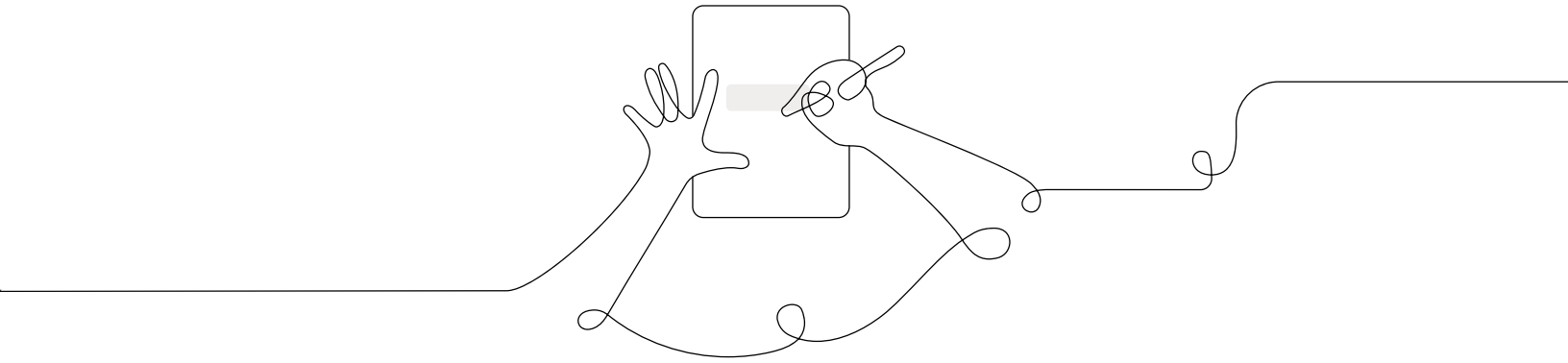
AmplifyScience

Participant Notebook

Grade 8: Earth, Moon, and Sun
Guided Unit Internalization with @Home Resources



Unit Guide resources

Once a unit is selected, select **JUMP DOWN TO UNIT GUIDE** in order to access all unit-level resources in an Amplify Science unit.

Planning for the unit

Unit Overview	Describes what's in each unit, the rationale, and how students learn across chapters
Unit Map	Provides an overview of what students figure out in each chapter, and how they figure it out
Progress Build	Explains the learning progression of ideas students figure out in the unit
Getting Ready To Teach	Provides tips for effectively preparing to teach and teaching the unit in your classroom
Materials and Preparation	Lists materials included in the unit's kit, items to be provided by the teacher, and briefly outlines preparation requirements for each lesson
Science Background	Adult-level primer on the science content students figure out in the unit
Standards at a Glance	Lists NGSS Standards (Performance Expectations, Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts), Common Core State Standards for English Language Arts, and Common Core State Standards for Mathematics

Teacher references

Lesson Overview Compilation	Lesson Overview of each lesson in the unit, including lesson summary, activity purposes, and timing
Standards and Goals	Lists NGSS (Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts) and CCSS (English Language Arts and Mathematics) standards in the unit, explains how the standards are reached
3-D Statements	Describes 3-D learning across the unit, chapters, and in individual lessons
Assessment System	Describes components of the Amplify Science assessment system, identifies each 3-D assessment opportunity in the unit
Embedded Formative Assessments	Includes full text of formative assessments in the unit
Articles in This Unit	Summarizes each unit text and explains how the text supports instruction
Apps in This Unit	Outlines functionality of digital tools and how students use them (in grades 6-8)
Flextensions in This Unit	Summarizes information about the Hands-On Flextension lesson(s) in the unit

Printable resources

Coherence Flowcharts	Visual representation of the storyline of the unit
Copymaster Compilation	Compilation of all copymasters for the teacher to print and copy throughout the unit
Flextension Compilation	Compilation of all copymasters for Hands-on Flextension lessons throughout the unit
Investigation Notebook	Digital version of the Investigation Notebook, for copying and projecting
Multi-Language Glossary	Unit vocabulary words in 10 languages
NGSS Information for Parents and Guardians	Information for parents about the NGSS and the shifts for teaching and learning
Print Materials (8.5" x 11")	Digital compilation of printed cards (i.e. vocabulary cards, student card sets) provided in the kit
Print Materials (11" x 17")	Digital compilation of printed Chapter Questions and Key Concepts provided in the kit

Unit Map

How can an astrophotographer plan for the best times to take photos of specific features on the Moon?

Students take on the role of student astronomers, advising an astrophotographer who needs to take photographs of the Moon. In order to provide this advice, students investigate where the Moon's light comes from, what causes the characteristic changes in the appearance of the Moon that we observe, and what conditions are required to view phenomena such as particular moon phases and lunar eclipses.

Chapter 1: Why is there a border between light and dark on the Moon?

Students figure out: The Moon does not make its own light; the sun illuminates the Moon. The sun illuminates the half of the Moon that is facing it, and the other half of the Moon is dark. Light from the sun travels in straight lines. When a model is to scale, object sizes and distances are larger or smaller than in the real world, but the same relative to one another. Some models need to be not to scale to be useful.

How they figure it out: Students analyze photographs of the Moon. They explore the Simulation and test the effect of turning sunlight on and off. They observe a physical model using a lightbulb to represent the sun and a foam sphere to represent the Moon. They use the Modeling Tool to show their understanding so far.

Chapter 2: Why does the border between light and dark on the Moon change location?

Students figure out: From Earth we can only see the half of the Moon that is facing us. Because the Moon moves to different positions around Earth, we see different amounts of the illuminated half of the Moon. This is why we see different phases of the Moon. There is a pattern to the appearance of the Moon because the Moon orbits around Earth. It takes about one month for the Moon to orbit Earth, so it takes about one month to see the full pattern of moon phases. This pattern repeats with every orbit of the Moon.

How they figure it out: They read an article about moon phases. They return to the physical model from Chapter 1 and examine how the Moon appears in different positions relative to the Earth and sun. They watch a video that explains how the point of view from which the Moon is viewed affects how it appears. They make predictions about how the appearance of the Moon changes, and check those predictions in the Sim. They use a paper model to check their understanding. They show their understanding in the Modeling Tool and in writing.

Chapter 3: What are the conditions that cause a lunar eclipse?

Students figure out: During a lunar eclipse, the Moon is completely dark because Earth blocks sunlight from hitting the Moon. Lunar eclipses can only happen when Earth is directly in between the sun and the Moon. Lunar eclipses do not happen every time Earth is in between the sun and the Moon. The Moon is only completely dark when the sun, Earth, and the Moon are in a straight line, with Earth in the middle.

How they figure it out: They explore lunar eclipses in the Sim and in the physical model. They read an article about an ancient device found in a shipwreck that was used to predict lunar eclipses. They create visual models of a lunar eclipse in the Modeling Tool. They use the Reasoning Tool to plan writing to explain the cause of a lunar eclipse.

Chapter 4: Students apply what they learn to a new question—During a year, will there be a lunar eclipse of the moon of Kepler-47c?

Keplar 47c is a planet that orbits around a pair of binary stars. Students use evidence about that system as well as analogous evidence from our solar system to argue about whether a lunar eclipse is likely to happen for a moon of Keplar 47c. They engage in oral argumentation in a student-led discourse routine called a Science Seminar and then write final arguments.

Progress Build

Each Amplify Science Middle School unit is structured around a unit-specific learning progression, which we call the Progress Build. The unit's Progress Build (or Build) describes the way students' explanatory understanding of the unit's focal phenomena is likely to develop and deepen over the course of a unit. It is an important tool in understanding the structure of a unit and in supporting students' learning: it organizes the sequence of instruction (generally, each level of the Build corresponds to a chapter), defines the focus of assessments, and grounds the inferences about student learning progress that guide suggested instructional adjustments and differentiation. By aligning instruction and assessment to the Progress Build (and therefore to each other), evidence about how student understanding is developing may be used during the course of the unit to support students and modify instruction in an informed way.

The *Earth, Moon, and Sun* Progress Build consists of three levels of science understanding. To support a growth model for student learning progress, each level encompasses all of the ideas of prior levels and represents an explanatory account of unit phenomena, with the sophistication of that account increasing as the levels increase. At each level, students add new ideas and integrate them into a progressively deeper understanding of why the Moon's appearance changes as it orbits Earth. Since the Progress Build reflects an increasingly complex yet integrated explanation, we represent it by including the new ideas for each level in bold.

Prior knowledge (preconceptions). At the start of the *Earth, Moon, and Sun* unit, middle school students will likely have some everyday experience with the changing appearance of the Moon in the night sky. They are also likely to understand that the sun is a star that provides all of the light in our solar system. However, few students will have experience thinking about the repeating, regular pattern of moon phases and what causes this pattern. Students may think that moon phases are caused by the shadows of clouds or of Earth, they may think that the Moon is actually larger or smaller at different times of the month, or they may think of the Moon as having a lighter-colored half and a darker-colored half that become visible at different times as the Earth rotates. Students also may not understand the difference between the Moon's orbit and the Moon's rotation, or they may believe that Earth's orbit and rotation affect the Moon's phases. However, students' experience and prior knowledge related to changing moon phases and the sun as a source of light can be built on and re ned, which the *Earth, Moon, and Sun* Progress Build and unit structure are designed to do.

Progress Build Level 1: We see the Moon because the sun illuminates the half of the Moon that is facing it.

The Moon does not make its own light; we can see the Moon because the sun illuminates it. Since light travels in straight lines, the sun is always illuminating the half of the Moon that faces it, and the other half of the Moon is dark.

Progress Build Level 2: The Moon's repeating cycle of phases is caused by the Moon's changing position in its orbit around Earth.

The Moon does not make its own light; we can see the Moon because the sun illuminates it. Since light travels in straight lines, the sun is always illuminating the half of the Moon that faces it, and the other half of the Moon is dark. **The Moon is always orbiting around Earth in a circle, and from Earth we can only see the half of the Moon that is facing Earth. As the Moon's orbital position changes, the portion of the illuminated half of the Moon that we can see from Earth also changes. This changing orbital position, which affects the relative positions of Earth, the Moon, and the sun, is what causes the phases of the Moon that we see. Since the Moon's orbit repeats in a predictable pattern, about once a month, the phases of the Moon that we see also follow a predictable monthly pattern.**

Progress Build Level 3: Lunar eclipses happen during relatively rare moments when the sun, Earth, and the Moon are perfectly aligned.

The Moon does not make its own light; we can see the Moon because the sun illuminates it. Since light travels in straight lines, the sun is always illuminating the half of the Moon that faces it, and the other half of the Moon is dark. The Moon is always orbiting around Earth in a circle, and from Earth we can only see the half of the Moon that is facing Earth. As the Moon's orbital position changes, the portion of the illuminated half of the Moon that we can see from Earth also changes. This changing orbital position, which affects the relative positions of Earth, the Moon, and the sun, is what causes the phases of the Moon that we see. Since the Moon's orbit repeats in a predictable pattern, about once a month, the phases of the Moon that we see also follow a predictable monthly pattern. **During the part of the Moon's orbit when Earth is in between the sun and the Moon, we usually see a full moon. However, during some full moons, the relative positions of the sun, Earth, and the Moon align so that they create a straight line, with Earth in the middle. When this happens, Earth blocks the sun's light from reaching the Moon, and we see a lunar eclipse. An eclipse does not happen during every full moon because often the Moon is either slightly above or slightly below this straight line.**

Guided Unit Internalization Planner

Part 1: Unit-level internalization

Unit title:

What is the phenomenon students are investigating in your unit?	
Unit Question:	**Student role:**
By the end of the unit, students figure out ...	
What science ideas do students need to figure out in order to explain the phenomenon?	

Unit Guide Document

Unit Map

Lesson Overview Compilation

Unit Map

Progress Buld

Guided Unit Internalization

Part 1: Unit-level internalization

Unit title: Earth, Moon, and Sun

What is the phenomenon students are investigating in your unit?

An astrophotographer can only take pictures of specific features on the Moon at certain times.

Unit Question: What determines the appearance of the Moon from Earth?

Student role: Student astronomers

By the end of the unit, students figure out ...

The sun illuminates the Moon, and light from the sun travels in straight lines. The sun illuminates the half of the Moon that is facing it, and the other half of the Moon is dark. Because the Moon moves to different positions around Earth, we see different amounts of the illuminated half of the Moon. There is a pattern to the appearance of the Moon because the Moon orbits around Earth. During a lunar eclipse, the Moon is completely dark because Earth blocks sunlight from hitting the Moon.

What science ideas do students need to figure out in order to explain the phenomenon?

We can see the Moon because the sun illuminates the half of the Moon that is facing it. The Moon is always orbiting around Earth in a circle, and from Earth we can only see the half of the Moon that is facing Earth. The changing orbital positions of the Moon, which affects the relative positions of Earth, the Moon, and the sun, is what causes the phases of the Moon that we can see. During the part of the Moon's orbit when Earth is between the sun and the Moon, we usually see a full moon. During some full moons, a lunar eclipse happen, a rare moment when the sun, Earth, and the Moon are perfectly aligned.

Earth, Moon, and Sun @Home Lesson Index

The Amplify Science@Home Units are versions of Amplify Science units adapted for use in a remote learning or hybrid learning situation. To help you plan instruction, below we have listed the @Home Lessons alongside the Amplify Science unit's Lesson(s) from which they come.

Index: @Home Unit Lessons and corresponding *Earth, Moon, and Sun* Lessons

@Home Lesson	**Adapted from Amplify Science *Earth, Moon, and Sun***
@Home Lesson 1	Lesson 1.2
@Home Lesson 2	Lessons 1.3
@Home Lesson 3	Lessons 1.4
@Home Lesson 4	Lesson 2.1 and 2.2
@Home Lesson 5	Lesson 2.3
@Home Lesson 6	Lesson 2.4
@Home Lesson 7	Lesson 2.5
@Home Lesson 8	Lesson 3.1
@Home Lesson 9	Lesson 3.2
@Home Lesson 10	Lesson 3.3
@Home Lesson 11	Lessons 3.3 and 3.4
@Home Lesson 12	Lessons 4.1
@Home Lesson 13	Lesson 4.2 and 4.3
@Home Lesson 14	Lesson 4.4

The student sheets and packets used in @Home Units are original or modified versions of the unit's Amplify Science Investigation Notebook pages or copymasters. When necessary, new pages were also created. In the following table we have outlined the @Home Student Sheet and Packet page titles and their origins.

Index: @Home Student Sheets/Packets and corresponding *Earth, Moon, and Sun* materials

@Home Lesson	Student Sheet/Packet page title	Investigation Notebook page, copymaster, or print material	Possible Responses
1	*Earth, Moon and Sun* Glossary	Lesson 1.2 Digital Resource	N/A
1	Investigating Light on the Moon	Modified, based on Pg. 7	Lesson 1.2, Activity 3, Card 2, Possible Responses
2	Investigating Light and Dark	New	N/A
3	Investigating Darkness on the Moon	Modified, based on Pg. 15	Lesson 1.4, Activity 2, Possible Responses
3	Modeling Light and Dark	New	N/A
3	Chapter 1 @Home Science Wall	New, based on Classroom Wall materials	N/A
4	Gathering Evidence from a Model	Modified, based on Pg. 27	Lesson 2.3, Activity 2, Possible Responses
4	Gathering Evidence from Diagrams and Text	Modified, based on Pg. 28	Lesson 2.3, Activity 3, Possible Responses
5	Predicting Moon Phases	New	N/A
5	Why We See Phases of the Moon	Modified, based on Pg. 34	Lesson 2.3, Activity 3, Card 1 Possible Responses
5	Moon Phase Matching	New	N/A
6	Write and Share Routine: Predicting Moon Phases Partner A	Modified, based on Lesson 2.4 copymaster	N/A
6	Write and Share Routine: Predicting Moon Phases Partner B	Modified, based on Lesson 2.4 copymaster	N/A
7	Moon Phases Model	New	N/A
7	View from Earth Cards	Lesson 2.5 Digital Resource	N/A

7	Taking Pictures of the Moon	Modified, based on Pg. 47	N/A
7	Chapter 2 @Home Science Wall	New, based on Classroom Wall materials	N/A
8	Modeling an Eclipse	Modified, based on Pg. 69	Lesson 3.1, Activity 2, Card 3, Possible Responses
8	Investigating Lunar Eclipses	Modified, based on Pg. 70	Lesson 3.1, Activity 3, Card 2, Possible Responses
9	Article "An Ancient Machine for Predicting Eclipses"	Lesson 3.2 Digital Resource	N/A
10	Gathering Evidence from the Sim	Modified, based on Pg. 79	Lesson 3.3, Activity 2, Possible Responses
11	Modeling a Lunar Eclipse and a Full Moon	New	N/A
11	Write and Share: Discussing Lunar Eclipses Partner A	Modified, based on Lesson 3.4 copymaster	N/A
11	Write and Share: Discussing Lunar Eclipses Partner B	Modified, based on Lesson 3.4 copymaster	N/A
11	Advising the Astrophotographer	Modified, based on Pg. 90	N/A
11	Chapter 3 @Home Science Wall	New, based on Classroom Wall materials	N/A
12	Science Seminar Evidence Cards	Lesson 4.1 Digital Resource	N/A
12	Analyzing Evidence	Pg. 96	Lesson 4.1, Activity 3, Card 1, Possible Responses
12	Drawing Activity	Pg. 97 and 98	Lesson 4.1, Activity 3, Card 2, Possible Responses
12	Science Seminar Question and Claims	Lesson 4.1 Digital Resource	N/A
12	Sorting Evidence	Modified, based on Pg. 100	Lesson 4.1, Activity 4, Possible Responses
13	Argumentation Sentence Starters	Print material	N/A
13	Writing a Scientific Argument	Modified, based on Pg. 114 and 115	Lesson 4.3, Activity 4. Possible Responses

14	Written-Response Question #1	Lesson 4.4 Digital Resources	Lesson 4.4, Activity 2, Possible Responses
14	Written-Response Question #2	Lesson 4.4 Digital Resources	Lesson 4.4, Activity 3, Possible Responses

Multi-day planning, including planning for differentiation and evidence of student work

<table>
<tr><td colspan="4">Day _____</td></tr>
<tr><td colspan="2">Minutes for science: _____

Instructional format:
❑ Asynchronous
❑ Synchronous</td><td colspan="2">Minutes for science: _____

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<tr><td colspan="2">Lesson or part of lesson:

Mode of instruction:
❑ Preview
❑ Review
❑ Teach full lesson live
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❑ Students work independently using:
❑ Printed @Home Slides
❑ Digital @Home Slides
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</table>

Look at the *Students will* columns. What are students working in the lesson(s) above that you could collect, review, or provide feedback on?
See Some Types of Written Work in Amplify Science to the right for guidance.

If there isn't a work product listed above, do you want to add one? Make notes below.

Some Types of Written Work in Amplify Science

- Daily written reflections
- (6-8) Homework tasks
- (K-5) Investigation notebook pages
- Written explanations (typically at the end of Chapter)
- Diagrams
- Recording pages for Sim uses, investigations, etc

How will students submit this work product to you?
See the Completing and Submitting Written Work tables to the right for guidance on how students can complete and submit work.

Completing Written Work	Submitting Written Work
• Plain paper and pencil (videos include prompts for setup) • (6-8) Student platform • Investigation Notebook • Record video or audio file describing work/answering prompt • Teacher-created digital format (Google Classroom, etc)	• Take a picture with a smartphone and email or text to teacher • Through teacher-created digital format • During in-school time (hybrid model) or lunch/materials pick-up times • (6-8) Hand-in button on student platform

How will you differentiate this lesson for diverse learners? (Navigate to the lesson level on the standard Amplify Science platform and click on differentiation in the left menu.)

Multi-day planning, including planning for differentiation and evidence of student work

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Suggestions for synchronous time

The following are some ideas for making the most of synchronous time with your students. As a general rule, the best way to use your synchronous time is to provide students opportunities to talk to one another, or to observe or visualize things they could not do independently.

Online synchronous time	Notes
Online discussions: It's worthwhile to establish norms and routines for online discussions in science to ensure equity of voice, turn-taking, etc. **Digital tool demonstrations:** You can share your screen and demonstrate, or invite your students to share their screen and think-aloud as they use a Simulation or other digital tool. **Interactive read-alouds**: Screen share a digital book or article, and pause to ask questions and invite discussion as you would in the classroom. **Shared Writing:** This is a great opportunity for a collaborative document that all your students can contribute to. **Co-constructed class charts:** You can create digital charts, or create physical charts in your home with student input.	

Amplify Science@Home resources reference

Use this guide to keep track of the different resources available for remote and hybrid learning.

Instructional materials: Click Remote and hybrid learning resources, then select your grade level from the dropdown menu. Select your unit.	
@Home Unit resources: These will appear when you select your unit.	
Teacher Overview	General information for teaching with @Home Units, planning information, chapter and lesson outlines
Lesson Index	Lists the original Amplify Science lessons associated with each @Home lesson, and the Investigation Notebook pages, copymasters, and print materials associated with the @Home Unit Student Sheets
Family Overview	Information to send home to families to help them support students with remote learning
Student lesson materials for @Home Units	Printable or digital lessons condensed to be about 30 minutes long. You can access compilations of all student materials for your unit, or select from individual lessons.
@Home Video resources: After selecting your grade level and unit, select the @Home Videos tab below your unit title.	
@Home Video links	Links to video lessons that include all activities from the original units. Lesson playlists are on YouTube, and they autoplay in a playlist form.
Additional remote and hybrid instructional materials: These can be accessed from the tabs below your unit title.	
Hands-on investigations support	Videos of every unit's hands-on activities (note, these videos also appear in the student lesson materials).
Read-aloud videos	Link to a YouTube playlist of read-aloud videos of all books in your unit.
Orientation and Tutorials: Click Remote and hybrid learning resources, then select your grade from the dropdown menu. Click Orientation and Tutorials. You'll not only find videos to help you use the resources, but also videos you can share with students and caregivers.	

Notes