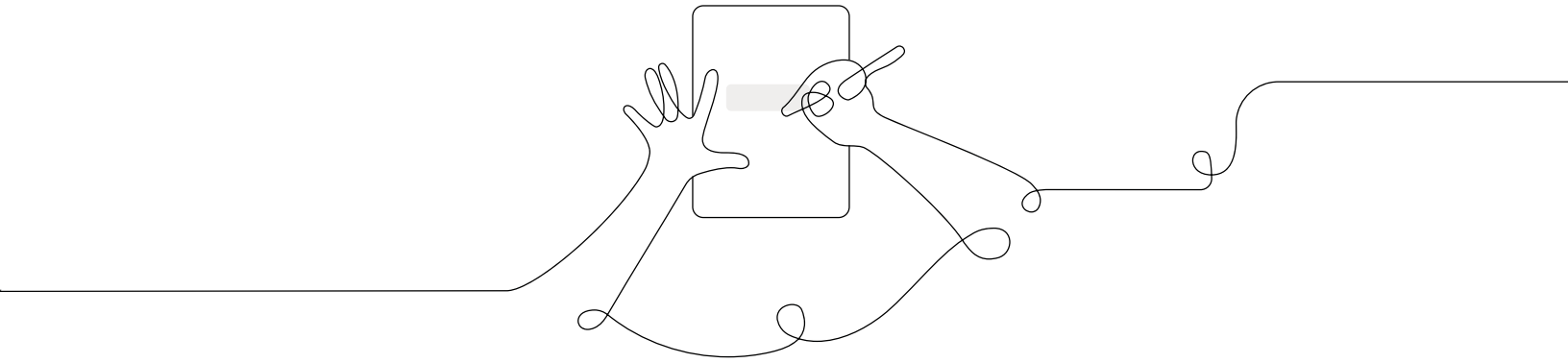
AmplifyScience

Participant Notebook

Grade 8: Light Waves
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

Why is there a higher rate of skin cancer in Australia than in other parts of the world?

Australia has one of the highest skin cancer rates in the world: More than half of the people who live there will be diagnosed with skin cancer in their lifetime. In their role as student spectroscopists, students gain a deeper understanding of how light interacts with materials and how these interactions affect our world, from the colors we see to changes caused by light from the sun, such as warmth, growth, and damage. Students use what they learn about light to explain the causes of Australia's skin cancer problem.

Chapter 1: How does light from the sun cause skin cancer?

Students figure out: Light causes skin cancer because the energy from light can damage materials in cells. When light hits a material, the material can absorb energy from the light. When a material absorbs energy from light, the energy causes the material to change. Sunlight is causing the changes to cells that lead to skin cancer, but Australia gets the same or even a lesser amount of sunlight than some places with much lower skin cancer rates.

How they figure it out: They investigate the effect of light on water, a solar-powered toy, and a material that changes color when exposed to light. They watch a documentary video about a light scientist. They test which materials are affected by sunlight in the Sim. They create visual models showing their understanding of how light causes skin cancer.

Chapter 2: How can the same amount of sunlight cause different rates of skin cancer?

Students figure out: Australia's skin cancer rate is affected by the amount of ultraviolet light that Australia receives, and also by the levels of melanin in the skin cells of the Australian population. There are different types of light that can change a material in different ways. A light source can emit more than one type of light. Different types of light have different wavelengths. A material absorbs energy from some types of light and not others. Australia gets more ultraviolet light from sunlight than many other places do. Melanin in cells absorbs ultraviolet light and prevents it from being absorbed by other parts of the cell which can be damaged. Many people in Australia have low levels of melanin.

How they figure it out: They investigate the effects of light from a normal flashlight and a UV flashlight on materials and watch a video that extends the investigation. They read an article about photosynthesis and solar power. They watch a video about waveforms. They investigate different types of light in the Sim, and observe their effects on skin cells. They analyze and write about evidence related to melanin and skin cancer. They create models showing their understanding of the factors affecting skin cancer in Australia.

Chapter 3: Why does Australia get more ultraviolet light than other parts of the world?

Students figure out: Ozone in the atmosphere blocks ultraviolet light, but there is less ozone over Australia than in other places, allowing more ultraviolet light to transmit. Light travels in a straight line. When a light wave hits a material, the light can be absorbed by the material, transmitted through the material, or reflected off the material. A material transmits or reflects some types of light and not others. When light is transmitted through or reflected off a material, the energy is not absorbed, so the material does not change.

How they figure it out: They use a laser obstacle course to investigate transmission and reflection. They read an article explaining how eyes detect light in order to see. They investigate absorption, transmission and reflection in the Sim.They analyze evidence about how light interacts with different gases in the atmosphere and model the effect of the ozone hole on light reaching Australia. They model and write their final explanations of the skin cancer problem in Australia.

Chapter 4: Students apply what they learn to a new question—Can the crabs see the plankton they eat near the ocean floor?

Students consider whether a particular type of crab can see the plankton they eat near the ocean floor. Students consider evidence about light transmission, reflection, and absorption in ocean water, and evidence about the crab and the plankton to determine if it is possible for the crab to detect light reflecting off the plankton or if the crab must detect its prey in a different way. 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 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 Progress 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 *Light Waves* 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 how light interacts with materials. 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 *Light Waves* unit, middle school students will likely have some everyday experience with the ways that light can affect a material, such as by warming an object, changing an object's color, or causing a sunburn. They are also likely to understand that energy is required to make things happen. However, few students will have experience with the idea of light as a wave, or the fact that light carries energy that can be absorbed by a physical material, which is what causes that material to change. Students are also not likely to be familiar with the idea that there are types of light outside of the visible spectrum, and that various types of light can pass through objects that appear opaque, or bounce off of objects that appear clear. Students may think that all light is the same, that the only way that light can affect things is by warming them up, or that only certain kinds of "special" light can affect materials. Students also may not understand the concept of different light sources, such as the sun or a lamp, or that different types of light have different wavelengths. Students' experience and prior knowledge can be built on and refined, which the *Light Waves* Progress Build and unit structure are designed to do.

Progress Build Level 1: Light carries energy that can be absorbed by a material, causing the material to change.

Light carries energy. When light hits a material, this energy can be absorbed by the material, which transfers the energy into the material and causes the material to change in some way.

Progress Build Level 2: Different types of light can change a material in different ways; a material can absorb energy from some types of light but not others.

Light carries energy. When light hits a material, this energy can be absorbed by the material, which transfers the energy into the material and causes the material to change in some way. **There are different types of light. These different types of light can change the same material in different ways, and a material can absorb the energy from certain types of light but not others. A single light source can give off more than one type of light.**

Progress Build Level 3: Light can be absorbed, reflected, or transmitted by a material; if the light is reflected or transmitted, the energy is not absorbed and the material will not change.

Light carries energy. When light hits a material, this energy can be absorbed by the material, which transfers the energy into the material and causes the material to change in some way. There are different types of light. These different types of light can change the same material in different ways, and a material can absorb the energy from certain types of light but not others. A single light source can give off more than one type of light. **Light travels in a straight line. When different types of light hit a material, they can be absorbed by the material, transferring energy to the material; they can reflect off of the material; or they can transmit through the material. When light is transmitted through or reflected off a material, the energy is not absorbed, so the material does not change. A material can absorb, reflect, or transmit certain kinds of light but not others.**

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: Light Waves

What is the phenomenon students are investigating in your unit?

Australia has one of the highest skin cancer rates in the world: More than half of the people who live there will be diagnosed with skin cancer in their lifetime. .

Unit Question:

How does light interact with materials?

Student role:

Student spectroscopists

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

Australia gets more ultraviolet light from sunlight than many other places do. Melanin in cells absorbs ultraviolet light and prevents it from being absorbed by other parts of the cell which can be damaged. Many people in Australia have low levels of melanin. In addition, ozone in the atmosphere blocks ultraviolet light, but there is less ozone over Australia than in other places, allowing more ultraviolet light to transmit.

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

Light carries energy that can be absorbed by a material, causing the material to change. Different types of light can change a material in different ways, and a material can absorb energy from certain types of light but not others. When different types of light hit a material, they can be absorbed, reflected, or transmitted by a material. If the light is reflected or transmitted, the energy is not absorbed and the material will not change.

Light Waves @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 *Light Waves* Lessons

@Home Lesson	**Adapted from Amplify Science *Light Waves***
@Home Lesson 1	Lesson 1.2
@Home Lesson 2	Lessons 1.3
@Home Lesson 3	Lessons 1.4
@Home Lesson 4	Lesson 2.1
@Home Lesson 5	Lesson 2.2
@Home Lesson 6	Lesson 2.3
@Home Lesson 7	Lesson 2.4
@Home Lesson 8	Lesson 2.5
@Home Lesson 9	Lesson 3.1 and 3.2
@Home Lesson 10	Lesson 3.3
@Home Lesson 11	Lessons 3.5 and 3.6
@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 *Light Waves* materials

@Home Lesson	Student Sheet/Packet page title	Investigation Notebook page, copymaster, or print material
1	Evidence of Energy from Light	Modified, based on Pgs. 8-9
1	*Light Waves* Glossary	Pgs. 133-134
2	Sim Mission: Energy and Light	Modified, based on Pgs. 13-14
3	Modeling the Cause of Skin Cancer	Modified, based on Pgs.19-20
3	Write and Share: Claim 1: Partner A	Modified, based on Pgs. 21-22
3	Write and Share: Claim 1: Partner B	Modified, based on Pgs. 23-24
3	Light Waves Chapter 1 @Home Science Wall	New, based on Classroom Wall materials
4	How Different Light Sources Change Materials	Modified, based on Pg. 34
4	Investigating Light Sources in the Sim	Modified, based on Pg. 36
5	Harvesting Sunlight	Lesson 2.2 Copymaster
6	Rereading "Harvesting Sunlight"	Pg. 43
6	Sim Mission: Creating Different Types of Light	Modified, based on Pgs. 44-45
7	Investigating Light's Effect on Genetic Material	Modified, based on Pgs. 50-53
7	"What Is Melanin?"	Lesson 2.4 Copymaster
7	Reading "What Is Melanin?"	Modified, based on Pg. 56
8	Write and Share: Melanin: Partner A	Modified, based on Pg. 60
8	Write and Share: Melanin: Partner B	Modified, based on Pg. 61
8	Supporting a Claim	Modified, based on Pg. 65
8	Light Waves Chapter 1 @Home Science Wall	New, based on Classroom Wall materials
9	"What Eyes Can See"	Lesson 3.2 Copymaster
9	Testing Glass and Aluminum Foil	Modified, based on Pgs. 73-75
10	Sim Mission: Reflection and Transmission	Modified, based on Pgs 84-85
10	Rereading "What Eyes Can See"	Modified, based on Pg. 86

11	Discussing Evidence About the Atmosphere	Pg. 104
11	Writing an Argument About Australia's Skin Cancer Rate	Pg. 109
11	Light Waves Chapter 3 @ Home Science Wall	New, based on Classroom Wall materials
12	Science Seminar Question and Claims Cards	Lesson 4.1 Copymaster
12	Analyzing Evidence	Pg. 115
12	Sorting Evidence	Pg. 116
13	Argumentation Sentence Starters	Pg. 126
13	Writing Scientific Arguments	Modified, based on Pgs 127-129
14	Written-Response Question #1	End-of-Unit copymaster Pgs. 13-16
14	Written-Response Question #2	End-of-Unit copymaster Pgs. 13-16

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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❑ Asynchronous
❑ Synchronous</td></tr>
<tr><td colspan="2">Lesson or part of lesson:

Mode of instruction:
❑ Preview
❑ Review
❑ Teach full lesson live
❑ Teach using synchronous suggestions
❑ Students work independently using:
❑ Printed @Home Slides
❑ Digital @Home Slides
❑ @Home Videos</td><td colspan="2">Lesson or part of lesson:

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<tr><td>Students will…</td><td>Teacher will…</td><td>Students will…</td><td>Teacher will…</td></tr>
</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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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.)

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