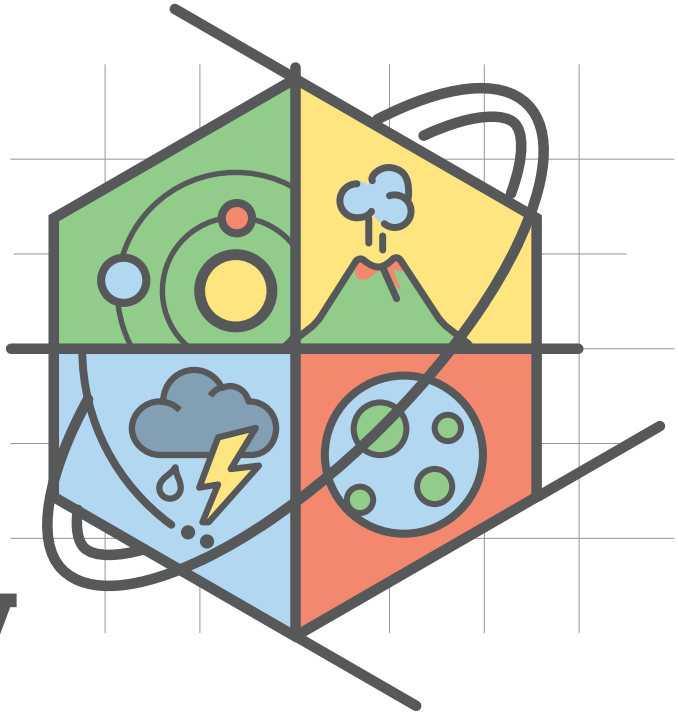
Patterns in the Sky



1st Grade Earth and Space Science Storyline to support the Air and Weather kit

STEM

6.11.19

ABOUT THIS UNIT

We are excited to present this NGSS Storyline Unit to help support educators in our region as we shift towards providing students with NGSS-aligned, phenomenon-based and project-based learning experiences. Our vision is to provide students with high-quality and equitable learning experiences that empower them to develop fluency in STEM and literacy. This unit strives to engage students in a series of relevant local and global phenomena as they study the changing patterns in the sky.

This unit also contains links to online resources created by other organizations which may use a different license. Please make sure that you understand the terms of use of third-party resources before reusing them. Prior to publishing this unit of study, we have reviewed the content of this unit to ensure that all materials are in accordance with creative commons regulations. If you notice that a part of this unit infringes another's copyright, please contact us.

A digital copy of this document is available on the STEM Materials Center website at:
https://www.stemmaterials.org/patternsinthesky

ATTRIBUTION

This unit is a result of a collaborative effort between Educational Service District 112 and educators and specialists from other school districts and agencies.

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STEM
Science
Technology
Engineering
Math

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OSPI

CLIME TIME
CLIMATE SCIENCE LEARNING

UNIT OVERVIEW

Embark on a journey with your students to answer the driving question: How are animals affected by changes in the sky? This NGSS-aligned integrated storyline unit strives to help students explore the 1st grade NGSS standards bundle Space Systems: Patterns in the Sky (1ESS1-1 and 1-ESS1-2). Students explore changing patterns in the sky through a series of investigations which are interwoven with the storyline of exploring animal behavior and how it changes as the sun, moon and stars appear to change. Help students understand these daily astronomical phenomenon while using a variety of picture books and expository texts to create an experience that cultivates literacy in both English Language Arts and STEM! The unit ends in an art gallery showcase where students create pieces of art to educate others about how a particular animal behaves as the sky changes.

Please note that only one investigation from the FOSS: Air and Weather Kit is included in this storyline. Materials from the FOSS: Air and Weather investigations are still included in your kit, in case you would like to utilize them, however, for alignment with NGSS and to create an integrated STEM-based learning experience for your students, it is recommended that you use this storyline unit instead of closely following the sequence of the FOSS guide.

For your convenience, all resources have been uploaded to this Google drive folder, Air and Weather (Patterns in the Sky NGSS Storyline), bit.ly/patternsintheskystoryline for easy access. Since curriculum revision during the school year will be limited, any additional resources and changes will be reflected in the live documents on the Google drive. You may also make comments for suggested revisions on these documents. In order to modify the Google resources to make changes, click "file" and "make a copy." This will create a copy in your drive that you can edit to fit your needs.

LESSON 1: Animals and Patterns in the Sky *pg. 7*

This lesson is an introduction to the driving question that students will be answering in this unit: *How are animals affected by changes in the sky?* Students will explore the phenomenon of a hibernating bear and will experience a series of lessons where they are able to use data to identify patterns in the daily amount of sunlight, and how this affects animal behavior.

Session	Materials Needed		Page
1. Animals and patterns in the sky	• KLEWS Chart	• Computer with internet and projector (most lessons)	**8**
2. Daily sun patterns	• Student resource: Record Observations of the Sun	• Sunglasses • Shadow stick (wooden stick)	**9**
3. Analyzing daily sun data	• Data Analysis Worksheet	• 3 door foldable sun diagram	**14**
4. Day and night: The Hokey Pokey (optional)	• *What Makes Day and Night* by Franklyn M. Branley • Earth Hokey Pokey Song	• Flashlight • Sticky notes • Large ball, globe, or inflatable globe	**22**
5. Daytime and nighttime animals	• *Nighttime Animals* by DK	• Daytime/Nighttime Animals Handout	**24**
6. Wrapping up the phenomenon of day/night using the KLEWS chart	• KLEWS chart		**28**

UNIT OVERVIEW (cont.)

LESSON 2: Oh, How the Days Change! *pg. 30*

In this lesson, students will:

- Investigate the phenomenon of how animal behaviors change based on changing patterns of daylight throughout the year
- Study the phenomenon of forest fires and smoky skies (another reoccurring pattern in the sky) and design a solution to help firefighters with this problem

Session	Materials Needed		Page
1. Changes in daylight and animal behavior	• Time to Sleep by Denise Fleming • KLEWS chart	• Computer with internet and projector (for teacher slides)	**31**
2. FieldSTEM outdoor walk: Making observations outdoors	• Clipboard/notebook for taking observations	• Field STEM template	**32**
3. Days can be longer or shorter	• *Animals in the Winter* by Henrietta Bancroft	• Daylight Data • Sky Patterns and Seasons worksheet	**35**
4. Other patterns in the sky	• Slides presentation with data graphs	• KLEWS chart	**41**
5. Intro to the problem and the WONDER phase	• Engineering Design Poster	• Engineering Design template	**50**
6. IMAGINE a solution	• Engineering Design Poster	• Engineering Design template • Post-it notes	**51**
7. PLAN a prototype	• Engineering Design Poster	• Engineering Design template • Post-it notes	**52**
8. CREATE the device	• Engineering Design Poster	• Engineering Design template • Misc. items for building	**53**
9. CHECK and OPTIMIZE	• Directions for Charrette Protocol		**54**
10. SHARE our solutions	• Student projects		**55**

UNIT OVERVIEW (cont.)

LESSON 3: Different Moods of the Moon *pg. 57*

In this lesson, students will:

- Explore the different phases of the moon by making observations, reading texts, and viewing resources online
- Connect the changing phases of the moon with different animal behaviors

Session	Materials Needed		Page
1. Intro to the moon	• Moon Timelapse video	• Moon Observations worksheet • Students determine materials	**58**
2. FOSS Investigation 2: Looking for Change (Part 3: The Night Sky)	• Moon change calendar • Pattern of Sun and Moon	• *The Moon Seems to Change* by Dr. Franklyn M. Branley	**64**
3. Animals and the moon: Sea Turtle Game	• Little turtle shells • Blue butcher paper	• Sun and Moon Phases posters • Computer with projects	**66**
4-5 Mini-Engineering Challenge: Helping the baby turtles	• *Follow the Moon Home: A Tale of One Idea, Twenty Kids, and a Hundred Sea Turtles* by Philippe Cousteau	• Engineering Design Poster • Chart paper • Markers/crayons	**74**
6. Connecting with the KLEWS chart and storyline	• KLEWS Chart		**75**

LESSON 4: Animals in the Stars *pg. 77*

In this lesson, students will:

- Study the stars and how they appear to move in the night sky
- Read a Lakota myth about a coyote who created the constellations
- Wrap up the lesson by connecting to the KLEWS chart and thinking of ways that the stars may influence animals

Session	Materials Needed		Page
1. Intro to stars and star patterns	• Computer with projector (for teacher slides and videos)	• Patterns of stars worksheet • KLEWS chart	**78**
2. Coyote Places the Stars	• *Coyote Places the Stars* by Harriet Peck Taylor	• KLEWS chart	**80**

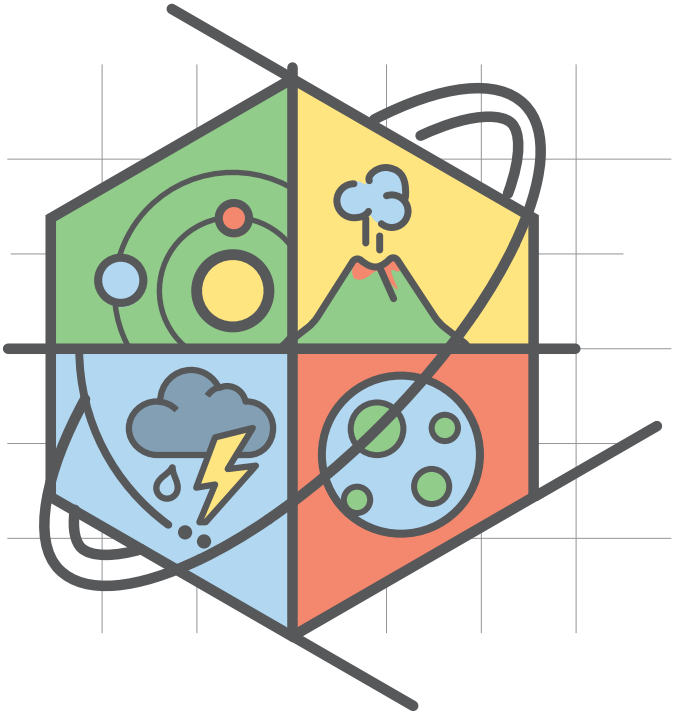
UNIT OVERVIEW (cont.)

LESSON 5: Patterns in the Sky Art Exhibition *pg. 82*

This final lesson will be the students' opportunity to create a piece of artwork that will educate the community about how patterns in the sky can affect animals. Students can pick a pattern that most interests them and focus on that one pattern. Refer to the KLEWS chart to help students review what patterns have been studied and what animal-related phenomena have been identified. Encourage students to pick a pattern or phenomena that interests them.

Session	Materials Needed	Page
1. Introducing the project	• Paper and pencils for students to sketch their art plan • Art brainstorming template	**83**
2-4. Creating the masterpiece	• Lots of art supplies and recyclable materials	**85**
5. Writing a caption and getting peer feedback	• Caption writing template • Peer feedback form	**86**
6. Writing the final captions	• Caption writing template	**89**
7. Gallery walk with peers	• Place to display student art • Tape to tape up student art	**90**
8. Public gallery opening	• Parent letter	**91**

LESSON 1: Animals & Patterns in the Sky



STRATEGY: ENGAGE

This lesson is an introduction to the driving question that students will be answering in this unit: ***How are animals affected by changes in the sky?*** Students will explore the phenomenon of a hibernating bear and will experience a series of lessons where they are able to use data to identify patterns in the daily amount of sunlight, and how this affects animal behavior.

SESSION 1:
Animals and patterns in the sky (30 min)

Warm-up (5-10 min)

Start by showing students a video of a black bear hibernating in her den:
www.youtube.com/watch?v=CAZd-Le5GSs

Ask students, What do you notice about this video? What is the bear doing? How do you know? What time of the year do you think it is? Why? Allow students to talk about what they think the bear is doing and why. Have them look at details in the background (ex. Dry grass and snow) to identify what time of year it is. This is a great opportunity to connect to students' prior knowledge and allow them to share their experiences. Write students' observations on a chart paper titled "What we notice."

Materials Needed

Computer with internet access

KLEWS chart

Main activity

Present students with the driving question of the unit: *How are animals affected by changes in the sky?*

Tell students that we will be studying how changes in the sky affect animals. Ask students to think of different changes in the sky by facilitating a discussion and asking some prompting questions. Use a KLEWS chart to chart students' initial ideas and wonderings. Help students to identify their own understanding of patterns in the sky by asking questions like:

- What are some things you see in the sky?
- Is the sky always the same or does it change?
- How does it change?
- Do animals behave differently depending on how they sky looks?
- What are examples of animals behaving differently during day or night?
- What are some examples of animals that change the way they act based on the time of the year (ex. There will be more birds flying when it is sunny than when it is raining. Bears will hibernate over the winter when the sky is cloudy and snowy).
- Write students ideas in the "K" or "What we Know" section of the KLEWS chart. It is ok if students ideas are incorrect, now is not the time to correct students but rather to validate their efforts in thinking about the question. Misconceptions can be addressed throughout the unit during regular check-ins with the KLEWS chart.

Wrap-up

Ask students: What do you still need to know before you can answer the driving question? What do you wonder about? Write student wonderings on the "W' column of the KLEWS chart. What questions do you have about changes in the sky? What questions or wonderings do you have about how plants and animals behave because of those changes?

Essential question for the week: *How does the daily changing sun affect animal behaviors?*

SESSION 2:
Daily sun patterns (30 min)

Main activity

Students engage in an investigation where they map out the path of the sun traveling during the day. Please access this lesson on betterlesson created by 1st grade teacher, Kathryn Yablonsky, which guides the students through a discussion about patterns in the sky, and then an activity where students investigate the movement of the sun throughout the day by going outside and observing the location of the sun in the sky. Please note that resources (such as handouts and student work samples) are located at the bottom of each phase of the lesson.

Materials Needed

- Observations of the Sun handout
- Dow rod (Shadow stick)*
- Sunglasses (optional)*

** not provided in kit*

Kathryn Yablonski Knight VINCENT FARM ELEMENTARY, WHITE MARSH, MD
1st Grade Science : Unit #3 - Space: Patterns in the Sky : Lesson #2

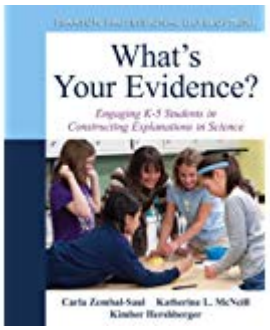
Observing the Sun

Objective: SWBAT observe and describe patterns in the sun's movement.

Standards: **1-ESS1-1 SP1 SP3 SP5 SP8 XC-P-LE-1**
Subject(s): Science
60 minutes

Instructional Notes - 0 minutes

In this unit, students are not only studying space, they are observing and making discoveries about*patterns* in the sky! The NGSS standard states, *1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted*.
In this lesson, students will continue thinking about the focus questions from lesson one, including, *What are objects in the sky?* and *What makes a pattern?* Today's lesson will take students outside at 3 different times of day: morning, noon, and late afternoon. Make this as easy as possible within your daily schedule, for example, go outside first thing in the morning, right after lunch/recess, and about fifteen minutes before your dismissal.
What's key is that students see how the sun's position changes during the day, which will also affect shadow lengths. (PS-- Of course, the sun doesn't actually move! We'll get to this big idea soon!)
If this is the first Science unit you are teaching for the year, consider making a What does a scientist do? Anchor Chart (https://betterlesson.com/lesson/resource/3164004/what-does-a-scientist-do-anchor-chart) throughout this unit.
Today's lesson incorporates the Science and Engineering Practices of making observations and recording data.
One of the coolest parts of the NGSS standards is that students are learning content through hands-on experiences, like today's observations! (The practices are the blue boxes on the NGSS standards.)
In tomorrow's lesson, we'll formally record and analyze the data as a class on a KLEWS chart. In the resources here, I've included a sample KLEWS chart (https://betterlesson.com/lesson/resource/3009753/sample-klews-anchor-chart-filled-out). This is what it may look like (just about!) by the end of the unit. You can learn more about KLEWS charts by checking out the book by Carla Zembal-Saul. A KLEWS is like a KWL, but gives you science-specific columns too!



RESOURCES

KLEWS space.docx https://betterlesson.com/lesson/resource/3009753/sample-klews-anchor-chart-filled-out

What does a scientist do Anchor Chart.JPG
https://betterlesson.com/lesson/resource/3164004/what-does-a-scientist-do-anchor-chart

Warm-Up - 5 minutes

I start out today's lesson by reviewing the focus questions students discussed in Lesson 1, namely, *What are objects in the sky?* and *What makes a pattern?*

> ***Let's go back to our thinking from yesterday. We named many objects we can see (observe) in the sky, and then we highlighted the ones that are in nature. Read them with me: the sun, moon, and stars. Great. We also talked about patterns. Tell the person next to you what makes a pattern. Right, a pattern repeats, so we know what is going to come next. That's called predicting what comes next.***

Next, I activate schema (background knowledge) students are bringing about daily patterns of the **sun**.

> ***Today let's think only about the sun. What does the sun do that repeats? What patterns does the sun have? Turn-and-talk to share your schema, and then we'll share together.***

Link (https://www.youtube.com/embed/MN-gnsX4fU8)

Discussion is so important! It gives *all* students the chance to process the question, get their ideas together, and practice listening and speaking skills. Discussion also works wonders for your shy students! Plus, if there isn't a lot of excited discussion, that's a clue to me that I need to build a bit more background knowledge.

I have students turn-and-talk (we sit knee-to-knee and toe-to-toe), and then I call on a few to share with the larger group. Hint: While students are sharing, I make sure all friends have found a partner. Then, I try to listen in and find unique ideas that will take our conversation farther.

Finally, I want to explain the basic sequence of the lesson to students, so they know what to expect.

> ***Today, we will observe (look at closely) the sun 3 times. We are going outside in a few moments, then again after lunch, and then one more time at the end of the day. Each time we go outside, we're going to make some measurements and record them on the page you glued into your science journal as morning work.***

How your students record their data is completely up to you! My students use marbled composition notebooks, and today they glued in the student resource sheet. You could also take the resource sheet outside on clipboards!

RESOURCES

Student Resource- Record Observations of the Sun.docx
https://betterlesson.com/lesson/resource/3010115/student-resource-record-observations-of-the-sun

PREASSESSMENT DATA: Pre-Tests

Question 4 PreAssessment Data
(https://betterlesson.com/lesson/resource/3164026/question-4-preassessment-data-mp4)

Question 4 PreAssessment Data.mp4
https://betterlesson.com/lesson/resource/3164026/question-4-preassessment-data

Exploration - 20 minutes

It's important that students are a part of the observation process, so I really want them to get involved! I suggest that on the day previous to this lesson, your students help you put a dow rod (we are calling it the "shadow stick") in the middle of your school's baseball field. You are going to want to pick are area of your school ground that isn't

going to have trees or buildings blocking the shadows. If you don't have a good sized field to put in a dow, you can measure shadows of your flagpole too! Or, students can draw their own shadow outline with partners on large chart paper!

First, I teach students how to measure using handspans. This is a nonstandard measurement using students' fists. We'll also put on sunglasses when we go out (I sent home a note to parents a few days earlier to request them.).

> ***First, straighten one arm all the way out and lock your elbow. Move your arm up or down until the bottom of your fist is at the horizon (where the grass meets the trees). Now try to keep your fist still! Put your fists one on top of the other until you get to the sun. How many handspans (or fists) above the horizon was the sun? Record your measurement.***

Some students are bound to need help with this! I encourage them to help each other and share their measurements. Hint: since their hands are about the same size, the numbers should be the same. Listen for students with wacky responses, and try to help them measure more accurately.

Then, we want to see how the position of the sun affects shadow length. Measure from the stick (or flag pole) to the end of the shadow. Your class can use string, or use their feet as a nonstandard tool. Check out this BetterLesson.com lesson all about measuring with "kid feet" (https://betterlesson.com/lesson/567788/measuring-with-student-steps)!

Lastly, students can record the sun either by drawing the circular shape or by showing a horizon line and where the sun is above the horizon. Keep an eye out for rays or smiley suns-- as cute as they are, they aren't "scientific." Also, keep an eye out for any drawings showing the horizon. They are great examples to pull for tomorrow's lesson!

Here we are collecting data!!!

Me explaining how to measure the flagpole shadow:

Link (https://www.youtube.com/embed/13svt65OU18)

Students in the morning measuring the length of the flagpole shadow:

Link (https://www.youtube.com/embed/GoSBI-fQLjc)

Students using handspans to measure the height of the sun above the horizon in the morning:

Link (https://www.youtube.com/embed/b_vZvEBzAKA)

And again mid-day:

Link (https://www.youtube.com/embed/d8GwqE0OfaA)

And now in the afternoon, "Eek! The sun moved!"

Link (https://www.youtube.com/embed/V-n5CCJ3u10)

RESOURCES

DSCN2934.JPG https://betterlesson.com/lesson/resource/3164054/measuring-handspans

MEETING THE STANDARDS: Standards Alignment

The NGSS standard states that students should use patterns in the sky to make predictions. When we went out mid-day, I asked students to predict where the sun would be by the afternoon, based on its movement thus far. This question helps students take the pattern to the next level, by using it to make predictions. I will be reinforcing this pattern over the coming days as we go outside as a class.

Link (https://www.youtube.com/embed/fajpFfj1hp0)

Closing - 5 minutes

Today's lesson may not allow time for wrap-up. If you do find time, here are two ways to summarize. This first one addresses an Essential Question that gets students to connect to the Science and Engineering Practices.

> ***Let's return to our anchor chart, "What does a scientist do?" Friends, what did we do today as scientists?*** (Observed, recorded data)

Or, try this ending, which gives students the chance to figure out ways the data can be entered onto the KLEWS chart:

> ***Tomorrow, we will look closely at the data we collected and record it under the E "Evidence" section of our KLEWS chart. Evidence means the proof that we actually saw, our observations! How do you suggest that we record the data, since our numbers are different?***

I am always surprised by student suggestions! Perhaps one of your students will suggest you take the average, or the most common number (mode), or record the teacher's numbers... who knows! If your students suggest the mode, you could make bar graphs or tally mark charts during math to figure out the most common number.

Assessment - 0 minutes

Formative Assessment: Student data and drawing

- Was the student able to accurately make and record observations?
- Was the student able to record data?

Here are some samples of student work:

Student sample #1 (https://betterlesson.com/lesson/resource/3164197/dscn2946-jpg)
Student sample #2 (https://betterlesson.com/lesson/resource/3164197/dscn2946-jpg)
Student sample #3 (https://betterlesson.com/lesson/resource/3164197/dscn2946-jpg)

RESOURCES

DSCN2946.JPG https://betterlesson.com/lesson/resource/3164197/student-sample-1

DSCN2944.JPG https://betterlesson.com/lesson/resource/3164198/student-sample-2

DSCN2945.JPG https://betterlesson.com/lesson/resource/3164199/student-sample-3

ADJUSTMENTS FOR FUTURE YEARS: Adjustments to Practice

Evaluating the lesson, reflection:
Link (https://www.youtube.com/embed/_ssAdBZ_pGE)

SESSION 3:
Analyzing daily sun data (30 min)

Main activity

Use this lesson that follows the previous activity to help students analyze the data they found from their observations of the sun. Ask students what a pattern is (a sequence that repeats itself and can be predicted). How did they observe a pattern in the sun data they collected? How can we predict what will happen tonight? How can we predict what will happen tomorrow morning?

Materials Needed

- Analyzing sun data handout
- 3 door foldable

Kathryn Yablonski Knight VINCENT FARM ELEMENTARY, WHITE MARSH, MD
1st Grade Science : Unit #3 - Space: Patterns in the Sky : Lesson #3

Analyzing the Sun Data

Objective: SWBAT analyze data in order to describe patterns of the sun.

Standards: 1-ESS1-1 SP1 SP2 SP4 SP5 SP6 XC-P-LE-1
Subject(s): Science
30 minutes

Instructional Notes - 0 minutes

In the previous lesson (https://betterlesson.com/lesson/613470/observing-the-sun), we went out at three times to measure both the sun's position in the sky and the effect on shadows. Today, we need to organize our data and analyze it. What does the data show?
Throughout this unit, I use a KLEWS anchor chart to record our new learning. This is a science-specific type of KWL chart designed with primary students in mind! Check out this video I like to call KLEWS chart 101:
Link (https://www.youtube.com/embed/W90hV9qiWyY)
We will record our evidence and observations under the "E" today.
Next, I give students a chance to analyze their data with some guiding questions. Then, I will call them back together to analyze the data as we add it to the KLEWS chart. I guide students to the big understandings for today:

- The sun has a pattern of movement across the sky as it appears to rise and set.
- Shadow lengths change as the sun moves; shadows lengthen in the morning and evening as the sun's position changes.

Finally today, students will draw a diagram in their Science Journals to show the sun's movement. I use marbled composition notebooks as Science Journals, but if your students don't have science journals, you can use the 3-door foldable sheet I included!

Materials - 0 minutes

- KLEWS Anchor Chart (on large bulletin board paper)
- Student data recording sheets from the previous lesson
- Science Notebooks (optional)
- Data Analysis (https://betterlesson.com/lesson/resource/3025780/data-analysis-docx) guiding questions
- 3 door foldable (https://betterlesson.com/lesson/resource/3026196/3-door-foldable-docx) for the sun diagram

RESOURCES

Data Analysis.docx https://betterlesson.com/lesson/resource/3025780/data-analysis

3 door foldable.docx https://betterlesson.com/lesson/resource/3026196/3-door-foldable

Warm-Up (The Launch!) - 10 minutes

First I orient students to the KLEWS chart (https://betterlesson.com/lesson/resource/3092133/sample-klews-chart-for-space).

> ***Friends, in this science unit, we're going to record our thinking on this anchor chart which is called a KLEWS chart. At the top, I have written our Essential Question for this unit: How can patterns we observe in the sky help us make predictions?***

In the first lesson (https://betterlesson.com/lesson/613469/introduction-and-pre-assessment) of this unit, we discussed as a class two questions, *What is a pattern*? and *What objects are in the sky?* We came to a conclusion as a class that a pattern is a repeating set, and we narrowed our focus about objects to those in space-- the sun, moon, and stars.

> ***Next, look at this column "K." The K stands for what we already Know. Here I put what we know already about patterns and objects in nature in the sky.***

Next, I give students time to try to figure out on their own what the data shows. The Science and Engineering Practices calls for **students** to analyze data. I want to give them a chance to figure it out, and then we'll come back together as a class to analyze and fix any wrong conclusions.

Here is our evidence on the KLEWS chart (https://betterlesson.com/lesson/resource/3166312/klews-data).

While students are working with the person next to them, I look for students who are struggling to analyze or have poor number sense. I support them, and also make note that tomorrow during science, I can pull them in a small group for extra practice.

> ***Today, we are going to look at the observations and data we recorded outside yesterday. I have some questions to help you figure out what the data means. Then, we'll come back together and write it on our KLEWS chart.***

Here are the four guiding questions (https://betterlesson.com/lesson/resource/3025781/data-analysis-docx) to assist students:

1. Based on your data, does the sun appear to move in the sky? Yes/No
2. Based on your data, what time is the sun highest? ___
3. Based on your data, so the shadow lengths change? Yes/No
4. Based on your data, what time are shadows the shortest? ____

These questions lead us directly to today's two patterns-- the sun changes position as it appears to move across the sky, and when the sun moves, shadow position and lengths change! The big ideas link straight to the NGSS standard 1-ESS1-1.

Here are two pairs discussing that I checked in with and what they had to say!

Link (https://www.youtube.com/embed/xN8MOYIT0j8)

Link (https://www.youtube.com/embed/ijeDin5RtUk)

As you can tell from the second check-in, it is important that we describe the spatial relationships between celestial bodies. We'll be getting to these concepts in the subsequent lesson (https://betterlesson.com/lesson/615205/day-and-night-the-hokey-pokey).

RESOURCES

- KLEWS space.docx https://betterlesson.com/lesson/resource/3092133/sample-klews-chart-for-space
- DSCN2916.JPG https://betterlesson.com/lesson/resource/3166319/klews-chart-prior-to-this-lesson
- KLEWS data.JPG https://betterlesson.com/lesson/resource/3166312/klews-data
- Data Analysis.docx https://betterlesson.com/lesson/resource/3025781/data-analysis

Exploration (The Space Walk!) - 15 minutes

While I play a transition song, students bring their data and answers to the analysis questions to the rug. I post the KLEWS chart in the front of the room so that we can add to it.

Link (https://www.youtube.com/embed/Wg3UTCE5rV0)

First, I add our data to the KLEWS chart under E, Evidence.

> ***Friends, scientists always record their data, just like we did yesterday. Our data and observations go here on the KLEWS chart under Evidence because when people ask how we know we are right, we'll say, "Just look at this evidence!" Let's fill in our data."***

- 9 am Sun is ___ handspans above the horizon
- 12pm Sun is ___ handspans above the horizon
- 3pm Sun is ___ handspans above the horizon

You can take the mode (the most popular number) of the class measurements.

> ***Based on this data, did the sun stay in the same place or did it move across the sky? Right, it moved. So for question one, make sure you circle YES. Have you noticed that the sun moves across the sky every day? Right, it does!***
>
> ***Link (https://www.youtube.com/embed/AW94vkiFxSQ)***
>
> ***Link (https://www.youtube.com/embed/ZwrvtUmZu4g)***
>
> ***This is a pattern. Our evidence shows that the sun's position appears to change as it rises in the morning and then sets in the evening. We'll write the pattern under L-- Our Learning. When people don't believe us that the sun moves, we'll show them the evidence! I know the sun moved because my handspans changed.***

Next, I record the shadow data and see what students figured out.

- 9am Shadow length ___
- 12pm Shadow length ___
- 3pm Shadow length ___

> ***Based on the data, do the shadow lengths change? Yes! When are shadows the shortest? At 12pm, in the middle of the day. Hmm, so the shadows are the shortest when the sun is the highest. And the sun moves every day. Do shadows move every day? Right!***
>
> ***This is a pattern. Our evidence shows that the shadows are shortest when the sun is high and longer when the sun is rising or setting. Let's write the pattern under L-- Our Learning.***

The KLEWS chart (https://betterlesson.com/lesson/resource/3166536/klews-chart-after-the-lesson) is a little funky, since you fill out the "E" and then reach your conclusions/ new learning "L." It doesn't go neatly from left to right. That's because KLEWS is based on the intermediate elementary science graphic organizer called a CER (Claims, Evidence, Reasoning) which is also a little funky and non-linear! To help students see the relationship between the "L" and "E," most teachers draw an arrow from the "E's" to the "L's." I do that next.

RESOURCES

Student work #1.JPG https://betterlesson.com/lesson/resource/3166313/student-work-1

Student work #2.JPG https://betterlesson.com/lesson/resource/3166314/student-work-2

DSCN2976.JPG https://betterlesson.com/lesson/resource/3166536/klews-chart-after-the-lesson

ADJUSTING THE LESSON: Flexibility

I adjusted the data in this lesson because we were able to observe the shadow location moving, however, our shadow length did not change significantly. And, in the afternoon, the shadow was hidden within our building shadow. Because of this, we could not answer question 4 on the data analysis sheet.
Here are some other issues with our shadow measurements:
Link (https://www.youtube.com/embed/_ssAdBZ_pGE)

Closing (Prepare for Landing) - 5 minutes

Finally today, I want students to draw a diagram showing how the sun moves across the sky. A diagram is a form of a scientific model, and drawing a diagram meets Science & Engineering Practice #2.
First, I show this short video clip (https://www.youtube.com/watch?v=1K63Rq1FoMo) to help students visualize.
Link (https://www.youtube.com/embed/1K63Rq1FoMo)
You can choose to do a labeled diagram, or try out a 3 door foldable (https://betterlesson.com/lesson/resource/3026194/3-door-foldable-docx)! A 3-door foldable is a normal size sheet of paper, folded in half to make 2 long rectangles. Then, students cut the top rectangle and make 3 flaps (the directions are on the resource sheet I included). This is a shared writing experience. I model it using the projector, and students draw the same diagram (https://betterlesson.com/lesson/resource/3094037/3-door-foldable-image-png).
Link (https://www.youtube.com/embed/7X2AfMM6j1A)
Then, students will turn-and-talk with a friend to answer the question:

What pattern in the sky does the diagram show?

Discussion is so important! It gives *all* students the chance to process the question, get their ideas together, and practice listening and speaking skills. Discussion also works wonders for your shy students! Plus, if there isn't a lot of excited discussion, that's a clue to me that I need to provide some guidance. I have students turn-and-talk, and then I call on a few to share with the larger group.
I also circulated while students were finishing in order to have selected students retell the sequence to me. I circulated to students who have difficulty with verbalization and also to an ELL student who I knew could use additional help with the vocabulary.
Link (https://www.youtube.com/embed/GlOq5LK2qac)
The diagram of the sun moving across the sky shows a daily pattern (1-ESS1-1). By drawing the sun's movement, students are constructing an explanation of the phenomena (SP6). Science explanations don't always need to be elaborately written out, especially by first graders! A good illustration or diagram can be a very powerful tool in nonfiction text and writing.

RESOURCES

- 3 door foldable.docx https://betterlesson.com/lesson/resource/3026194/3-door-foldable
- 3 door foldable image.png https://betterlesson.com/lesson/resource/3094037/3-door-foldable-image
- Sun diagram #1.JPG https://betterlesson.com/lesson/resource/3166315/sun-diagram-1
- Sun diagram #2.JPG https://betterlesson.com/lesson/resource/3166316/sun-diagram-2

RESPONDING TO PREASSESSMENT NEEDS: Pre-Tests

The 3-door foldable diagram activity helps us clarify misunderstandings from the pre-assessment.
Question 4 PreAssessment Data (https://betterlesson.com/lesson/resource/3164068/question-4-preassessment-data-mp4)
I also reflected a bit as students made this worksheet their own:
Link (https://www.youtube.com/embed/WI7OokD1jDg)

- Question 4 PreAssessment Data.mp4 https://betterlesson.com/lesson/resource/3164068/question-4-preassessment-data

SUPPORTING AN ELL STUDENT: ELL Students

Link (https://www.youtube.com/embed/Iw_g0i_iknc)

Assessment - 0 minutes

Data Analysis

- Was the student able to synthesize the data, compare the numbers, and reach a conclusion? If not, pull the student tomorrow in a data-analysis small group.

Sun and Shadows Data

Based on the data, does the sun move in the sky?

Yes or No

Based on the data, what time is the sun the highest?

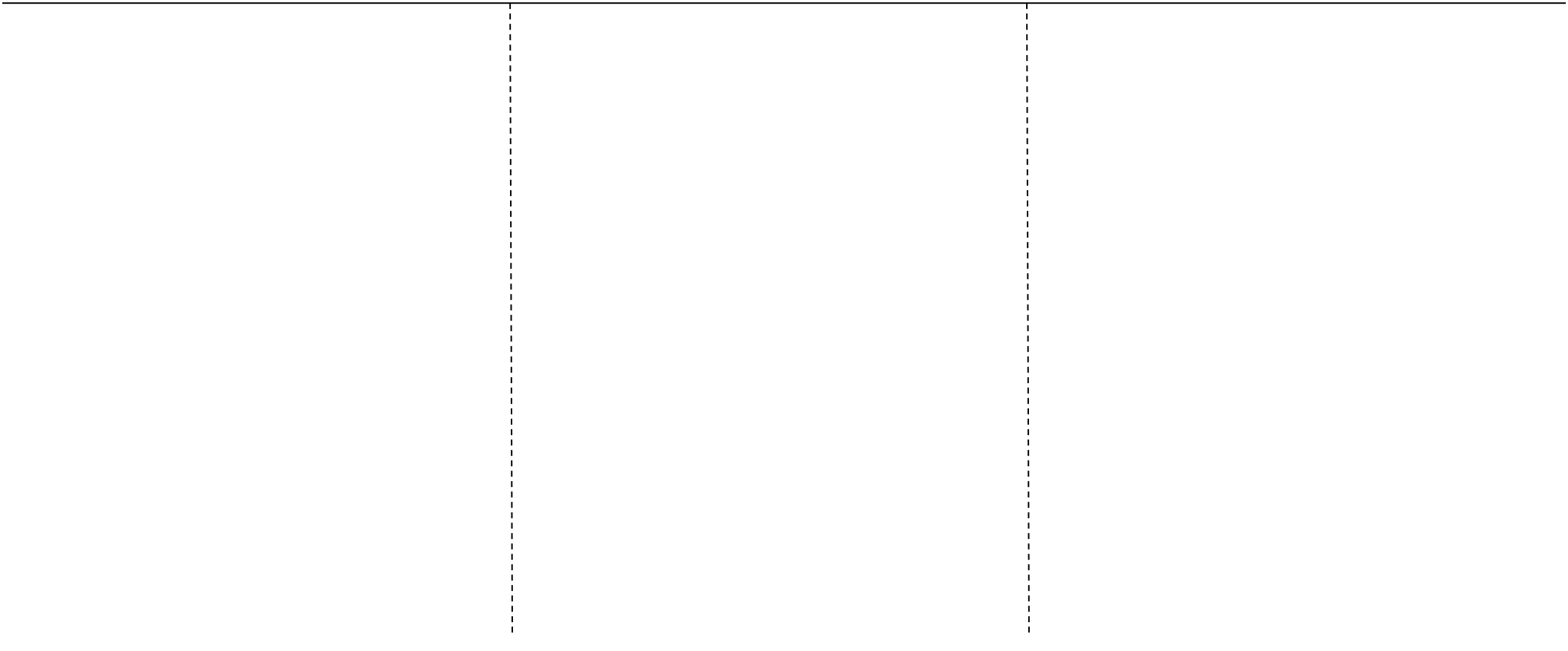
- ○ Morning
- ○ Mid-day
- ○ Late Afternoon

Based on the data, do the shadow lengths change?

What time are the shadow lengths the shortest?

- ○ Morning
- ○ Mid-day
- ○ Late Afternoon

Three-door foldable. Fold on the solid line. Cut on the dotted lines to form 3 doors. Open each door to draw a diagram inside.



SESSION 4:
Day and Night: the Hokey Pokey (optional)

Main activity

Use this lesson to talk to help students understand why day and night happen. Note: the NGSS bundle for this grade level does not have students focus on explaining *why* the patterns in the sky are observed, which is why this lesson is an optional extension.

Materials Needed

What makes Day and Night by Franklyn Branley

Sticky notes*

Large ball, globe, or inflatable globe*

Flashlight*

* *not provided in kit*

Earth's Rotation Hokey-Pokey

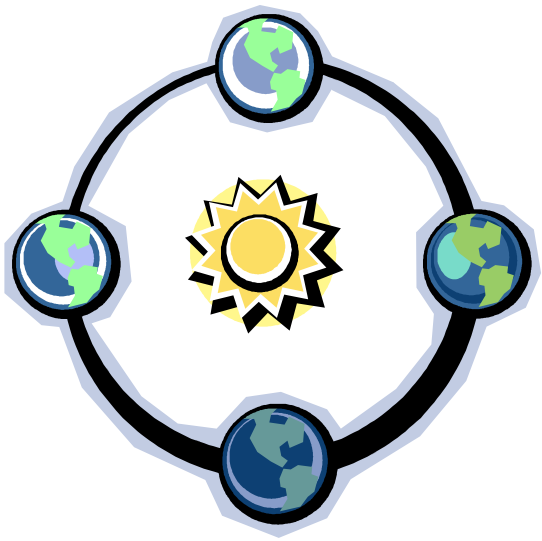
By: Katie Yablonski

You put your front in, you put your front out.

You put your front in, and you shake it all about.

When you face the sun, it's daytime now

That's what it's all about!



You put your back in, you put your back out.

You put your back in, and you shake it all about.

When you face away, it's nighttime now

That's what it's all about!

You put your whole self in, you put your whole self out.

You put your whole self in, and you shake it all about.

You rotate around on your axis now

That's what it's all about!

SESSION 5:
Daytime and nighttime animals (30 min)

Warm-up

Refocus students' attention back to the driving question and the KLEWS chart. Review by asking students: What patterns did we find about how the sun moved in the sky during the day? Students can use their flip books to review what they learned and share their conclusions. Now ask students: What are some things that animals do during the day? What are some things that animals do during the night? Some students may have the misconception that all animals are asleep during the day.

Main activity

Read *Nighttime Animals* by DK and pause to allow students to make observations and express their thinking. Ask students: what do these animals do at night time? What do you think these animals do during the day? Are all animals sleeping at night?

Wrap-up/assessment

This handout can be used as a classroom task or homework review (it is recommended to let students draw animals instead of limiting them to the animals on the cutout page).

OR, you can have students pick one animal either nocturnal or diurnal and draw a picture of what it does during the day or night. Ask students to complete the sentence frame. In the _____the _____is _____. (ex. In the nighttime, the raccoon is hunting for food).

Materials Needed

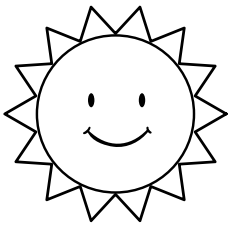
Nighttime Animals by DK

Day and nighttime animals handout

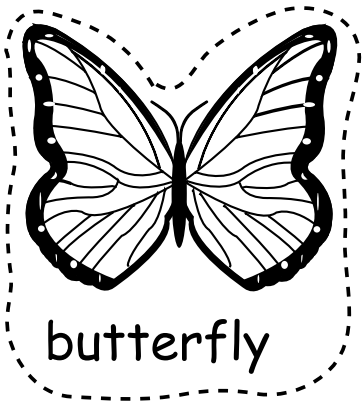
Daytime/Nighttime Animals

Cut out and paste each animal.

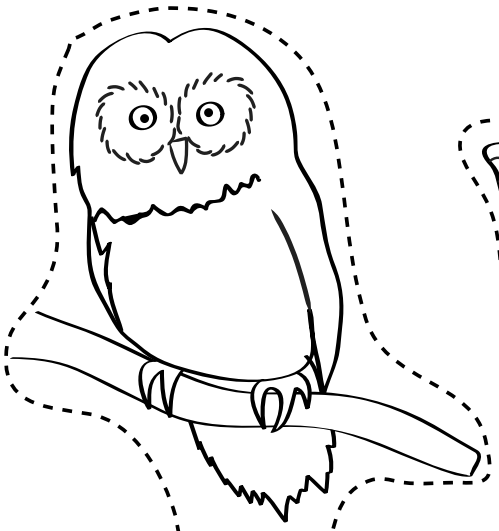
Daytime Animals



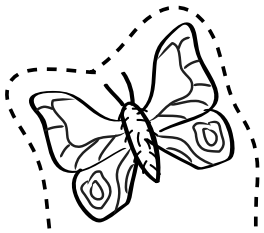
Nighttime Animals



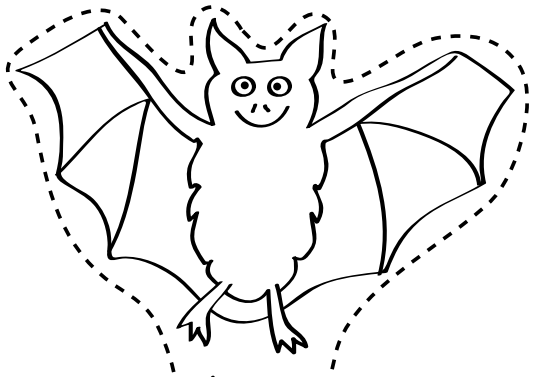
butterfly



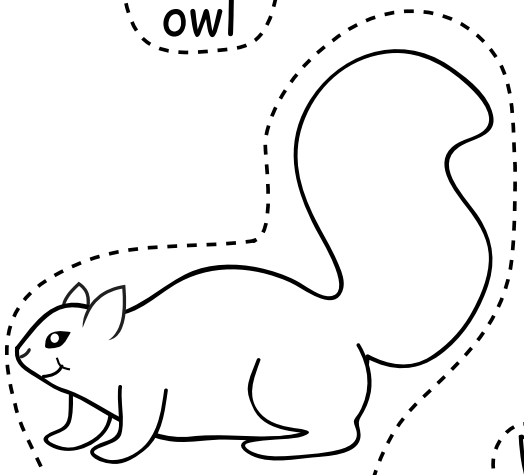
owl



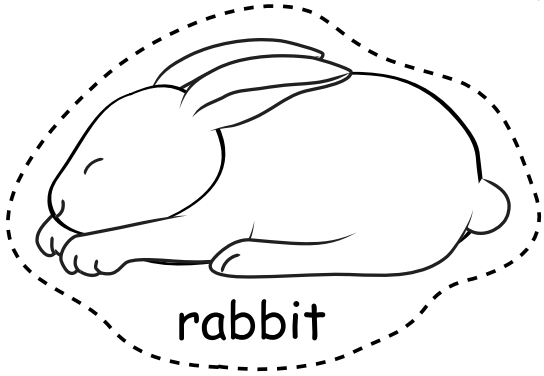
moth



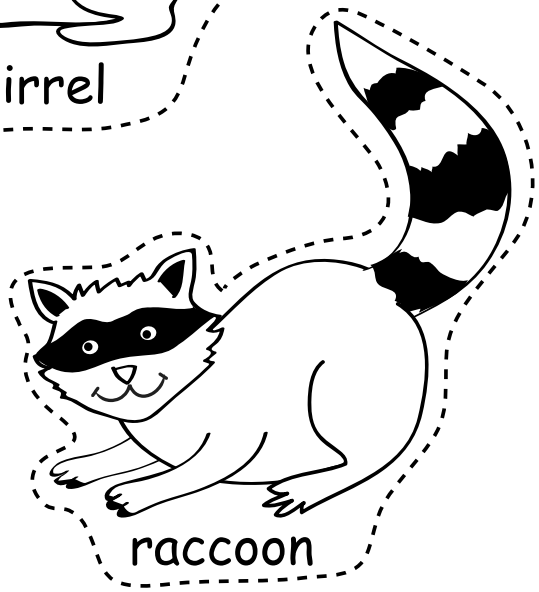
bat



squirrel



rabbit



raccoon

Answer Key

Daytime Animals	Nighttime Animals
butterfly	moth
squirrel	bat
rabbit	raccoon
	owl

SESSION 6: Wrapping up the phenomenon of day/night using the KLEWS chart (15-20 min)

Main activity

Check back in with the KLEWS chart and ask students, "So how does the pattern of night and day affect animals?" Write down students ideas on the KLEWS chart. This is a great place to check-in with the sections of the "What did we Learn?" "What Evidence did we find?" and "What science words (concepts) did we learn about?" Be sure to help students define the concepts of the sun, day, night, and patterns. The "S" column of the KLEWS chart provides a great space almost like a science "word wall" where new vocabulary and science words can be listed and discussed.

Materials Needed
KLEWS chart

How Lesson 1 Supports Next Generation Science Standards

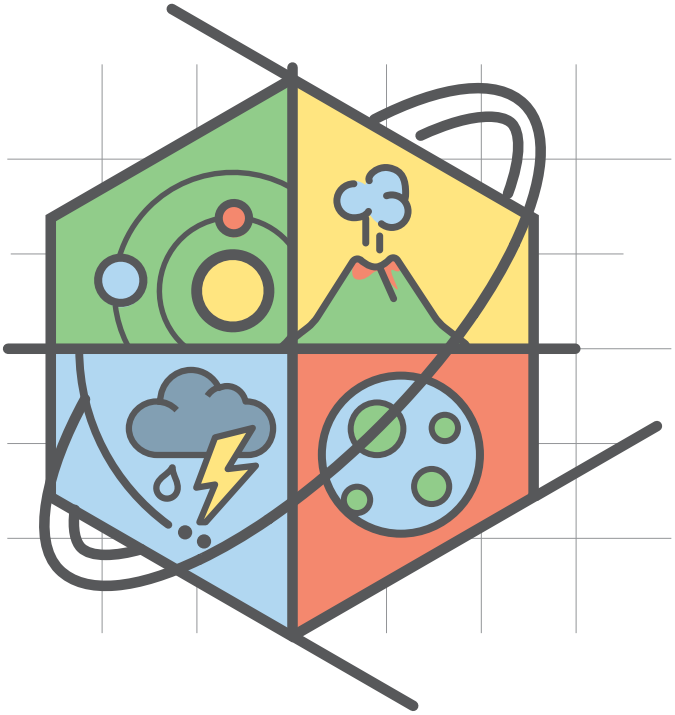
1-ESS1
Space Systems: Patterns & Cycles

Performance Expectation	Connections to Classroom Activity, *Students:*
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.	• Determine whether the sky changes or stays the same based on personal experiences. • Identify some occurrences or changes that they see in the sky. • Think about and ask questions of the ways that animals might behave different based on changes in the sky. • Ask questions about the driving question and create a list of wonderings. • Observe and describe daily patterns in the sun's movement. • Connect changing sun patterns with different animal behaviors.
SCIENCE & ENGINEERING PRACTICES	
Analyzing and Interpreting Data Asking Questions Constructing Explanations Planning and Carrying out Investigation	• Analyze a video of a bear hibernating and construct an explanation about what time of year it is based on evidence from the video. • Ask questions about the driving question (about how the sky changes and how animals are affected by these changes). • Plan and carry out investigation about how the sun seems to move in the sky on a daily basis. • Analyze data from the sun and identify a pattern that can be used to predict the sun's movement. • Construct an explanation (using drawings in a flipbook) to show how the sun moves from day to day. • Analyze and interpret textual information to connect animal behaviors with patterns of day and night. • Construct an explanation for how an animal behaves based on the time of day and amount of daylight.
DISCIPLINARY CORE IDEAS	
ESS1.A The Universe and its Stars ESS1.B Earth and the Solar System	• Ask questions about changes in the sky. • Construct an explanation about when the sun is visible and how it appears to move across the sky.
CROSSCUTTING CONCEPTS	
Patterns Scientific Knowledge Assumes an Order and Consistency in Natural Systems	• Identify changing patterns in the sky • Analyze data and identify a pattern that can be used to understand and predict the sun's daily movement. • Identify patterns of behavior that correlate with patterns of day and night.

The materials/lessons/activities outlined in this activity are just one step toward reaching the Performance Expectations listed below. Additional supporting materials/lessons/activities will be required.

https://www.nextgenscience.org/topic-arrangement/1space-systems-patterns-and-cycles

LESSON 2: Oh, How the Days Change!



STRATEGY: EXPLORE

In this lesson, students will investigate the phenomenon of how animal behaviors change based on changing patterns of daylight throughout the year. Students will also study the phenomenon of forest fires and smoky skies (another reoccurring pattern in the sky) and design a solution to help firefighters with this problem.

STEM

SESSION 1:
Changes in daylight and animal behavior

Warm-up/intro (5-10 min)

Start the conversation by reading students *Time to Sleep* by Denise Fleming.

Main activity

Ask students to turn-and-talk for the following discussion: What changes did the animals notice that showed them it was time for winter? What are some changes that happen in the fall or over the winter? Why might some animals want to sleep over the winter? How do the plants change when summer is over and fall begins? What happens to the trees? What does it look like outside in the winter?

Students may need some visuals to help spur their thinking and refresh their memories. Feel free to use this slides presentation to provide students with visuals that they can talk about to relate to the changes associated with each season. Ask students: How does the sky look in the winter?

Wrap-up

Reconnect with the KLEWS anchor chart. What were some things you learned about animals behaving a certain way because of changes in the sky during winter? What evidence did we find (names of animals that hibernate over the winter)? What new science words did you learn about (hibernation)?

Materials Needed

Time to Sleep
by Denise Fleming

Teacher slides

KLEWS chart

SESSION 2: FieldSTEM outdoor walk: Making observations outdoors (15 min)

Main activity (15 min)

Take students on a walk outside and have them first look at the sky. How does the sky look? What do they see in the sky? Now have them look at the living things in their environment. Do they see any plants? Do they see any animals? Task students with looking at one particular plant or animal (that is not moving) and to sketch a drawing of this plant or animal. Students can use this template to sketch and write a few descriptive words about what they see.

Materials Needed

FieldSTEM template

Clipboard/notebook for taking observations

Wrap-up (5-10 min)

Bring students inside and ask them to turn-and-talk with a partner about their observations. What were they observing, what observations did they make?

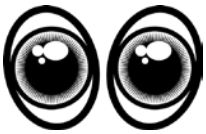
Name_____

Date_____

Time of day_____

Field STEM Journal

What did I see?



Words that describe what I saw:

SESSION 3:
Days can be longer or shorter

Warm-up

What patterns do they remember about the amount of sunlight we have during different times of the year? Write students' prior ideas on a chart paper. Read *Animals in Winter* by Henrietta Bancroft. Ask students, what are some of the changes that happened in the sky and in the environment in the winter? How did some of the animals behave differently in the winter?

Main activity

Have students look at data from different times of the year using this lesson. Students engage in where they look at patterns of day and light over the span of a year. If time permits, you can provide students with actual local data based on your location using this website that shows sunset/sunrise data for different times of the year.

Career connections:

Talk to students about meteorologists. A meteorologist is a scientist who studies patterns in the sky and uses their understanding of science to predict what the weather will be like. Ask students if they have ever watched a weather report on the news, a meteorologist is the person who creates and delivers that report to help us be prepared for the weather! This video (I Want To Be a Meteorologist by Radical Jr.) of a 1st grader talking about wanting to be a meteorologist can be used to engage students.

Wrap-up

When checking in with the KLEWS chart after the lesson, ask students: why do you think living things change so much when the amount of daylight changes. Ask students, what have we learned about our driving question: How are animals affected by patterns in the sky?

Assessment

Use this Sky Patterns and Seasons worksheet to see if students are able to identify what patterns will be seen in the sky during certain times of the year.

Materials Needed

- *Animals in Winter* by Henrietta Bancroft
- Computer with internet access
- Sunset/sunrise times
- Sky Patterns and Seasons worksheet

Kathryn Yablonski Knight VINCENT FARM ELEMENTARY, WHITE MARSH, MD
1st Grade Science : Unit #6 - Space: Part 2 : Lesson #3

Data for Days

Objective: SWBAT analyze data to make comparisons between the amount of daylight in summer and winter.

Standards: 1-ESS1-2 SP4 SP5
Subject(s): Science
60 minutes

Instructional Notes - 0 minutes

This unit is a mini-unit that can be taught directly after Space Part 1 or independently. I chose to teach the Space Part 1 unit (also here (https://betterlesson.com/user/472042/68207/160576/kathryn-yablonski/curriculum) on BetterLesson!) during January, and then Space Part 2 in late May.
Space Part 1 addresses the following NGSS standard:
1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted.
This mini-unit addresses this additional standard:
1-ESS1-2. Make observations at different times of year to relate the amount of daylight to the time of year.
It becomes so clear to children that days are getting longer in the Spring and Summer, which makes this a perfect time to analyze data about the amount of daylight in different seasons. Also, now having lived through multiple seasons with my students, we can share common experiences (remember when snow covered the playground *forever*!?!).
In this lesson, students are given charts with data for daylight amounts. Together we will analyze the data and read the charts in order to provide evidence for the fact that there is more daylight in the summer. This lesson aligns closely to NGSS Science and Engineering Practice #4 Analyzing and Interpreting Data, including using data to make predictions. It also aligns to SEP #5 Using Mathematics and Computational Thinking, as we use numbers displayed in table form to describe patterns.

Warm-up - 5 minutes

In today's warm-up, I review how to read a chart. I show a sample chart and we discuss (https://betterlesson.com/lesson/resource/3248692/daylight-data-conversation) the components.

- Where is the title on this chart? What is the purpose of the title?
- How do you read a chart?
- What do the horizontal rows mean?
- What does it mean when I read a column up and down?
- How can I use the information to compare items in each row?

I like all students to have a copy of the sample chart, so that they may follow along with their finger and trace the columns. I also display it on the whiteboard with a transparent rectangle to highlight the columns or rows under

discussion. Using colors to differentiate sections is incredibly helpful for students. I also breakdown the definition of data-- numbers that give us information-- into kid-friendly terminology.

RESOURCES

Daylight Data conversation.pdf https://betterlesson.com/lesson/resource/3248692/daylight-data-conversation

Exploration - 30 minutes

I provide all students with a copy of Daylight Data (https://betterlesson.com/lesson/resource/3226222/daylight-data) local to my area. Here is a great website (http://www.sunrisesunset.com/usa/) where you can enter your location in the USA and get a calendar showing the sunrise and sunset times.
NGSS Science and Engineering Practice #5 Using Mathematics and Computational Thinking asks students to use counting and numbers to identify and describe patterns in the natural and designed world(s). Now that we have reviewed how to read a chart in the warm-up, we move towards interpreting the data. In this video, students are asked to use the data to make predictions about the amount of daylight on the next few days.
Link (https://www.youtube.com/embed/G3VKQcFixM0)
Next, students used the winter data to make predictions.
Link (https://www.youtube.com/embed/5vXP7iGiftQ)
Since students had the data on clipboards with them, students recorded predictions (https://betterlesson.com/lesson/resource/3248693/student-work-with-predictions-written) and notes (https://betterlesson.com/lesson/resource/3248694/student-sample-2-with-their-notes). My students also have Science Journals-- marbled composition notebooks dedicated to science notes. Here, one of my more advanced students transcribed the data into a science journal and continued making additional predictions (https://betterlesson.com/lesson/resource/3248695/student-work-3-transcribed-into-a-science-journal-with-more-predictions) by analyzing the patterns.

RESOURCES

Daylight Data.docx https://betterlesson.com/lesson/resource/3226222/daylight-data

IMG_4108.JPG https://betterlesson.com/lesson/resource/3248693/student-work-with-predictions-written

IMG_4109.JPG https://betterlesson.com/lesson/resource/3248694/student-sample-2-with-their-notes

IMG_4110.JPG
https://betterlesson.com/lesson/resource/3248695/student-work-3-transcribed-into-a-science-journal-with-more-predictions

Closing - 5 minutes

Link (https://www.youtube.com/embed/pCd4vgJl0so)
In closing, it is time to make direct comparisons between the amounts of daylight in the summer and winter. NGSS Science and Engineering Practice #5 Using Mathematics and Computational Thinking asks students to describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs. Here, after viewing data about the amount of daylight in winter, students are working with partners to make predictions and compare which days have more daylight.
NGSS Science and Engineering Practice #5 Using Mathematics and Computational Thinking asks students to describe, measure, and/or compare quantitative attributes of different objects and display the data using simple graphs. Here, after viewing data about the amount of daylight in winter and summer, students are working with partners to compare data in a graph and use the data to answer the question, "Which season has the most daylight?"

I close the lesson with a discussion which reaches the objective: verifying that indeed, summer has more daylight hours than winter.

Summer Data 

Date	Sunrise Time	Sunset Time	Total Daylight Time
July 1	5:42am	8:37pm	14 hours, 55 minutes
July 2	5:43am	8:37pm	14 hours, 54 minutes
July 3	5:43am	8:36pm	14 hours, 53 minutes
July 4	5:44am	8:36pm	14 hours, 52 minutes
July 5	5:45am	8:36pm	14 hours, 51 minutes

Winter Data 

Date	Sunrise Time	Sunset Time	Total Daylight Time
January 1	7:26am	4:52pm	9 hours, 26 minutes
January 2	7:26am	4:53pm	9 hours, 27 minutes
January 3	7:26am	4:54pm	9 hours, 28 minutes
January 4	7:26am	4:55pm	9 hours, 29 minutes
January 5	7:26am	4:56pm	9 hours, 30 minutes

Patterns in Seasons

Draw the pattern in the sky that matches with each person.

SESSION 4:
Other patterns in the sky

Warm-up (5 min)

Show students these pictures of the sky during the eagle creek fire. Feel free to make a copy of the slides presentation and add photos of your own that are more locally relevant to students. Ask students to share their thoughts about the pictures and write their ideas on chart paper. Ask students if they remember hearing about or seeing the fires that were burning in the Pacific Northwest over the summers. Provide a space for students to share their thoughts and feelings (some students may remember feelings of fear and sadness from that time).

Materials Needed

- Slides presentation
- KLEWS chart

Main activity

Ask students if they remember anything about the Eagle Creek fire or other wildfire that may have occurred during the Summer. Allow students to share their memories and experiences. Show students the air quality chart on the slides presentation showing the air quality in Washington on August 20th, 2018. What do students notice about the air/sky during that time? Allow students to share their thoughts. Show students the graph on slide 3 showing how he occurrence of wildfires is increasing in Washington. Ask students: "why do hotter summers mean that there can be more forest fires? Why does less rain (especially in the summer) mean that we will have more forest fires?" Provide a space for students to share their ideas.

Wrap-up

Connect with the storyline:

Ask students to think about how our black bears are affected by forest fires. Have students share their thoughts and ideas.

- Show students part of this cartoon about Smokey Bear and preventing forest fires: www.youtube.com/watch?v=g5XkiQyxkLQ

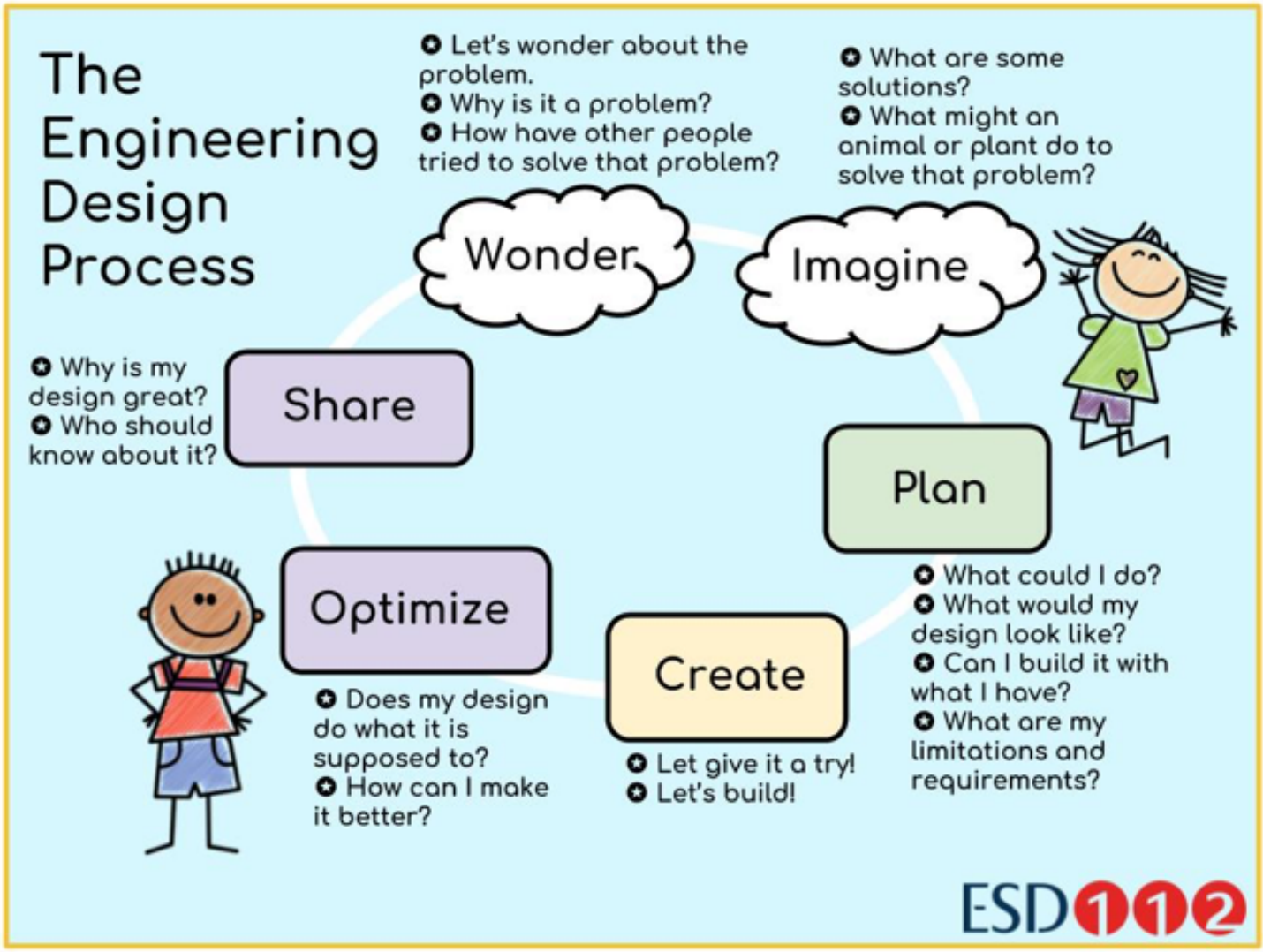
Check-in with the KLEWS chart and ask students to share what they have learned about animals being affected by smoky patterns in the sky. Students will likely come up with things to add to the "what we **L**earned," "what **E**vidence do we have" columns.

Career connections:

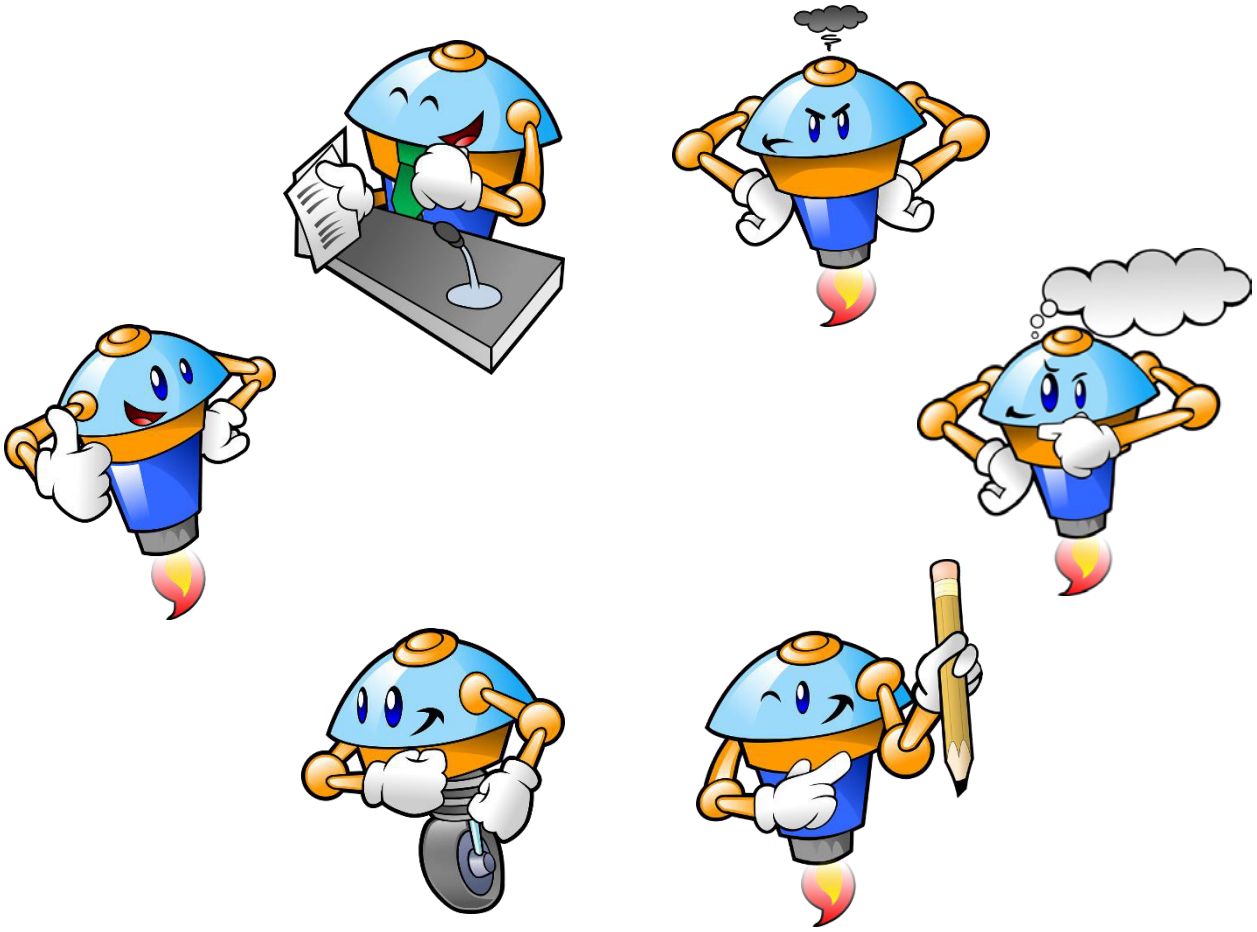
Take this opportunity to introduce the career of a firefighter to students. This video ("I Want To Be A Firefighter" by Radical Jr) can be used to present students with an idea of what firefighters do. Firefighters are an important part of our world as they help to put out fires (and try to prevent forest fires from getting out of control) and they protect us from harm! Ask students what they like about the job of the firefighter. Would they be interested in being a firefighter when they grow up? Why or why not? Have students turn and talk.

THE ENGINEERING DESIGN PROCESS:
Engineering design mini-project

The next several sessions will engage students in an age-appropriate engineering design project. In this engineering project, students will brainstorm the problems that happen during a forest fire, design a solution that can help humans or animals with the problem, check to see if the design would work, and share their solution. This engineering design process has been articulated to help primary students understand different parts of the process. This Engineering Design Project Template can be used as a place for students to plan and log their ideas. An editable version can be found here.



Engineering Design Project



Name:_____

STEP 1: WONDER

What is the problem?

Use words or pictures to draw the problem you are trying to solve.

STEP 2: IMAGINE

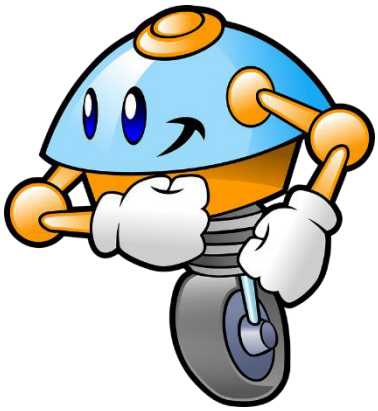
What are some solution ideas?

STEP 3: PLAN a prototype

Draw what your solution looks like. What materials will you use?

STEP 4: CREATE a prototype

Build!



STEP 5: OPTIMIZE your solution

Does your design work? How can you make it better?

STEP 6: Share

Share why your design is great! Who should know about it?

SESSION 5:
Intro to the problem & the WONDER phase

Warm-up

Show students this video ("Wildland Fire Recruiting Video") to help students see the different ways that firefighters have to fight the fires. Tell students that for the next few days, they will be working on designing a solution to help people fight forest fires. Tell students that we will be solving the problem: "What is a tool you could create to help firefighters fight a forest fire? OR What is a device that could keep people or animals safe in the case of a forest fire?"

Materials Needed

Engineering Design Poster

Engineering Design Project Template

Main activity

Have students work in pairs to think about what the problem is. Why is a forest fire a problem? What do firefighters need to do in order to stop the fire? Have students draw a sketch showing what the problem is. Ask students to draw a picture of the problem the want to try and solve. Different students may pick different parts of the problem to focus on. Some students may want to create some kind of a device to help extinguish the fire, some may want to create a device to prevent the fire from getting large, and others may want to create a device that helps people and/or animals stay safe in case the fire has already started.

Wrap-up

Have students partner up and share their problem with their partner. Make sure you ask students to share 1) what the part of the problem is that they'd like to focus on and 2) why the problem is a serious problem.

SESSION 6:
IMAGINE a solution

Warm-up

Share with students: "Now we are going to try and imagine a solution to the problem you chose." Tell students that this is the part of the engineering design process where they have to think about creative ways that they can solve their problem.

Main activity

Have students work in pairs to brainstorm possible solutions. Remember that this is the part of the engineering design process where students should be able to come up with as many ideas they can. No idea is too crazy at this point. Have students work in pairs and to draw out sketches of their ideas. If possible, provide students with post-its or small paper squares. Each square should only have one idea. Ask student groups to come up with at least 3 ideas.

Wrap-up

Have student teams pair up and share their most interesting idea with another group.

Materials Needed

Engineering Design Poster

Engineering Design Project Template

Post-it notes

SESSION 7:
PLAN a prototype

Warm-up

Tell students, "We came up with some pretty amazing ideas on how to solve our problems and help the firefighters or animals and people, now we will try to plan our device. Some of our ideas, as awesome as they were, were also a little out there! We will have to look at the materials we have available and decide which parts of our ideas we can actually realistically build." (ex. if student solutions involved robots or helicopters, then that is something they will not be able to design with resources available at school).

Materials Needed

Engineering Design Poster

Engineering Design Project Template

Post-it notes

Main activity

Provide students with the opportunity to look at the materials that are available to build their device. Ask students to create a **drawing** of their device and to label the materials they will use. A blueprint is a drawing of how a device or structure is going to be built. Provide students with a large piece of paper to create their designs. Depending on resources and time, you may choose to allow students to actually build the device (next session) or you may skip the building process and have students proceed with their blueprint drawings.

Wrap-up

Give students a chance to share their ideas and get feedback from another group of peers. What are the different materials they plan on using to build their device? How will the device work? What are they still trying to figure out?

SESSION 8:
CREATE the device

Main activity

Give students time to create their prototype devices. Students can work individually or in pairs (teacher discretion). Tell students that they will be creating a prototype. A prototype is a first-time model of an object that is intended to have a certain purpose. Provide assistance and guidance in building and choosing materials as needed.

Materials Needed

Engineering Design Poster

Engineering Design Project Template

Misc materials for building device: Can use parachutes, fan templates, and materials from the FOSS kit in addition to recyclable items (cardboard, plastic cartons and bottles, etc.).

SESSION 9:
CHECK and OPTIMIZE

Warm-up

The Charrette Protocol: Pair teams together and have students partake in a Charrette Protocol to give each other feedback. Background and teacher directions on facilitating a Charrette can be found here. Simplified steps for a Charrette Protocol are as follows:

1. Ask each team to identify one problem area where they could use some feedback and help (5 min)
2. Pair up student teams.
3. Have one team share their design and the problem they need help with. Then, this team must keep quiet.
4. Have the other team discuss the first team's problem and talk through some ideas.
5. When the first team has gotten enough feedback to move on, they end the session.
6. Teams switch roles.

Materials Needed

Directions for Charrette Protocol

Main activity & wrap-up

Give students time to make adjustments to their design based on the feedback they got from their peers.

SESSION 10:
SHARE our solutions

Main activity

Facilitate a gallery walk where students are able to share their devices with others. Since the purpose of this phase of the engineering design process is to share/communicate results (not on getting peer feedback), it may be nice to invite students from other classrooms to share your students' achievements.

Materials Needed
Student projects

How Lesson 2 Supports Next Generation Science Standards

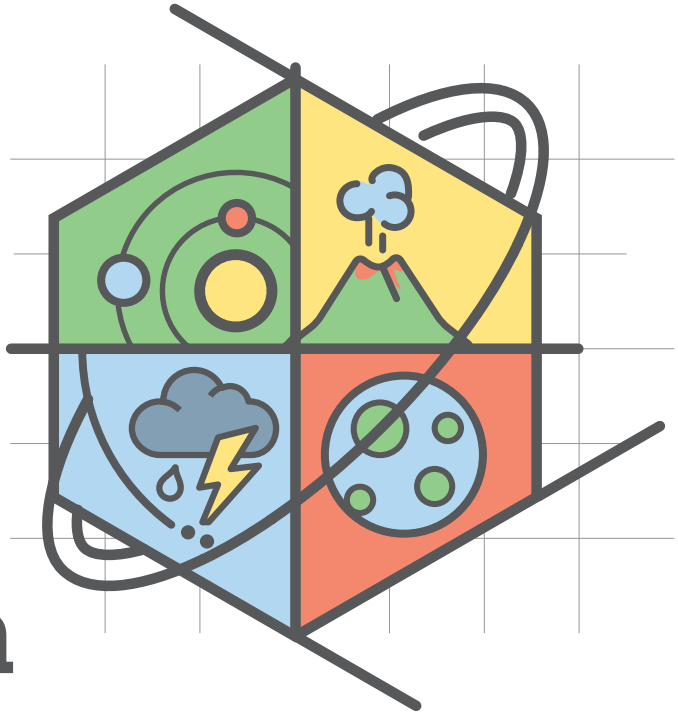
1-ESS1
Space Systems: Patterns & Cycles

Performance Expectation	Connections to Classroom Activity, *Students:*
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. 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.	• Analyze and interpret at data showing different lengths of day during different times of the year. • Construct an explanation to compare how the amount of daylight is different during the year. • Make observations about sky patterns related to summer wildfires. • Design a simple device that helps firefighters fight a forest fire or helps a person or animal stay safe in case of a forest fire.
SCIENCE & ENGINEERING PRACTICES	
Asking questions and defining problems Analyzing and interpreting data Constructing explanations and designing solutions	• Obtain information about current patterns in the sky by making field observations outdoors. • Analyze and interpret data about how different times of the year have days with different amounts of daylight. • Construct an explanation for how the environment changes when the seasons change. • Construct an explanation for how animals behave differently when the weather changes.
DISCIPLINARY CORE IDEAS	
ESS1.A The Universe and its Stars ESS1.B Earth and the Solar System	• Analyze data to relate the amount of daylight to the time of the year. • Identify patterns of daylight that can be predicted.
CROSSCUTTING CONCEPTS	
Patterns Scientific Knowledge Assumes an Order and Consistency in Natural Systems	• Analyze data and identify patterns of varying daylight during different times of the year. • Explain how patterns affect animal behaviors and how these patterns can be used to make predictions about plant and animal behaviors. • Analyze data and identify changing patterns in the sky related to climate change and increased wildfires. • Identify patterns in the sky that are repeated and can be predicted.

The materials/lessons/activities outlined in this activity are just one step toward reaching the Performance Expectations listed below. Additional supporting materials/lessons/activities will be required.

https://www.nextgenscience.org/topic-arrangement/1space-systems-patterns-and-cycles

LESSON 3: Different Moods of the Moon



STRATEGY: EXPLAIN

In this lesson, students will explore the different phases of the moon by making observations, reading texts, and viewing resources online. Students will then connect the changing phases of the moon with different animal behaviors.

STEM

SESSION 1:
Intro to the moon

Introduce students to the moon using this lesson. Students will be studying the moon by making observations about the position and shape of the moon in the sky during the day. Note: student worksheets are included at the bottom of each section of the lesson. The main portion of the lesson, where students observe the moon can be repeated on several days for students to compare the location and shape of the moon on different days. When wrapping up students' thinking for this segment, be sure to discuss patterns with students where they are able to talk about the moon (rising, moving across the sky, and then setting).

Materials Needed

Computer with projector for teacher slides

Career connections:

Use this video (Astronomer - Kid's Dream Job - Can You Imagine That? By Radical Jr) to introduce students to the career of an astronomer. An astronomer is someone who studies the objects in our sky. Students will be acting as astronomers for the rest of the unit by studying patterns related to the moon and stars. Ask students if they think that the career of an astronomer is an interesting job. Why or why not?

BetterLesson

Kathryn Yablonski Knight VINCENT FARM ELEMENTARY, WHITE MARSH, MD
1st Grade Science : Unit #3 - Space: Patterns in the Sky : Lesson #6

The Man in the Moon

Objective: SWBAT describe patterns of the moon.

Standards: MP5 1-ESS1-1 SP1 SP3 SP5 SP8
Subject(s): Science
30 minutes

Instructional Notes - 0 minutes

In today's lesson, students will observe patterns for a second celestial object, the moon. The NGSS standards call for students to *make observations*. Therefore, students *must* go outdoors to actually observe the moon. The new standards focus just as much on standards and practices (like observations) as content. In other words, it's not just reading a book about the moon; instead, students experience the moon for themselves!
In this lesson, students will observe shape of the moon, use hand spans (fist over fist) to record the moon's distance above the horizon, and record their data.
There are websites (http://www.timeanddate.com/worldclock/moonrise.html) that can help you figure out the best time to teach this lesson. Check the web and verify the current moon phases and whether the moon will be visible during the day. Note: the moon is visible during the day usually in the afternoon, except closest to the new moon. This lesson is flexible, can be moved based on the current moon phase.
Throughout this unit, I use a KLEWS anchor chart to record our new learning. This is a science-specific type of KWL chart designed with primary students in mind! Check out this video I like to call KLEWS chart 101:
Link (https://www.youtube.com/embed/W90hV9qiWyY)
Here is what the KLEWS chart (https://betterlesson.com/lesson/resource/3170639/klews-chart-prior-to-this-lesson) looked like prior to this lesson, as well as a template (https://betterlesson.com/lesson/resource/3170640/klews-space-template) of how the KLEWS chart will unfold throughout the unit.

RESOURCES

KLEWS chart after this lesson.JPG https://betterlesson.com/lesson/resource/3170639/klews-chart-prior-to-this-lesson

KLEWS space.docx https://betterlesson.com/lesson/resource/3170640/klews-space-template

TIMING FOR THIS LESSON: Flexibility

Flexibility and Sequencing the Lesson
(https://betterlesson.com/lesson/resource/3170635/flexibility-and-sequencing-the-lesson)

WIN_20141217_183611.mp4
https://betterlesson.com/lesson/resource/3170635/flexibility-and-sequencing-the-lesson

Materials - 0 minutes

- KLEWS chart (from previous lessons), This is a science-specific version of a KWL. Check out my video resource to learn more about how they work!
- Student Recording Sheet Moon Observations (https://betterlesson.com/lesson/resource/3064194/student-resource-moon-observations)
- Video (https://www.youtube.com/watch?v=yhXlUUfxoZk) showing the movement of the moon across the sky, such as this link.

RESOURCES

Student Resource- Moon Observations.docx
https://betterlesson.com/lesson/resource/3064194/student-resource-moon-observations

Student Resource- Moon Observations.pdf
https://betterlesson.com/lesson/resource/3170636/student-resource-moon-observations

Warm-Up (The Launch!) - 5 minutes

I start out today's lesson by referring to the focus questions students discussed in Lesson 1, namely, *What are objects in the sky?* and *What makes a pattern?* I have these displayed on a KLEWS chart, which is a science-specific KWL graphic organizer.

> ***Let's go back to our KLEWS chart about space. We named many objects we can see (observe) in the sky, and then we highlighted the ones that are in nature. Read them with me: the sun, moon, and stars. Great. We also talked about patterns. Tell the person next to you what makes a pattern. Right, a pattern repeats, so we know what is going to come next. That's called predicting what comes next.***

Next, I activate schema (background knowledge) students are bringing about patterns of the moon.

> ***Today let's think only about the moon. What does the moon do that repeats? What patterns does the moon have? Turn-and-talk to share your schema, and then we'll share together.***

Discussion is so important! It gives *all* students the chance to process the question, get their ideas together, and practice listening and speaking skills. Discussion also works wonders for your shy students! Plus, if there isn't a lot of excited discussion, that's a clue to me that I need to build a bit more background knowledge.

I have students turn-and-talk (we sit knee-to-knee and toe-to-toe), and then I call on a few to share with the larger group. Hint: While students are sharing, I make sure all friends have found a partner. Then, I try to listen in and find unique ideas that will take our conversation farther.

Exploration (The Space Walk!) - 20 minutes

First, I ask students if you can see the moon during the day. If these lessons are taught in sequence, expect some disagreement or uncertainty here.

Then, I set the purpose for the lesson by describing our next activity.

> ***Today, we will observe the moon.***

How your students record their data is completely up to you! My students use marbled composition notebooks, and today the will glue in the Student Resource- Moon Observations (https://betterlesson.com/lesson/resource/3064193/student-resource-moon-observations-docx). We will be taking them outside on clipboards!

I show the recording sheet to students and they reflect about what they will be doing. I ask questions like:

- What do you think this rectangle will be for? (Drawing the moon)
- Will we draw a circle, or the actual shape of the moon today? (Actual, accurate)

- What do you think we might put here, under "My Notes?" (the shape of today's moon, that the moon is out during the day, our questions about the moon)

The recording sheet has a rectangle for students to draw the shape of the moon. If it is not a full moon, then students begin to accurately record a different shape. This alludes to the idea that the moon's shape changes. The recording sheet also asks students to measure how far above the horizon the moon is. To do this, students use nonstandard measurement. I model how to measure with handspans.

> ***First, straighten both of your arms in front of you. Make your hands into fists. You will place one fist on top of the other. Move your arm until your bottom fist hits the top of the grass, the horizon. But one fist on top of the other and count how many fists high the moon is in the sky.***

I encourage students to help one another and compare their measurements. I also keep an eye out for any wacky numbers-- those friends need a little help!

Here we are finding the moon as we walk outside (https://betterlesson.com/lesson/resource/3170615/find_the_moon_-1-mov) , and here we are completing our nonstandard measurements with hand spans (https://betterlesson.com/lesson/resource/3170617/nonstandard_measurement-mov). I love how my students are so used to getting comfy in our classroom that some were even laying down to record (https://betterlesson.com/lesson/resource/3170627/students-recording)!

Children chose different notes to write, as you can see from our samples.

- Student work #1 (https://betterlesson.com/lesson/resource/3170628/student-work-1)
- Student work #2 (https://betterlesson.com/lesson/resource/3170629/student-work-2)
- Student work #3 (https://betterlesson.com/lesson/resource/3170630/student-work-3)

RESOURCES

- Student Resource- Moon Observations.docx https://betterlesson.com/lesson/resource/3064193/student-resource-moon-observations
- Find_the_moon_ (1).mp4 https://betterlesson.com/lesson/resource/3170615/find-the-moon
- Nonstandard_Measurement.mp4 https://betterlesson.com/lesson/resource/3170617/nonstandard-measurement
- DSCN3118.JPG https://betterlesson.com/lesson/resource/3170627/students-recording
- Student work #1.JPG https://betterlesson.com/lesson/resource/3170628/student-work-1
- DSCN3121.JPG https://betterlesson.com/lesson/resource/3170629/student-work-2
- DSCN3122.JPG https://betterlesson.com/lesson/resource/3170630/student-work-3

Closing (Prepare for Landing) - 5 minutes

We return to the classroom. I display the KLEWS chart front and center.

I tell students that we will record the moon's shape under "E" for Evidence/Observations. I ask what other shapes the moon can be, and students share crescent and full moon/circle. I add those as well. Then, I tell them the pattern their evidence proves.

> ***Your observations that the moon changes shapes proves that the moon goes through a pattern. It slowly gets smaller, and then goes back to a full moon. We call this the moon's phases. I will write under the "L" Learning section that the moon's shape goes through a repeating pattern of shapes. We'll be learning more about them over the next few days. Since our evidence proves the pattern, I'll draw an arrow between them.***

Next, we record the number of handspans of the moon above the horizon. I take the mode of student responses, and record that one. I take a quick survey, "How many people got ___ handspans?" to see which measurement is most popular. Unfortunately, because the moon is only visible in late afternoon and night, we are unable to measure it later in the day to see that it also appears to rise and set. So, I tell children this pattern.

> ***Your observations show part of a pattern. Just like the sun rises, appears to move across the sky, and set, the moon also moves across the sky. If we were at school all night, we could watch the moon move across the***

sky. Instead, I have a short video clip to show you. This is a special kind of video called time-lapse, which shows a long period of time really quickly.

I display the video clip (https://www.youtube.com/watch?v=yhXlUUfxoZk) of a time-lapsed moon moving across the night sky.

Link (https://www.youtube.com/embed/yhXlUUfxoZk)

Then, I write the second pattern of the moon-- that is rises, moves across the sky, and sets-- on the KLEWS chart (https://betterlesson.com/lesson/resource/3173576/klews-chart-after-this-lesson).

Your observations of the moon's position in the sky is part of a pattern. I will write under the "L" Learning section that the moon's movement goes through a repeating pattern of rising, moving across the sky, and setting. Since our evidence shows the pattern, I'll draw an arrow between them.

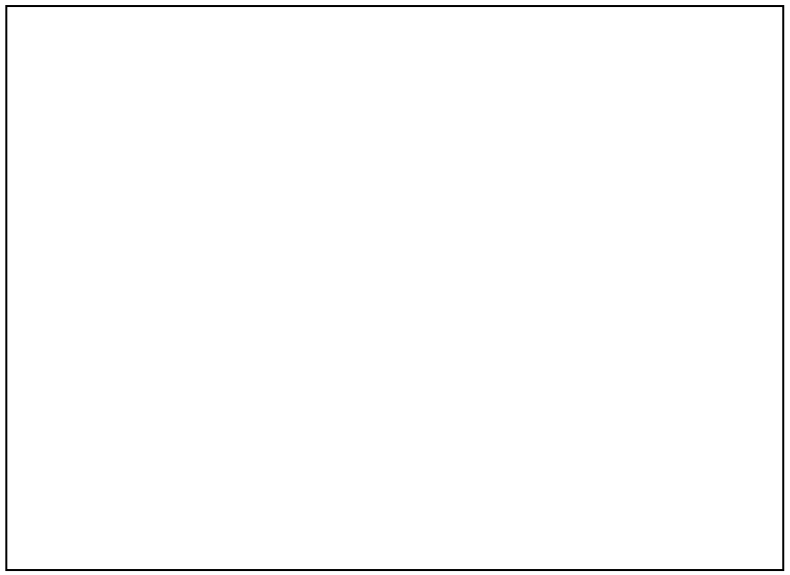
Last, because the standard wants students to describe the patterns, I ask them to turn and tell a friend one of the moon's patterns. Over the next few days, we'll be completing more activities together to help them better understand and be able to describe the lunar patterns.

RESOURCES

DSCN3124.JPG https://betterlesson.com/lesson/resource/3173576/klews-chart-after-this-lesson

DSCN3125.JPG https://betterlesson.com/lesson/resource/3173577/klews-chart-updated

Moon Observations

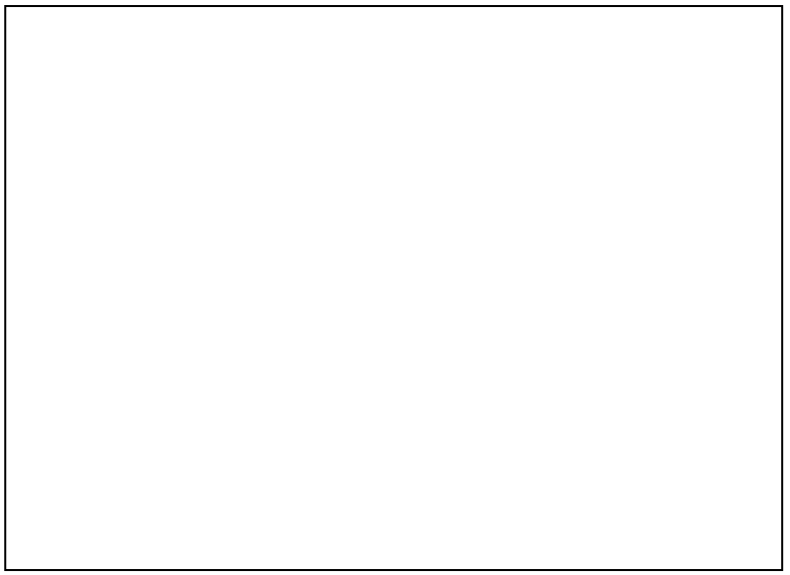


My Measurement:

_____ handspans

My Notes:

Moon Observations



My Measurement:

_____ handspans

My Notes:

SESSION 2: Foss Investigation 4: Looking for Change (Part 3: The Night Sky)

Warm-up
(Setting up for a month of moon observations)

Tell students that we will be investigating the way the moon changes over the span of the month. Ask students: how can we study how the moon changes for the next month? Provide students with moon calendar and send home letter to parents asking for their help in observing the moon over the span of the month. If the moon is not visible due to clouds, this website showing daily phases of the moon can be used to track the moon's shape each day.

After at least a few weeks of collecting data, check-in with students in a class discussion.

1. How did you see the moon change over time?
2. Did you notice any patterns?

Once students have shared their experiences with one another, ask them to share together with the class.

Supplemental reading while students take days/weeks to collect observations:
Please read *The Moon Seems to Change* by Dr. Franklyn M. Branley in short sessions to students as they spend time thinking about the moon and collect data. Check in with the KLEWS chart after each reading session so that students can add things they have learned, things that they wonder, and science vocabulary that they discovered.

Main Activity
(After observations have been collected)

Show students this video visualization of the different phases of the moon and ask them to share their thoughts about the phases and how the moon changes in the span of the month. Also, show students this video of a time-lapse of both the sun and moon rising and setting.

Assessment

By now, students should be aware of a few different patterns associated with the movement of the sun and the moon in the night sky. Ask students to draw or write about a pattern of the sun that they have observed, or a pattern of the moon. This template may be used.

Materials Needed

Moon Change calendar (in FOSS teacher resources)

The Moon Seems to Change by Dr. Franklyn M. Branley

Name_____

A pattern of the Sun
A pattern of the Moon

SESSION 3: Animals and the moon: Sea Turtle game (45 minutes)

Teacher Background about baby sea turtles and the moon

"Sea turtle hatchlings rely on the moon and star light reflecting off the ocean at night to direct them to the safety of the water. After birth, they orient toward the brightest light on the beach. For baby sea turtles born on brightly lit beaches in developed coastal areas such as Florida, this can bring dire consequences: Instead of heading toward waves sparkling with moonlight, the turtles are often drawn toward brightly lit roads and parking lots, where they quickly die." https://www.nps.gov/articles/nocturnal_earthnight.htm

Materials Needed

- Computer with projector for videos
- Little turtle shells
- Sun and Moon Phases Posters
- Blue butcher paper

Warm-up & discussion

Tell students that we will be learning about how animals, the sea turtles in particular, are affected by the changing moon patterns. Ask students where sea turtles live. Show students this general video of sea turtles to help them relate to the animal and understand that the ocean is its habitat. Let students share their observations about the sea turtles with a partner and then as a whole group.

Show students this video of the sea turtles hatching from their nest. Allow students to make lots of observations about the number, size, and quantity of baby sea turtles. Where are the sea turtles headed? Why are they headed that way? Then ask students: how do you think the sea turtles would get to the water at night? Show students this video of baby sea turtles moving towards the ocean during the full moon. Ask students to share their observations and take note of them. Students will notice how the moon was lighting up the sky and also reflecting on the ocean, making it easier for the baby turtles to make their way home. Ask students, in what phase of the moon do they think the baby turtles will have the easiest time moving towards the water at night?

Main activity: Baby turtles and moon phases game (20-30 min)

Pre-game set-up:

- Have students color and cut-out little turtle shells to wear using this or another template (you may want to have students color the shells in advance in their free time). Attach to students' backs using masking tape. Prepare the sun and moon phases.
- Find a large space (or go outdoors on grass if weather is appropriate). Draw or mark a long line in the space to represent the shoreline (where the water meets the sand). Put something blue on one side to symbolize the water so it is easier for students to visualize (ex. A large piece of blue butcher paper). This will help students who are visual learners, emerging bilingual students, or students with special needs.

Game directions:

- Have students get into crawling position (on their knees like a baby turtle) on the "sand" side and at least 5-10 meters away from the "shoreline." Tell students "today you will pretend to be baby turtles that have just been born! You are trying to reach the

SESSION 3: Animals and the moon: Sea Turtle game (cont.)

water! You will have to look at the patterns in the sky as you try to find your way to the water. Show students the different sky patterns (sun, full moon, half moon, crescent moon, new moon).

- Ask students, "when will it be easy for you to see the water? [when it is day-time with the sun, or when there is a full-moon] and "when will it be hard for you to see the water?" [when it is night and there is the new moon or a tiny crescent moon].
- Tell students: "you will act like a baby turtle moving towards the water. Look at the patterns in the sky to help you move."

Start to play!

Hold up the sun poster and ask students to model how a baby turtle would move in that situation. Then give students a heads-up by saying, "The sky is changing!" Then hold up the new moon poster. Pause and ask students: "did you move differently when the sun was up vs when there was a new moon? Why?"

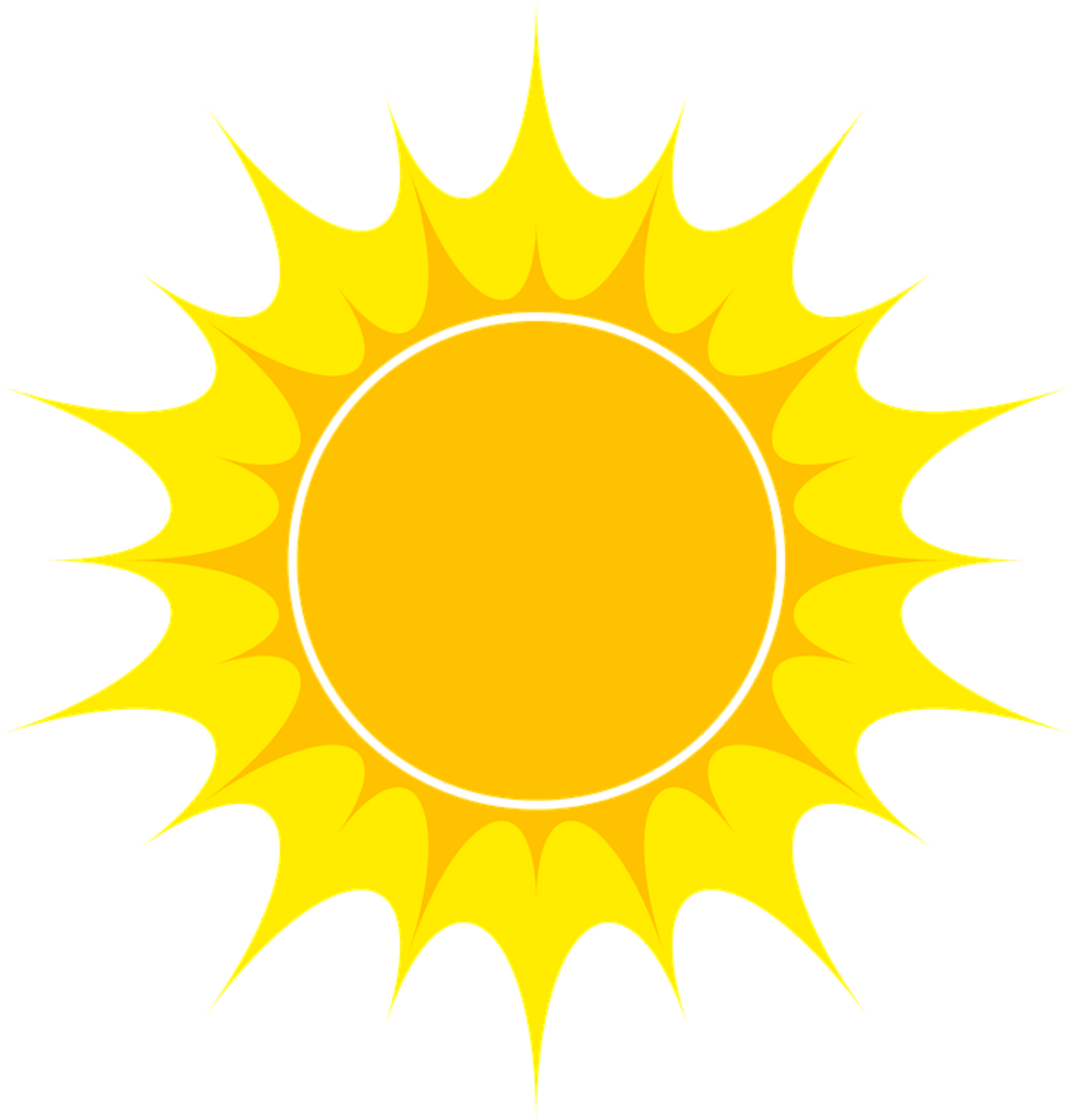
Go through different patterns and allow students to slowly get to the ocean.

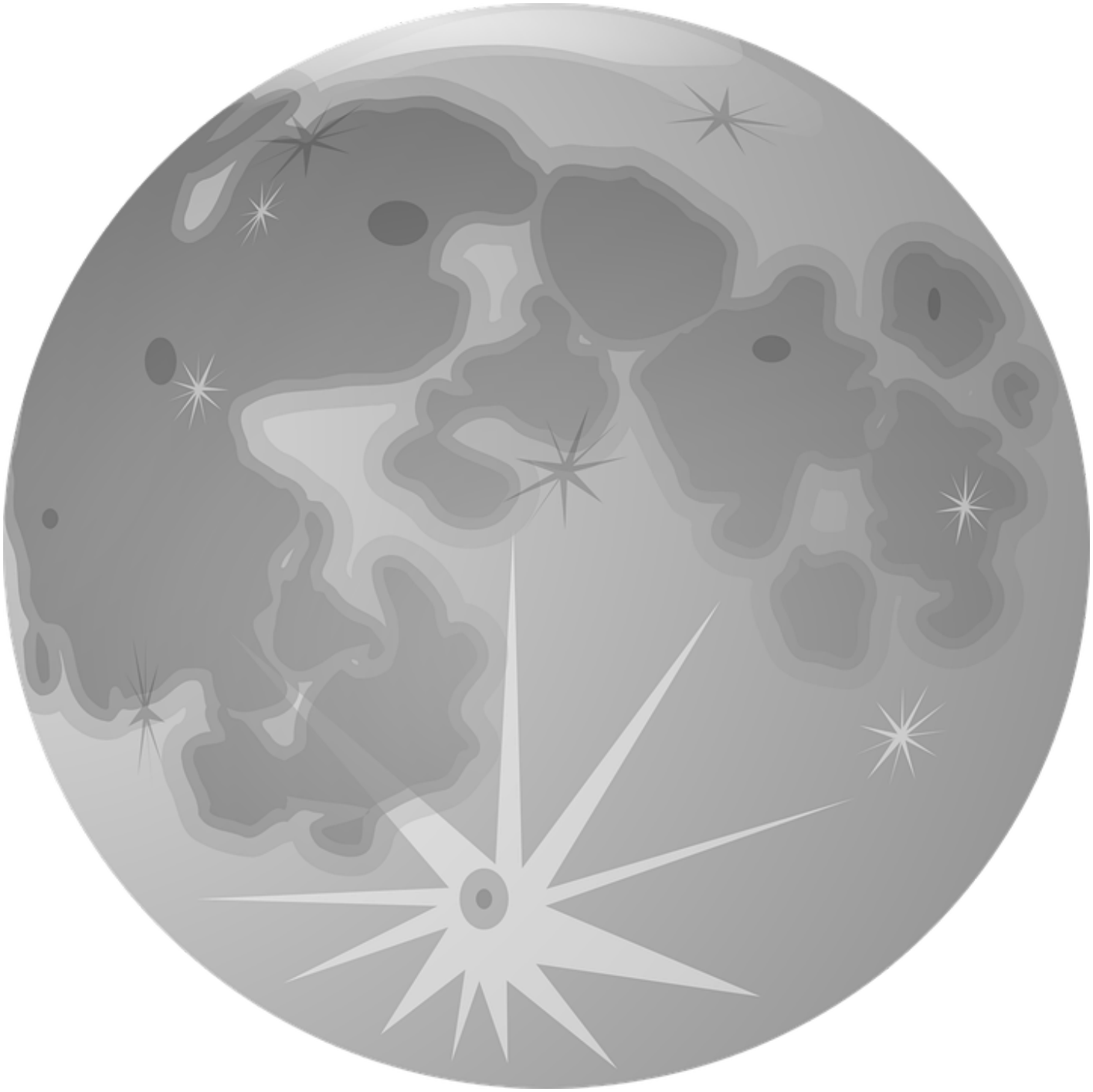
Wrap-up discussion
(can be done next day if you run out of time)

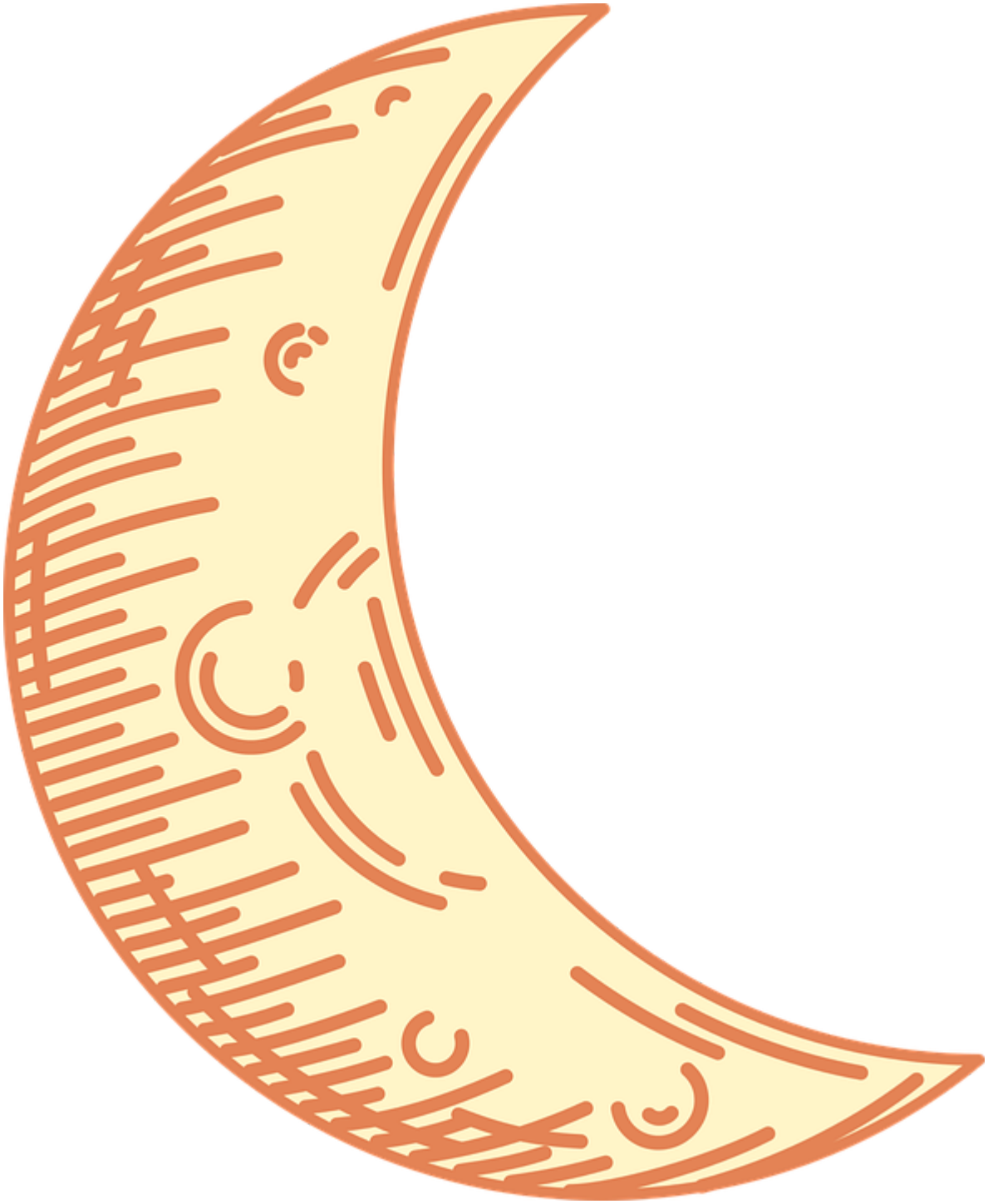
Revisit the KLEWS chart and have students share their thoughts about the game and today's lesson. How are baby sea turtles affected by patterns in the sky?

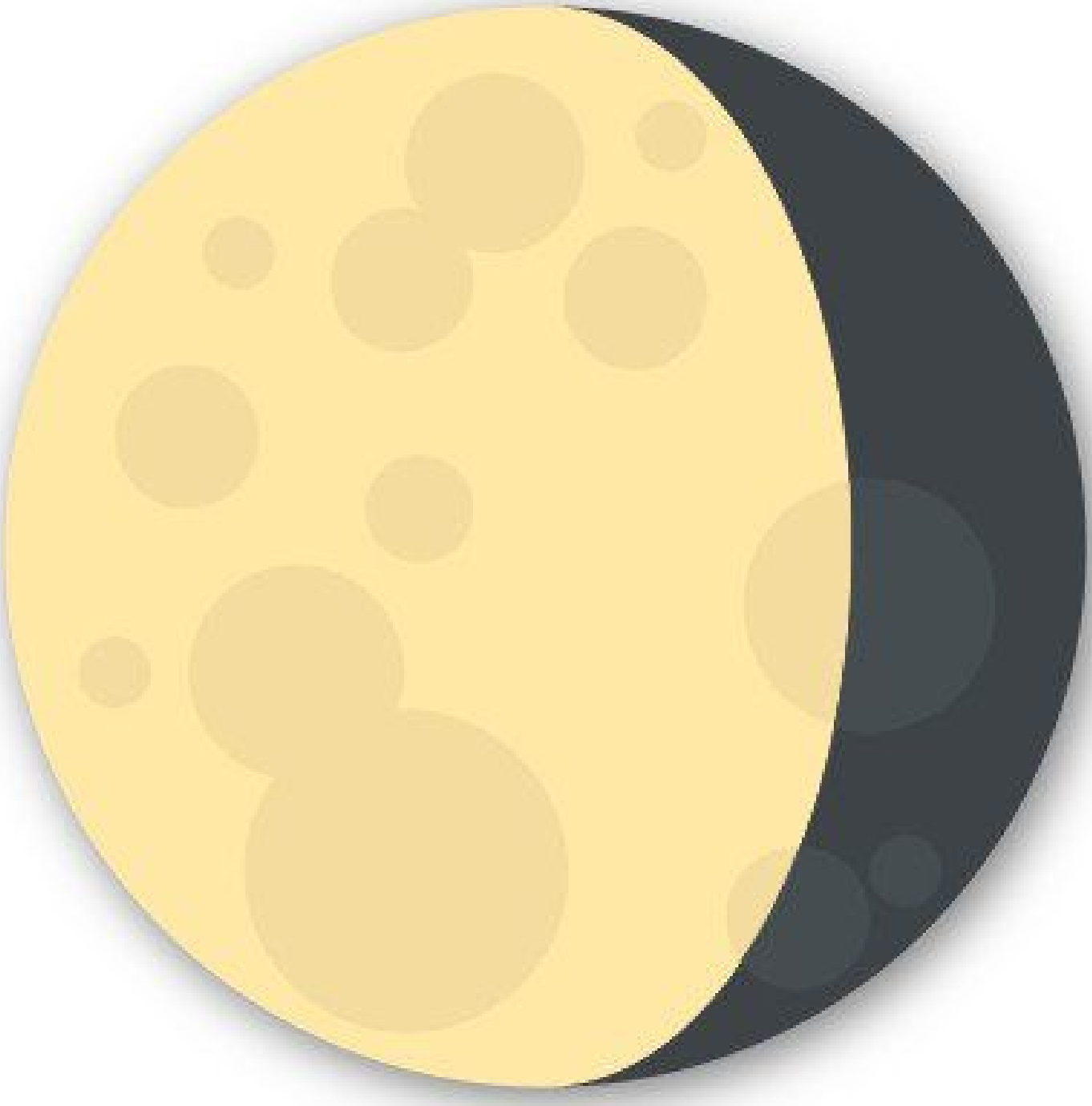
Some thoughts and optional discussion:

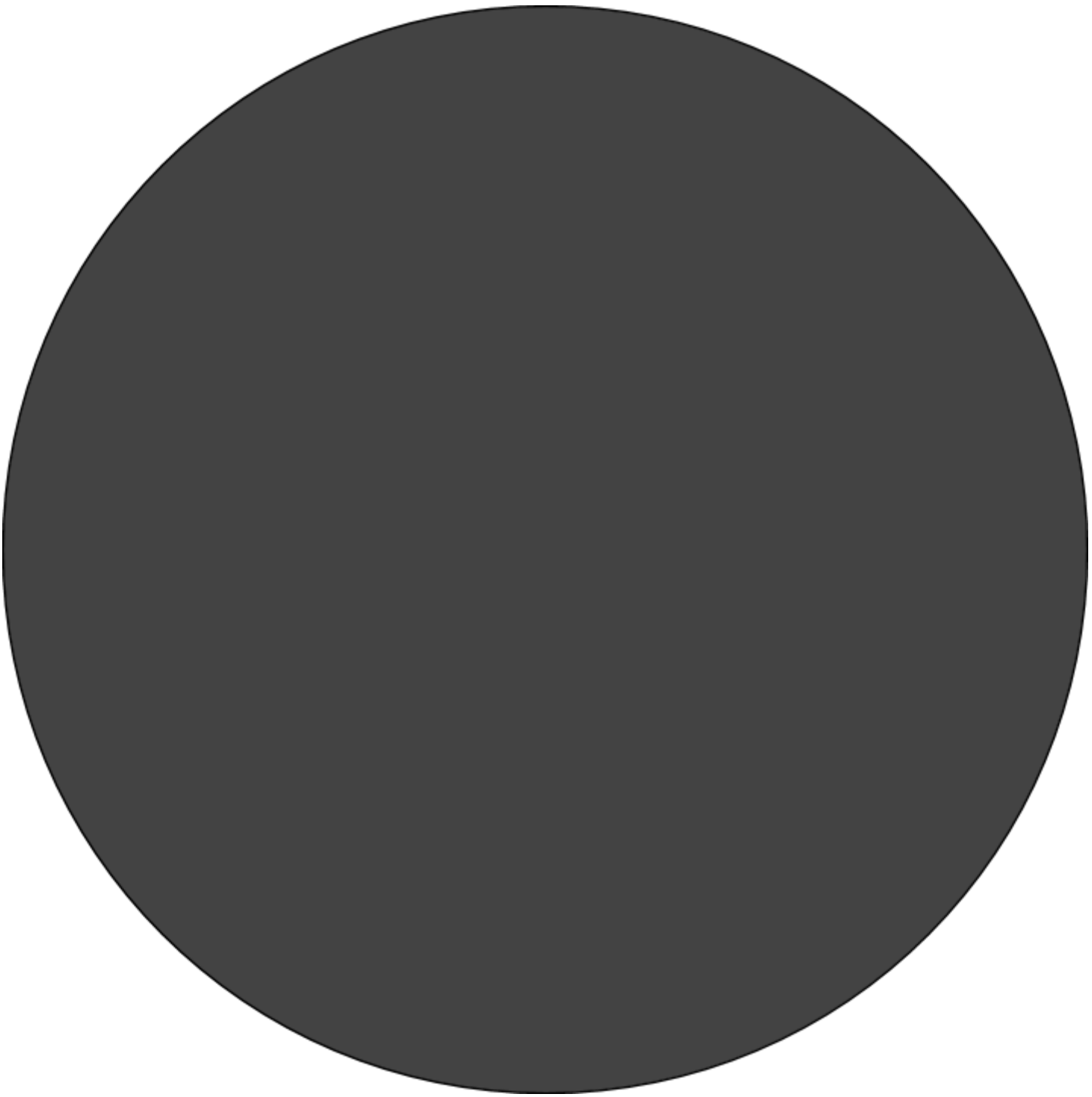
This is intended to be a fun game where students are able to think about how the baby sea turtles are affected by patterns in the sky. Like any model, it has its limitations, ex. baby turtles usually take a matter of hours to get to the sea (not several moon phases later as simulated in the game). Feel free to discuss this with students in the debrief if students bring up these ideas.

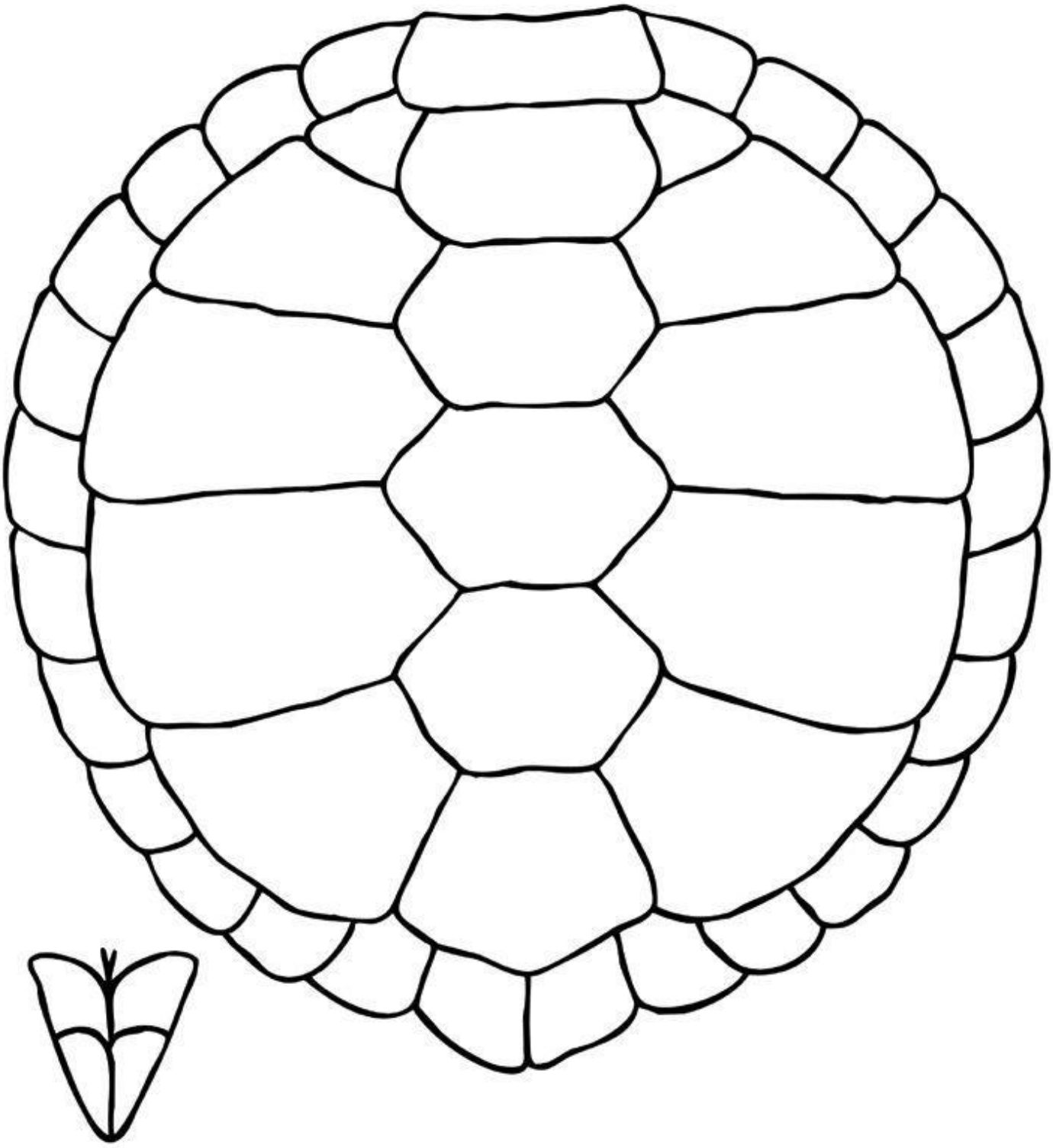












SESSIONS 4-5: Mini-engineering challenge: Helping the baby turtles (2+ sessions, based on time)

Warm-up/engagement

Start to read *Follow the Moon Home: A Tale of One Idea, Twenty Kids, and a Hundred Sea Turtles* by Philippe Cousteau. In this book, students will learn about a problem being faced by baby sea turtles due to light pollution on the shores. Pause periodically to allow students to share their thoughts and ideas and to talk about how the light pollution has been affecting the animals. Stop before the kids in the book start to work together to find a solution and proceed to present the engineering design challenge.

Career connections:

Use this video to introduce students to the career of a wildlife conservationist. A wildlife conservationist (conservation biologist) is someone who protects our natural world. Animals like baby sea turtles are a part of the natural world because they are living creatures that live in nature. Tell students that the role they are taking on to preserve the baby sea turtles resemble the role that conservation scientists take in nature in order to protect wildlife.

Materials Needed

- *Follow the Moon Home: A Tale of One Idea, Twenty Kids, and a Hundred Sea Turtles* by Philippe Cousteau
- Engineering design poster
- Engineering Design template (optional)
- Chart paper and markers (for drawing design solution)

Main activity: Mini-engineering challenge

How can you design a solution that will prevent sea turtles from getting lost on the shore and help them get to the ocean? Have students work with a partner on this mini-engineering project. Note: this design challenge does not require students physically building their design solutions, rather, students are brainstorming and prototyping their ideas using a simple sketch and a verbal explanation. You can use this Engineering Design Template to help provide a space for their thinking.

Ask: What is the problem that the baby sea turtles are having when there are lots of lights on the beach? Why is this a problem? Have students draw a sketch of the problem.

Imagine: What are ways that the problem could be solved? Have students work in teams to brainstorm some possible solutions. Ask students to draw one imagined solution per one post-it (or small square piece of paper).

Plan and Design: What could you design to help the babies reach the ocean safely? Have student teams revisit their imagined solutions. Which solution is the most realistic and possible to do? Provide students with this template where they can draw their design solution. Depending on time and resources, you can chose to have students either stop after drawing their design, or to have them actually build out their device with recyclables and materials available in the class. Note: engineering design does not have to require that students build their models—a detailed drawing can be enough to engage them in the innovative process of design thinking.

Check: How will their design help baby sea turtles reach the ocean safely? Allow teams to share with one another and get feedback about their designs.

Share: Give students the opportunity to share their designs using your preferred protocol (e.g. gallery walk, sharing in groups of 3 teams).

Wrap-up

Finish reading Follow the Moon Home. Ask students, how did the students help the loggerhead turtles?

SESSION 6: Connecting with KLEWS and the storyline (10-15 min)

Main activity

Reconnect with the KLEWS chart and have students add their ideas from this lesson to the chart. So what did we learn that we can add to the KLEWS chart about how animals are affected by patterns in the sky?

Materials Needed
KLEWS chart

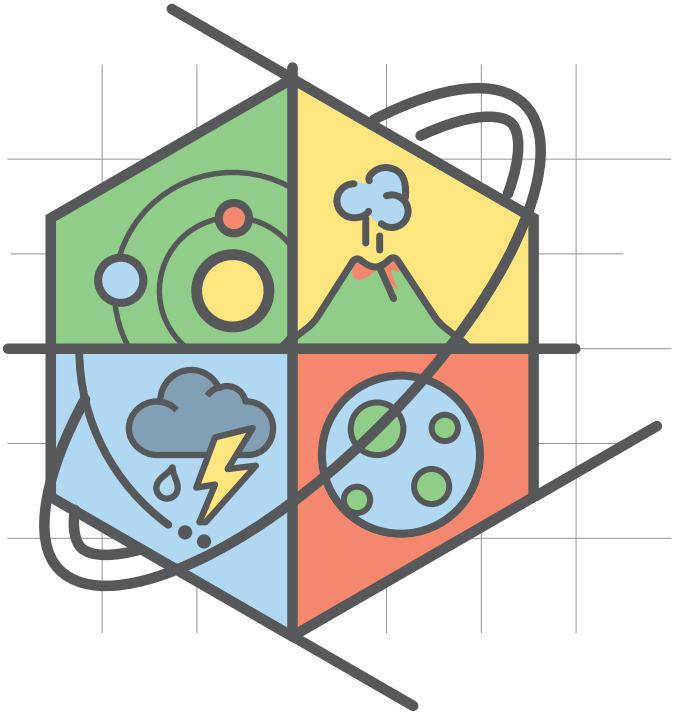
How Lesson 3 Supports Next Generation Science Standards

1-ESS1
Space Systems: Patterns & Cycles

Performance Expectation	Connections to Classroom Activity, *Students:*
1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted.	• Collect data about different patterns of the changing moon. • Collect and analyze data that shows how the moon changes phases over the span of the month. • Create a drawing showing at least one pattern of the sun and one pattern of the moon that can be identified and predicted.
SCIENCE & ENGINEERING PRACTICES	
Analyzing and Interpreting Data Asking Questions and defining problem Developing and using Models Constructing Explanations and Designing Solutions	• Analyze and interpret data about when the moon is visible and the different phases that the moon can be seen in throughout the month. • Construct an explanation for an observable pattern of the sun and moon that can be used to make predictions. • Use the baby sea turtle game as a model to show how baby sea turtles are affected by different phases of the moon. • Define the problem being faced by the baby sea turtles and design a solution to help them reach the sea safely when light pollution is present.
DISCIPLINARY CORE IDEAS	
ESS1.A The Universe and its Stars	• Make observations and identify patterns that explain the movement of the sun and the moon in the sky. • Make observations that explain the changes in appearance of the moon throughout the span of a month and how these changes can be predicted.
CROSSCUTTING CONCEPTS	
Patterns Scientific Knowledge Assumes an Order and Consistency in Natural Systems	• Identify patterns that can be used to predict the movement of the sun and the moon in the sky. • Identify patterns that can be used to understand and predict phases of the moon.

The materials/lessons/activities outlined in this activity are just one step toward reaching the Performance Expectations listed below. Additional supporting materials/lessons/activities will be required.

https://www.nextgenscience.org/topic-arrangement/1space-systems-patterns-and-cycles



LESSON 4: Animals in the Stars

STRATEGY: ELABORATE

In this lesson, students will study the stars and how they appear to move in the night sky. Students will then read a Lakota myth about a coyote who created the constellations. Students will wrap up the lesson by connecting to the KLEWS chart and thinking of ways that the stars may influence animals.

STEM

SESSION 1:
Intro to stars and star patterns

Warm-up

Show students this slides presentation and ask them what they see in the first image. Students will likely mention the stars or more based on their background knowledge (ex. galaxies, the milky way). Ask students, when do we see stars? What time of the day do we see stars? Allow students to share their responses with a partner and then with the whole group.

Main activity

Ask students, what did we notice about the moon and the sun in the sky? Did they move or were they always still? Well, how about stars? Do you think that stars move in the sky? Or are they still? Ask students to share their ideas with a partner. Then show students this video (also linked on slides). Ask students what they observe. Were they surprised?

Wrap-up/assessment

Check-in with the KLEWS chart and allow students to share their ideas. What did they learn about the stars, what do they still wonder? This assessment page can be assigned as homework or can be used as an exit ticket to the session.

Materials Needed

Computer with projector (for teacher slides and videos)

Patterns of stars worksheet

KLEWS chart

Star Patterns

Name:

Stars in the day	Stars at night

SESSION 2:
Coyote Places the Stars

Warm-up

Show students the slide of the Sirius constellation and ask: What do you see here? Ask students to share with a partner and then with the whole group. Explain to students that for thousands of years, people have looked up at the night sky and tried to make sense of it. Sometimes we even see animals in the stars. Sometime cultures have stories, myths or legends, to explain the different things they see in the stars. Are there any myths or legends about the stars that you can think of that you have read or heard before?

Main activity

Read *Coyote Places the Stars* by Harriet Peck Taylor. Ask students what they liked about the story. What did they find interesting? What patterns in the sky were present in the story? Did they witness any patterns in the story relating to the patterns we have study? Was the sun in the story? How about the moon?

Wrap-up

Ask students to think about the ways that animals might be affected by star patterns? What are ways that humans have used the stars? Is it possible that animals could use stars the same way? Check back with the KLEWS chart and allow students to share their ideas and make additions.

Materials Needed

Coyote Places the Stars by Harriet Peck Taylor

KLEWS chart

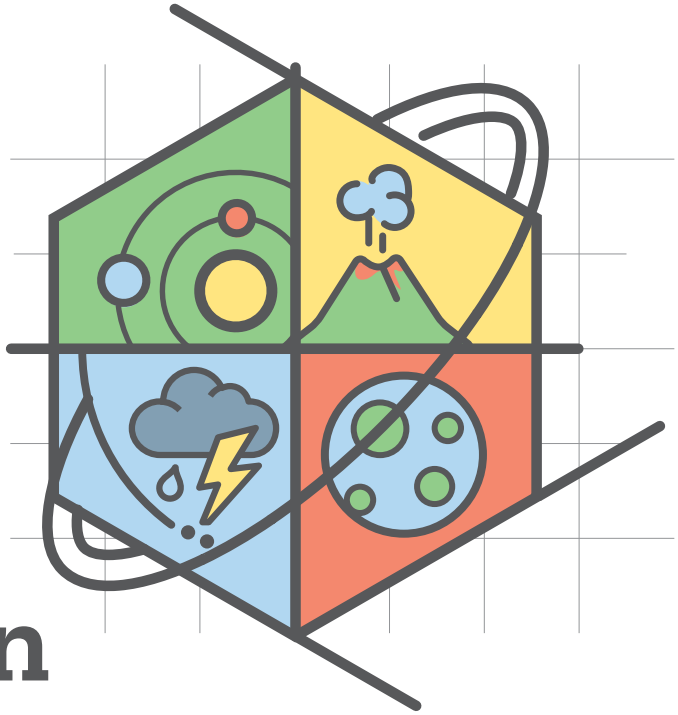
How Lesson 4 Supports Next Generation Science Standards

1-ESS1
Space Systems: Patterns & Cycles

Performance Expectation	**Connections to Classroom Activity,** *Students:*
1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted.	• Make observations of the stars and identify patterns that explain the appearance of stars in the night sky. • Draw an explanation of when stars can be seen in the sky.
SCIENCE & ENGINEERING PRACTICES	
Analyzing and Interpreting Data Constructing explanations Obtaining, Evaluating, and Communicating information	• Make observations and analyze data to construct an explanation of when in the day starts are and are not visible. • Create a drawing explaining when stars are visible and when they are not visible.
DISCIPLINARY CORE IDEAS	
ESS1.A: The Universe and its Stars. Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.	• Study how stars can be seen during certain parts of the day and not during other parts of the day.
CROSSCUTTING CONCEPTS	
Patterns	• Identify a pattern describing when stars are visible to us and when they are not.

The materials/lessons/activities outlined in this activity are just one step toward reaching the Performance Expectations listed below. Additional supporting materials/lessons/activities will be required.

https://www.nextgenscience.org/topic-arrangement/1space-systems-patterns-and-cycles



LESSON 5: Patterns in the Sky Art Exhibition

STRATEGY: EVALUATE

This final lesson will be the students' opportunity to create a piece of artwork that will educate the community about how patterns in the sky can affect animals. Students can pick a pattern that most interests them and focus on that one pattern. Refer to the KLEWS chart to help students review what patterns have been studied and what animal-related phenomena have been identified. Encourage students to pick a pattern or phenomena that interests them.

SESSION 1:
Introducing the problem

Warm-up

Engage students by telling them that we will be creating an art exhibit to educate the public about all the ways we found that patterns in the sky affect animals! Remind students of the driving question of the unit: ***How are animals affected by changes in the sky?***

Students' art will be displayed and parents and the community will have a chance to view the pieces of art. Explain to students that the piece of art must show two very important things 1) a pattern in the sky—how a particular thing changes in the sky (ex. Sun at different places in the sky, varying length of day throughout the year, phases of the moon, or absence of stars during the day vs night) 2) an animal that behaves differently based on that changing pattern in the sky. Students will also be writing a caption to explain the piece of artwork so people viewing the gallery will be able to understand their message.

Options for artwork: based on teacher discretion, students could potentially create a painting or poster, a diorama, a Scratch program (block coding program), or other piece of art with teacher's approval.

Main activity

Before students start to create their artwork, allow them to have one day to sketch their plan for their art piece. Check-in with the KLEWS chart and ask students to think about the different animal behaviors they learned about that were affected by changing sky patterns. Ask students to think about which pattern or animal they found most exciting or interesting and to share with a partner. Provide students with this brainstorming template to sketch their idea. Also ask them what art materials they plan on using so you can coordinate and prepare. This is a great time to go around and give students feedback, especially if you see that some students are not showing a changing pattern in their art piece (ex. Only showing the sun and an animal during daytime and not at nighttime).

Wrap-up

Have students team up with a partner and share their plan.

Materials Needed

Art brainstorming template

Paper and pencils

Name_____
Topic_____

Changing Sky Patterns Art Plan

Picture or diorama scene showing the sky	Picture or diorama scene showing a change in the sky and how the animal acts differently

SESSIONS 2-4:
Creating the masterpiece

Main activity

Provide students with the materials needed and allow them to create their pieces of art. It may be helpful to create stations with different art materials in case there are students using many different types of materials. You may also chose to limit students' options with art media based on resources, time and space.

Materials Needed

Lots of art supplies and recyclable materials

SESSION 5:
Writing a caption and getting peer feedback

This session engages students in writing a caption for their piece of art. Students will need instruction and modeling about what a caption is and how to write it Show students' slides for writing a caption. Ask students what they see in the art gallery besides artwork. Students should notice little captions on the wall in addition to the pieces of art. Tell students that we will be writing captions to help viewers understand out piece of art. The different parts of the caption are labeled in the slide.

Materials Needed

- Caption writing template
- Peer feedback form

Main activity

Model how to write a caption by creating a caption template and giving students an example. This is a possible template that you could use. Please change to fit your needs. Allow students to work on their captions.

Wrap-up

Have students share their captions with a partner. Writers, Scientists, and almost all grown-ups share their work with peers to get feedback and make their work better. Let students know that it is also important to be respectful and sensitive when giving feedback on someone's work. Give examples of appropriate and inappropriate feedback. Students can use this Peer feedback form to give each other feedback. Students can first self-evaluate using one color or crayon and have their peer give feedback using a different color.

Name: _____

Topic: _____

I observed _____

_____

_____

_____

_____

I learned_____

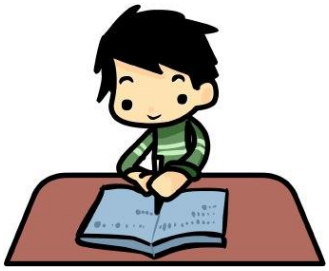
_____

_____

_____

_____

Peer Review Checklist



Author's name_____

Reviewer's name_____

Topic_____ Date_____

- I checked for capital letters.
- I checked for punctuation marks.
- The sentences make sense.
- I explain something they observed in the sky.
- I explain how an animal acts based on the sky.

Talk to your partner: What did you like about their writing?

Peer Review Checklist

Author's name_____

Reviewer's name_____

Topic_____ Date_____

- I checked for capital letters.
- I checked for punctuation marks.
- The sentences make sense.
- I explain something they observed in the sky.
- I explain how an animal acts based on the sky.

Talk to your partner: What did you like about their writing?

SESSION 6:
Writing the final captions

Main activity

Provide students with a clean template to write the final draft of their caption. Circulate the room and coach students who are having difficulty getting started. They should already have some feedback to work off of.

Materials Needed
Caption writing template

SESSION 7:
Gallery walk with peers

Post students' artwork and facilitate a gallery walk where students are able to enjoy each other's work. Celebrate students' success and learning over the span of the unit.

Materials Needed
Space for Gallery walk
Student artwork

SESSION 8:
Public gallery opening

Arrange for student artwork to be displayed in a special place on campus. Invite parents, teachers, administrators and community members for a viewing of students' pieces of art. This parent letter can be used to invite families. Arrange a time where students can curate their pieces and discuss them with guests. Congratulate students on their achievements and success! Students successfully studied different patterns answered the driving question: ***How are animals affected by changes in the sky?*** Have the KLEWS Chart on display so students and parents can see how students have tracked their learning throughout the unit.

Materials Needed

- Space for Gallery walk
- Student artwork
- Parent letter

Date:_____

Dear Parents and Families,

We are excited to invite you to our art gallery titled, “Patterns in the Sky!” We have been studying changing patterns in the sky and how animals are affected by these changes.

We would love to have you join us on _____ from _____ to _____, we are so excited to share our work with you!

Sincerely,

How Lesson 5 Supports Next Generation Science Standards

1-ESS1
Space Systems: Patterns & Cycles

Performance Expectation	Connections to Classroom Activity, *Students:*
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.	• Create a piece of art and an accompanying caption that describes a pattern in the sky and a way that an animal is affected by this pattern.
SCIENCE & ENGINEERING PRACTICES	
Analyzing and Interpreting Data Constructing explanations Obtaining, Evaluating, and Communicating information	• Analyze observations and explanations to select one changing pattern and construct an explanation for how an animal is affected by this changing pattern. • Create a drawing showing how a pattern changes in the sky. • Create a drawing showing how a changing pattern affects an animal's behavior.
DISCIPLINARY CORE IDEAS	
ESS1.A: The Universe and its Stars. Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted. ESS1.B Earth and the Solar System. Seasonal patterns of sunrise and sunset can be observed, described, and predicted. LS1: From Molecules to Organisms: Structures and Processes	• Review the different patterns in the sky that were observed throughout the unit. • Connect the observed pattern in the sky with an animal behavior that helps the animal to survive.
CROSSCUTTING CONCEPTS	
Patterns	• Identify a pattern describing when stars are visible to us and when they are not.

The materials/lessons/activities outlined in this activity are just one step toward reaching the Performance Expectations listed below. Additional supporting materials/lessons/activities will be required.

https://www.nextgenscience.org/topic-arrangement/1space-systems-patterns-and-cycles