engineering Practices	Disciplinary Core Ideas	Cross Cutting Concepts
P.1-5 	Planning and Carrying Out Investigations Students will.... Make observations and form questions using their journals at each station.	ESS1.A: The Universe and its Stars Students will.... Make observations of night/day patterns light and movement pattern of the sun's movement	Patterns Students will.... Create and work with objects to make patterns.

*Instructional Sequence-**The purpose of this lesson is for students to make observations, activate their background knowledge, and raise questions they are interested in investigating.***

Description of the IEA:This is potentially a 2 or 3 day process, where the students will visit stations each day with time to record observations and questions that they might have using pictures and/or words in their science journal.

1. Break students into groups of 5-6 for the different stations:

- Stations set up in the room
 - Station 1 (shadows) materials: flashlights, blocks, figurines, etc-- stationary objects that are not moved
 - Goal of this station: Object stays stationary, while students move around objects with flashlights to notice movement/change of the shadow of the object.
 - Station 2 (making patterns) materials: unifix cubes, colored chips
 - Goal of this station: To generate patterns, like there are patterns in nature
 - Station 3 (observing patterns) materials: pictures of patterns in our world and make observations (one picture is of the phases of the moon)
 - Goal for this station: Things that they notice about the shapes of the moon and how it is changing
 - Station 4 (day/night pictures & word cards) materials: a variety of pictures of day and night activities with day/night words.[Pictures of day and night](#) [day/night words](#)
 - Goal for this station: Students to notice things that are identified with night and day, such as, moon, stars, sun, sunset, sunrise, etc.
 - Station 5 (Whole group): Watch a [timelapse](#) video of the sun moving throughout the day. As a whole class watch the video then give students time to make observations about what was happening in their science journals. (What do they see? What do they wonder about it?)
 - Goal for this station: Students will notice the sun going across the sky in a pattern.

Next Lesson: Students will develop a Big Idea for the unit and Big Questions to investigate

Lesson 2 -Big Idea and Big Questions



[1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted.](#)

[1-ESS1-2. Make observations at different times of year to relate the amount of daylight to the time of year.](#)

Materials
Student
Thinking
Logs

[Thinking
Logs...P 6](#)



At the end of the lesson students will...
Generate the big idea and Big Questions to investigate.

[Instructional Slides](#)

Science and Engineering Practices

Disciplinary Core Ideas

Cross Cutting Concepts

P.9-9



Planning and Carrying Out Investigations

[ESS1.A: The Universe and its Stars](#)

[Patterns](#)

Students will.... Determine an investigable question

Students will....think of ways to test their understanding of seasons and patterns.

Students will....Use patterns they have discovered to ask bigger questions to investigate about these patterns

Instructional Sequence—Today's lesson will be to develop the Big Idea and Big questions that students have about the content (what was observed during stations)

- Review what was observed at each station before going into developing the Big Idea. Have students share out what they noticed from each station-- writing down key vocabulary used on an anchor chart
- **Establish the “Big Idea” for the activity**
 - To create the Big Idea, discuss the students' observations at each station and guide the discussion towards the Big Ideas, as seen above.
 - When students talk about observations that include patterns, day and night, sun and moon...teachers should ask students to expand on their ideas.
 - **Potential Big Idea Developed From the IEA:**
 - The sun and moon follow a predictable pattern.
 - It's light during the day and dark at night.
 - Days are longer in the summer, shorter in the winter.
- Questions must fit the Big Idea, Questions must be testable, Questions must be safe to perform at school and done with available resources
- After the teacher helps students create the Big Idea the next step is to ask students to create a **concept map**.
- Teachers will want to create the concept map using an **anchor chart** during whole group learning and sharing.
- Definition of a Concept Map
 - A concept map is a type of [graphic organizer](#) used to help students organize and represent knowledge of a subject.
 - Concept maps begin with a main idea (or concept) and then branch out to show how that main idea can be broken down into specific topics.
- Concept mapping serves several purposes for learners
 - Helping students brainstorm and generate new ideas
 - Encouraging students to discover new concepts and the propositions that connect them
 - Allowing students to more clearly communicate ideas, thoughts and information
 - Helping students integrate new concepts with older concepts
 - Enabling students to gain enhanced knowledge of any topic and evaluate the information
- Finally, select a question to investigate. Ideally, we would like students to come up with their own question. However, the question that is set up in the thinking logs is: “Does our shadow change during the day?”

Next Lesson: Investigation #1: Patterns of the Sun -- Testing and Observing

Lesson 3- Investigation #1: Patterns of the Sun -- Testing and Observing

NGSS



1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted.

Materials

- Student Thinking Logs
- Sidewalk chalk
- Cubes or tiles

[Thinking Logs...P 7-8](#)



At the end of the lesson students will...Collect data from their investigation.

Instructional Slides

Science and Engineering Practices

Disciplinary Core Ideas

Cross Cutting Concepts

P.10-11



Planning and Carrying Out Investigations

ESS1.A: The Universe and its Stars

Patterns

Students will....Test and collect data about the movement of their shadows and how they change over time.

Students will....Make observations about the movement of the sun over time.

Students will...Notice the pattern of the sun's movement across the sky and how it affects their shadows.

Instructional Sequence-*The purpose of this lesson is to collect data about shadows (this lesson will take place during multiple times during the day. You will need to schedule 3 or 4 times to go outside and measure the students' shadows.*

Test and Observe: (Shadow Activity)

- Split students into groups of two-three and explain that we will go outside to trace our shadows (take pictures if you would like it for later reference or observation). Before/after tracing shadows come back inside and give them two minutes to draw/write what they observed while drawing their shadows.
 - For this lesson, you want to provide students with a hands-on experience investigating how their shadows change throughout the day. To prepare, set out the following for each group: a bag with a piece of sidewalk chalk, and 1 inch tiles and/or connecting cubes. I explain: *Today, we will be going outside 3-6 different times today, morning, midday, and end of school day. (Try to break up the 3 times as evenly during the day as possible. ie: every two hours.)* **Important Note: The graph has up to 6 times for the student to record if you want to go outside more than 3 times to draw shadows.**
 - Decide with students how you will determine the position of the sun in the sky. As long as you are consistent so the data is reliable any method could work. One suggestion is to measure with a fist, starting from the horizon and stacking one on top of the other to determine how many fists between the horizon and spot in the sky where the sun is seen.
- Getting Ready
 - Pass out a copy of [Student Shadow Record Sheet](#) (also in journal) to each student and explain: *Today, you'll each be keeping track of the time, location of the sun, direction of the shadow, and the length of the shadow, measured to the nearest inch. One of the most important rules to remember today is: **Don't look directly at the sun as it can hurt your eyes.***
 - Also go over the following key steps:
 - Draw around the feet of the person casting a shadow and place his/her initials inside the feet. Each time you go outside today, the person will stand in the exact same spot. Here's what this will look like: [Tracing Around Feet](#).
 - Make sure to label each shadow with the time so that you can look back and make accurate observations. I draw a diagram on the board to ensure understanding: [Labeling Shadows](#).
 - Whenever we go outside, always start by tracing and measuring the shadow. If you don't get to the location of the sun and direction of the shadow, we will discuss these as a whole group.

- Discussing Directions

- Following each outing, we discuss the direction of shadows and the direction of the sun. Students added to or changed their notes on their Student Shadow Record Sheets. Here are a few examples of student notes during this time:
- Conversations follow each outing as well. For example, one student points out, "Our shadows keep getting shorter and shorter." *Why do you think that is?* Another student shares, "The sun was down much lower this morning. Now the sun is up higher." *What do you think is going to happen this evening? Is your shadow going to continue getting longer?* Students agree, "The sun will get lower in the sky again, which means our shadows will get longer again."

- Making a Graph

- After the students have gathered data on their shadows, have them turn to the [Student Shadow Graph](#) on pages 8-9 in their Student Journals. Begin by discussing an appropriate scale interval on the y-axis. Some students are able to count by 25 while others count by 30 in order to accommodate their highest data points.
- Here are a few examples of completed graphs:
 - [Student Graph Example 1](#)
 - [Student Graph Example 2](#)

- Monitoring Student Understanding

- Once students begin working, I conference with every group. My goal is to support students by asking guiding questions (listed below). I also want to encourage students to engage in Science & Engineering Practice 7: Engaging in Argument from Evidence.
 1. What patterns have you noticed?
 2. Why do you suppose ____?
 3. What have you found so far?
 4. Has your thinking changed?
 5. What evidence do you have?
 6. How did you decide ____?
 7. What conclusion can you draw about ____?

After investigation, have students write about what they noticed during their experiment. This will help teachers know where the students are with their thinking before the negotiation day.

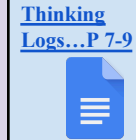
Next Lesson: Claims and Evidence

Lesson 4- Investigation #1: Patterns of the Sun -- Claims and Evidence



1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted.

Materials
Thinking
Log



At the end of the lesson students will...Make claims about why they think their shadow moved.

Instructional Slides	Science and Engineering Practices	Disciplinary Core Ideas	Cross Cutting Concepts
P.12-19 	Planning and Carrying Out Investigations Students will.... Use their observations to make a claim about why they think their shadow moved.	ESS1.A: The Universe and its Stars Students will.... Use their data to make a claim about the patterns of the sun's movement and how it affects their shadow.	Patterns Students will... Will notice the patterns of the movement of the sun by analyzing their shadow data.

Instructional Sequence- *The purpose of this lesson is for students to negotiate their understanding of why their shadow moved during the day and make an initial claim based on the data collected and their background knowledge.*

- Today's lesson will be a negotiation day. Students will develop their claim based on their observations from the Shadow investigation.
 - [Click this link for examples of dialogic feedback](#) and [Talk Moves](#)

Questions to help lead Negotiation

- If you stood outside in the same place all day, would your shadow stay in the same place? Explain your thinking.**
- What did you notice about your shadow throughout the day?
- How did your shadow change?
- Why do you think your shadow changed? Make a claim to explain your thinking.
 - Did it change because of the sun's position in the sky?
 - Did it change because of different weather (clouds)



WEDGE QUESTION: Last year my students negotiated if the reason the shadow changed was because the position of the sun changed and other students thought it was because the clouds made the shadow look strange. What do you think happened? Did the Sun change or did the clouds change the shadow?

- Ask students to interpret the results on the investigation (p. 7-8)
- The teacher will serve as the facilitator and will use the following guidelines:
 - Claims must be supported with evidence.
 - Where is the evidence coming from?
 - Science doesn't care what you believe.
 - Have students use the phrase "I support the idea _____" instead of "I believe that _____" ([poster](#))
- Finally, have students fill out [page 9](#) in the thinking log individually. This is their initial claim before they check with the experts.

Next Lesson: The students will read about shadow movement in "Check with the experts."



1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted.

Materials
[Check With Experts Document](#)

[Thinking Logs...P 10-13](#)

At the end of the lesson students will...Make new claims about how the Earth spins and that is why our shadows change throughout the day.

Instructional Slides

Science and Engineering Practices

Disciplinary Core Ideas

Cross Cutting Concepts

P.20-24



Planning and Carrying Out Investigations

ESS1.A: The Universe and its Stars

Patterns

Students will...Check with the experts through the use of books and videos to support their claims.

Students will...Check with the experts to support their claims on the patterns/motion of the sun and its effect on their shadows.

Students will...Incorporate the new information gained from checking with experts to revise their claim about patterns of the sun and its effect on shadows.

Instructional Sequence-*In the lesson students will learn about how science works, read the check with the experts, and show what they learned.*

START WITH MINI-LESSON ABOUT FINDING A RELIABLE SOURCE

- Begin, you will teach students a mini lesson about finding a reliable source. Have the students open to [page 10](#) and ask them
 - a. “If we wanted to ask someone to help us answer our question about sound energy. Who should we ask: An astronaut or a skateboarder.
 - b. Have a discussion with the students about why an astronaut would be a better source because they know a lot about space.
- Next, teach a mini-lesson about how science works. Go to [page 21](#) on Instructional Slides. These three science ideas are about how science is about evidence. Specifically, the mini-lesson about how ideas in space science changed with technology and scientists had to use evidence based on their observations.
- Next, read the [check with the experts](#) and ask the students to think about how the text helped answer the question.
- Have the students open to [page 11](#) and read each line of evidence helps us answer the question.
- Next, have the students open to [p. 12-13](#) and explain their understanding of the question.
 - a. On [page 12](#) the students will draw and label their understanding of the vocabulary learned
 - b. On [page 13](#) students will express their understanding of patterns of movement of the sun in a different context than the experiment.

Next Lesson: Formative Assessment

Lesson 6- Plan Investigation #2

 NGSS <u>1-ESS1-2. Make observations at different times of year to relate the amount of daylight to the time of year</u>			Materials Chart paper KLEWS Sunset website	Thinking Logs...P 16 	At the end of the lesson students will...Make observations about the patterns they notice about the lengths of days.
Instructional Slides	Science and Engineering Practices	Disciplinary Core Ideas	Cross Cutting Concepts		
P.26-27 	<u>Planning and Carrying Out Investigations</u>	<u>ESS1.A: The Universe and its Stars</u>	<u>Patterns</u>		
	Students will.... Analyze and interpret sunrise and sunset data from the graphs	Students will.... Develop ideas about seasonal patterns of sunrise and sunset	Students will... Use the data given in the seasonal graph to make observations and ask questions about patterns		

Instructional Sequence- *The purpose of this lesson is to learn about patterns of sunrise and sunset.*

- In this lesson we create a KLEWS anchor chart (in flipchart) titled, "When does the sun set at night?" A KLEWS anchor chart is described as a tool that allows students to track their data ([Video for how to use a KLEWS chart](#))
- Have you ever wondered how much sunlight or daylight we get each day? Do you think there is a pattern to the amount of hours the Sun is out each day or even each month? Allow students to share their ideas and thinking with their turn and talk partners.
- Record our new question, "Is there a pattern to how much daylight we get each day, month or season?" under the "W-What are we still wondering" section of our KLEWS chart.
- Exploration: Working in groups with graphs (p.19 in thinking logs)
- Students will work in groups-- looking closely at the Seasonal sunrise/sunset graph. Explain to the students that they should be thinking about the question: "Is there a pattern to the amount of daylight we have each day, month, or season?"
- Explain: This graph shows the sunrise and the sunset for each month. IF you look at the bottom of the graph you will see the months of the year. If you look at the side of the graph, you will see the times of the day. If you see AM- that means before lunch and PM means after lunch.
- As the students work, act more as a facilitator. Walk around and confer with each partnership guiding behavior, ask probing questions, and redirecting the learning. Conferring is the process of listening and recording the work the student or students are doing and then compliment the work. Students might notice things like, "In June and July the sunsets later and rises really early but in December the sunsets early and the sunrises late."

Next Lesson: Investigation #2: Thought Experiment

Lesson 7- Investigation #2: Patterns of the Sun, moon, and stars -- Thought Experiment

NGSS <u>1-ESS1-2. Make observations at different times of year to relate the amount of daylight to the time of year</u>			Materials Thinking Log	Thinking Logs...P 14-15 	At the end of the lesson students will... Make claims about the length of daylight throughout the year.
Instructional Slides	Science and Engineering Practices	Disciplinary Core Ideas	Cross Cutting Concepts		
P.28-35 	<u>Planning and Carrying Out Investigations</u>	<u>ESS1.A: The Universe and its Stars</u>	<u>Patterns</u>		
	Students will....Make an initial claim based on the thought experiment.	Students will....Make claims about how much sunlight or daylight we get each day and if they notice a pattern.	Students will...Use the data they observed in order to make claims about patterns they notice.		
Instructional Sequence-Students will make an initial claim after they negotiate with each other. A thought experiment is a way to engage in a negotiation based on an idea.					
 WEDGE QUESTION: Wallace’s mom said he has to go to bed when it gets dark out. Does his bedtime stay the same or change throughout the year? Explain your thinking.... (Continue this conversation using their background knowledge about bedtimes or specific daily routines-- bedtime, dinner, breakfast, etc). • The job of the teacher is to continue to ask Why and press the students on why they think their answer is correct. ◦ Students will eventually discover the correct answer when they check with the experts. • After some discussion have the students open to page 17 and write down their thoughts. • Finally, have students open to page 18 and teach a mini-lesson about reliable resources. • Ask the students: “who should we ask for help; A bowler or a Member of Space Force” ◦ After some discussion, I pointed out that a Member of Space Force would likely know more about space than a bowler.					
Next Lesson: Investigation #2: Check with the Experts					

Lesson 8- Investigation #2: Patterns of the Sun, moon, and stars -- Check with the Experts [Click here for an explanation of the lesson](#)

NGSS



1-ESS1-2. Make observations at different times of year to relate the amount of daylight to the time of year

Materials

[Check With the Experts Document](#)

[Thinking Logs...P 19-21](#)



At the end of the lesson students will...Make new claims about how the different times of the year relate to the amount of daylight

Instructional Slides

Science and Engineering Practices

Disciplinary Core Ideas

Cross Cutting Concepts

P.36-39



Obtaining, evaluation, and communicating information

Students will....Check with the experts through the use of books and videos to support their claims.

ESS1.A: The Universe and its Stars

Students will....Check with the experts through the use of books and videos to support their claims on the patterns of the length of daylight each day/month.

Patterns

Students will...Incorporate the new information gained from checking with experts to revise their claim about pattern of the length of daylight/month.

Instructional Sequence-*In the lesson students will learn about how science works, read the check with the experts, and show what they learned.*

- This lesson is the second negotiation after the students have read (or you have read the information to them) the “Check With the Experts.”
- Students will read/watch information that has the content that the scientific community has endorsed.
 - Text [Check With the Experts Document](#)
 - You can also show the students this video:<https://www.youtube.com/watch?v=b25g4nZTHvM>
- Next, teach a mini-lesson about how science works. Go to [page 36](#) on Instructional Slides. These three science ideas are about how science is about evidence. Specifically, the mini-lesson about how ideas in space science changed with technology and scientists had to use evidence based on their observations.
- Next, have the students open to [page 19](#) and read each line of evidence to help us answer the question.
- Next, have the students open to [p. 20-21](#) and explain their understanding of the question.
 - On [page 20](#) the students will draw and label their understanding of the vocabulary learned
 - On [page 21](#) students will express their understanding of patterns of movement of the sun in a different context than the experiment.

Next Lesson: Formative Assessment

Lesson 9- Engineering Challenge



K-2- ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

Materials
Variety of art supplies/or collect items from home
[Cutouts](#)

[Thinking Logs...P 22](#)

At the end of the lesson students will...Students will create a design that will help them tell time using the sun.

[Instructional Slides](#)

Science and Engineering Practices

Disciplinary Core Ideas

Cross Cutting Concepts

P.40



Asking Questions and Defining Problems

ESS1.A: The Universe and its Stars

Patterns

Students will...Define a simple problem (telling time with sun) that can solved through developing a new or improved object or tool.

Students will...Use what they have learned about the patterns of the sun to create a tool or object to solve a problem.

Students will...Use what they have learned about the patterns of the sun to create a tool or object to solve a problem.

Instructional Sequence- *This "lesson" will take multiple days*

- Today's lesson will focus on the engineering design process for this unit. What students will be doing: Using what has been learned about the sun's position and it's pattern, students will be creating a tool or object that will be able to solve the following problem. (example: sundial).
- **FOR TEACHER USE ONLY-- To help understand what students could create** <https://www.youtube.com/watch?v=oSMsX7cwzjk>. You can use these cutout if you would like [cutouts](#) or you can have students try to build their own.
- **Possible Constraints:**
 1. Size of project
 2. Mobility (needs to be mobile-- able to move from classroom to outside for testing purposes)
- **Instructional Sequence:**
- **Day 1: Introduce the engineering activity: Pose the question/challenge:**

What if no one had a watch or the clocks and bells did not work at school for a whole day. How would we know when it's time for school, or when to go to lunch, or when to go home for the day? Based on what we have learned about the patterns of the sun's position throughout the day, how could we use the sun to help us with telling time?

- **Days 2-3: Design and create time telling device using the sun-**

Tell students they are going to get with a group of students (2-4) During these days- groups will create a plan, list of materials, and develop their design. (page 21 in thinking log).

- **Days 4-5: Testing devices and evaluation of your group's device only**

Students will test out their devices. You will need to create multiple times throughout the day for students to bring their design outside to test/record their data and make observations.

- **Day 6: Present devices to the class and evaluate other groups devices (this might work better for them to present outside).**

Next Lesson: Multimodal Writing- Summative Assessment

Lesson 13- Multimodal Writing- Summative Assessment



[K-2- ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.](#)

Materials

Thinking log

[Thinking Logs...P 23](#)



At the end of the lesson students will...Students will write about their engineering project and how it worked or didn't work, explaining their thinking by using evidence learned.

ASSIST	Science and Engineering Practices	Disciplinary Core Ideas	Cross Cutting Concepts
Multimodal Writing- Summative Assessment	<u>Engaging in argument from evidence</u>	<u>ESS1.A: The Universe and its Stars</u>	Patterns
	Students will.... Write about their engineering project and how it worked or didn't work, explaining their thinking by using evidence learned.	Students will.... Write about their engineering project and how it worked or didn't work, explaining their thinking by using evidence learned	Students will... Write about their engineering project and how it worked or didn't work, explaining their thinking by using evidence learned

Instructional Sequence

This lesson is the final understanding of the concepts learned throughout this unit. Students will use their engineering project, skills, and observations made to write about whether their design worked or not and explain their thinking by using evidence.

Explain: Have students think about their design. Pose the question: **What if no one had a watch or the clocks and bells did not work at school for a whole day. How would we know when it's time for school, or when to go to lunch, or when to go home for the day? Based on what we have learned about the patterns of the sun's position throughout the day, how could we use the sun to help us with telling time?**

Based on this question, did their design solve the problem?

Engage: Students will write about their design and whether it worked or not-- explaining their thinking using the concepts and vocabulary words learned throughout the unit.

Other Ideas:

- Students could write to Kindergarteners to explain different components or vocabulary words
- Students could create a video, poster, or presentation to encompass content learned
- Student could make a book about the content learned