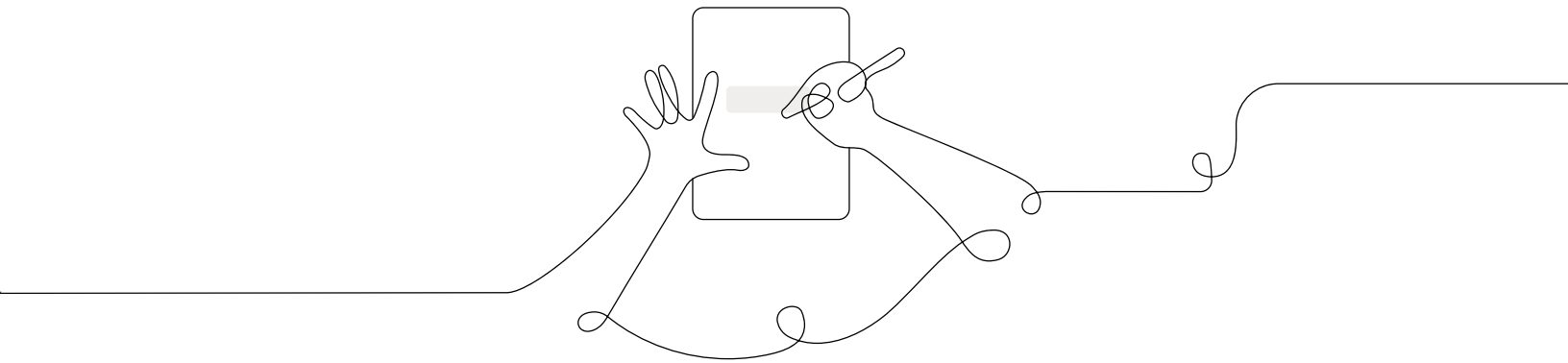


Participant Notebook

Grade 4: Energy Conversions
Unit 1 Unpacking for Hybrid Learning



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 Next Generation Science Standards (NGSS) (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) 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
Books 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 2-5)

Printable resources

Copymaster Compilation	Compilation of all copymasters for the teacher to print and copy throughout the unit
Investigation Notebook	Digital version of the Investigation Notebook, for copying and projecting
Multi-Language Glossary	Glossary of unit vocabulary in multiple languages
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 Unit Question, Chapter Questions, and Key Concepts provided in the kit



Unit Map

Why does Ergstown keep having blackouts?

Students take on the role of systems engineers for Ergstown, a fictional town that experiences frequent blackouts, and explore the reasons why an electrical system can fail. Students apply what they learn to choosing new energy sources and energy converters for the town, and then they prepare arguments for why their design choices will make the town's electrical system more reliable.

Chapter 1: What happened to the electrical system the night of the Ergstown blackout?

Students figure out: The devices stopped working in Ergstown because they weren't able to get electrical energy from the electrical system. To convert energy to light, heat, motion, or sound, devices need to be plugged into the wall and receive electrical energy. During the blackout, the devices weren't getting this electrical energy.

How they figure it out: Students investigate several different systems, including a simple circuit powered by a solar cell. They review evidence from the blackout and make an argument about what they think caused the blackout.

Chapter 2: What makes the devices in Ergstown output energy or fail to output energy?

Students figure out: Energy isn't created or destroyed. Devices can convert electrical energy to light, heat, motion, or sound when they get electrical energy because these are all forms of energy. When all the devices were running, they caused a blackout. The devices needed more energy from the electrical system than was available. Either the town was using too many devices, or the devices were not energy efficient. If more energy is needed from the electrical system than is available, a blackout can occur.

How they figure it out: Using the *Energy Conversions* Simulation, students explore different ways to convert energy from one form to another. They consider the relationship between the amount of energy used and the amount of energy in the electrical system. Finally, students write their first argument for how to solve the problem of blackouts in Ergstown.

Chapter 3: Where does the electrical energy for the devices in Ergstown come from?

Students figure out: Electrical energy that comes through the electrical grid must have a source and a source converter. There are many possible sources, such as fossil fuels, wind, water, and sunlight. Each source has a converter that changes the energy form of the source to electrical energy. Energy use in Ergstown could have caused a blackout if there wasn't enough energy coming from the source, there weren't enough source converters to convert energy from the source, or the source converters were broken.

How they figure it out: By investigating why the hospital did not lose power, students discover a variety of energy sources that provide power to Ergstown. They read about solar devices and design and build a wind converter that can power an electrical device. They weigh the strengths and weaknesses of two possible solutions to the problem.

**Chapter 4: How does energy get to the devices all over Ergstown?**

Students figure out: The energy that comes from the source is transferred through the electrical grid. The devices won't function if the wires that connect the source converter and the devices are broken. This can happen if the connections between the grid and the converters aren't strong enough, if the wires aren't in a secure location, or if there aren't enough backup wires.

How they figure it out: Students review evidence from Ergstown and analyze the efficiency of various converters. They assess different improvements to the electrical system and design and present two possible “best” solutions.



Progress Build

A Progress Build describes the way in which students' explanations of the central phenomena should develop and deepen over the course of a unit. It is an important tool in understanding the design of the unit and in supporting students' learning. A Progress Build organizes the sequence of instruction, defines the focus of the assessments, and grounds inferences about students' understanding of the content, specifically at each of the Critical Juncture Assessments found throughout the unit. A Critical Juncture is the differentiated instruction designed to address specific gaps in students' understanding. This document will serve as an overview of the *Energy Conversions: Blackout in Ergstown* Progress Build. Since the Progress Build is an increasingly complex yet integrated explanation, we represent it below by including the new ideas for each level in bold.

In the *Energy Conversions* unit, students will learn to construct scientific explanations of what could have caused a blackout and caused devices to stop working.

Prior knowledge (preconceptions): Students are likely to recognize that many familiar devices need electricity to function. Students will also likely recognize the idea that there is a source of electricity for those devices, but what that source is, how it functions, or how it relates to the device will likely still be mysterious. While neither of these ideas are necessary for students to participate fully in the unit, having exposure to these ideas will prepare students well for what they will be learning.

Progress Build Level 1: Devices work by converting electrical energy to another form.

Devices work by converting electrical energy to another form (motion, light, thermal, sound). They only work when they are plugged in because energy must be supplied to be converted. The electrical system gets a certain amount of energy. If devices in the system need more energy than is going into the system, then the devices will not function.

Progress Build Level 2: Energy must be supplied from a source and converted or there is no electrical energy available for devices to convert.

Devices work by converting electrical energy to another form (motion, light, thermal, sound). They only work when they are plugged in because energy must be supplied to be converted. The electrical system gets a certain amount of energy. If devices in the system need more energy than is going into the system, then the devices will not function.

Electrical energy is converted from a source—motion energy (wind, water, steam) is converted by a generator and light energy by solar panels. Energy has to come from somewhere, so energy must be supplied from a source and converted or there is no electrical energy available for devices to convert (the system does not function).

Progress Build Level 3: Electrical energy can be transferred by wires connecting the source converter to the device.

Devices work by converting electrical energy to another form (motion, light, thermal, sound). They only work when they are plugged in because energy must be supplied to be converted. The electrical system gets a certain amount of energy. If devices in the system need more energy than is going into the system, then the devices will not function.

Electrical energy is converted from a source—motion energy (wind, water, steam) is converted by a generator and light energy by solar panels. Energy has to come from somewhere, so energy must be supplied from a source and converted or there is no electrical energy available for devices to convert (the system does not function). **Electrical energy can be transferred by wires connecting the source converter to the device. If that connection is broken, the wires cannot play their role and the system does not function.**

Applying conceptual understanding to explain the phenomenon

Use ideas from the Progress Build and Unit Map to make notes about the conceptual and explanatory builds in your unit.

	Science concepts	Explanation of the phenomenon
	<i>Students figure out...</i>	<i>So they can explain...</i>
Chapter 1	To convert energy to light, heat, motion or sound, devices need to be plugged into the wall and receive electrical energy.	During the blackout,, the devices weren't getting electrical energy.
Chapter 2	Energy isn't created or destroyed. Light, heat, motion or sound are all forms of energy.	When all the devices were running, they caused a blackout. Either the town was using too many devices or the devices were not energy efficient
Chapter 3	Electrical energy that comes through the electrical grid must have a source and a source converter. Fossil fuels, windm water and sunlight are sources of energy.	Energy use in Ergstown caused the blackout.
Chapter 4	The energy that comes from the source i transferred through the electrical grid.	Evidence from Ergstown shows that the various converters were not efficient.

Applying conceptual understanding to explain the phenomenon

Use ideas from the Progress Build and Unit Map to make notes about the conceptual and explanatory builds in your unit.

	Science concepts	Explanation of the phenomenon
	<i>Students figure out...</i>	<i>So they can explain...</i>
Chapter 1		
Chapter 2		
Chapter 3		
Chapter 4		
Chapter 5		

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.	

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
<p>Online discussions: It's worthwhile to establish norms and routines for online discussions in science to ensure equity of voice, turn-taking, etc.</p> <p>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.</p> <p>Interactive read-alouds: Screen share a digital book or article, and pause to ask questions and invite discussion as you would in the classroom.</p> <p>Shared Writing: This is a great opportunity for a collaborative document that all your students can contribute to.</p> <p>Co-constructed class charts: You can create digital charts, or create physical charts in your home with student input.</p>	

Questioning Strategies for Grades 2–5

Overview of the Role of Open-Ended Questioning

Repeated opportunities for students to listen to and speak with others are essential for promoting deep thinking and learning in science. Meaningful teacher-initiated questions create a rich context for promoting open-ended student dialogue and discussion. The *Science Framework for California Public Schools* explains that “Simply providing opportunities to talk is not enough. Effective questioning can scaffold student thinking” (*California Science Framework*, 2016, Chapter 11, p. 21). The Framework suggests that “Teacher-initiated questions are key to helping students expand their communication, reasoning, arguments, and representation of ideas in science” (*California Science Framework*, 2016, Chapter 11, p. 21). The types of questions that teachers pose are instrumental in supporting student understanding. The Framework calls for more open-ended teacher questioning that “prompts and facilitates students’ discourse and thinking” and less teacher questioning that prompts “students to seek a confirmatory right answer” (*California Science Framework*, 2016, Chapter 11, p. 6).

The Amplify Science Teacher’s Guide is infused with opportunities for students to discuss their developing ideas in response to open-ended prompts. Questions to promote student thinking and discussion are purposefully built into the Teacher’s Guide instructional steps and Teacher Support notes that surround all our hands-on and reading activities. In addition, all units include discourse routines (e.g., Shared Listening, Think-Draw-Pair-Share, Write and Share, Word Relationships) that provide opportunities for students to use focal unit vocabulary as they think and talk with partners and the class about their understanding of key science content and practices. Many of the On-the-Fly Assessment suggestions provided throughout each unit offer open-ended follow-up questions that can be used to probe student thinking and formatively assess student understanding of the content. In addition, each unit includes multiple opportunities for students to respond to open-ended questions through additional modalities (e.g., in writing, with diagrams, through a kinesthetic model).

While the prompts embedded in each of the opportunities mentioned above provide fertile ground for student discussion, continued use of flexible, open-ended questions is invaluable for assessing students’ knowledge and skills, promoting student-to-student discourse, and guiding student learning. A collection of grade-appropriate questions follows that can be used for these purposes. You will also find a list of activity types included within the Amplify Science curriculum that are particularly conducive to the use of these questions. You may choose to print out these questions and activity types for reference throughout your instruction.

Open-Ended Questions to Facilitate Student Thinking and Discourse

Questions to assess students' knowledge and skills:

- Why do you think X?
- How did you (or Could we) figure that out?
- What are you wondering?
- What questions do you have?
- Can you give an example of X?
- What is your evidence for X?
- Can you explain what (or why X) happened?

Questions to promote student-to-student discourse:

- Do you agree or disagree with (that idea)? Why?
- Can you add to what (name of student) shared?
- Do you have any questions for (student who shared)?
- Is there some evidence you can share about X?

Questions to guide student learning:

- What did you notice?
- What else do we need to figure out?
- How are X and Y similar/different?
- What does this remind you of?
- Can you explain that idea by using the vocabulary words XX and YY?
- What kind of evidence would we need to answer our question?

Activity Types Within the Amplify Science Curriculum That Are Especially Suited for Additional Teacher Questioning

The activity types listed below are student-centered and often contain prompts for pairs or small groups of students to use to discuss content or to vet evidence together. As you circulate through the classroom during these activities, you can use the open-ended questions to assess students' knowledge and skills, promote student-to-student discourse, and guide student learning.

- Hands-on activities
- Partner Reading of unit texts
- Discussion before/during/after reading unit texts
- Discussion of photographs and videos
- Discourse routines (e.g., Thought Swap, Think-Draw-Pair-Share)
- Science Practice Tool activities (modeling, sorting, graphing, diagramming, data)
- Simulation activities (grades 4–5)
- Evidence Card sorts
- Evidence Circles
- Roundtable Discussions

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

Day@Home Lesson 1			
Minutes for science: <u>15 min</u>		Minutes for science: <u>30 min</u>	
Instructional format: <input checked="" type="checkbox"/> Asynchronous <input type="checkbox"/> Synchronous		Instructional format: <input type="checkbox"/> Asynchronous <input checked="" type="checkbox"/> Synchronous	
Lesson or part of lesson: Look at the slides and complete the worksheets (slides 1-4) (Pre-assessment)		Lesson or part of lesson: Introduce Ergstown and unit question and student role slides 5-13	
Mode of instruction: <input checked="" type="checkbox"/> Preview <input type="checkbox"/> Review <input type="checkbox"/> Teach full lesson live <input checked="" type="checkbox"/> Teach using synchronous suggestions Students work independently using: <input type="checkbox"/> Printed @Home Slides <input checked="" type="checkbox"/> Digital @Home Slides <input type="checkbox"/> @Home Videos		Mode of instruction: <input type="checkbox"/> Preview <input type="checkbox"/> Review <input type="checkbox"/> Teach full lesson live <input checked="" type="checkbox"/> Teach using synchronous suggestions Students work independently using: <input type="checkbox"/> Printed @Home Slides <input type="checkbox"/> Digital @Home Slides <input type="checkbox"/> @Home Videos	
Students will... View slides and write their initial ideas about why the lamp won't turn on.	Teacher will... Assign slides 1-4 in Schoology and also assign google sheets for the pre assessment in schoology.	Students will... Students will discuss what they think is happening in Ergstown. (Blackouts and why they are happening.)	Teacher will... Introduce the unit question Hold a discussion about the blackouts in Ergstown (Note: create some interactive discussion board such as Jamboard to share answers to questions on slide 9. Introduce the glossary and assign in schoology. Build a virtual classroom wall.

Look at the *Students will* columns. What are students working in the lesson(s) 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.

Asynchronous: students jot down their initial ideas

Synchronous: record observations of dolphin sounds.

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.

Asynchronous: students jot initial ideas on paper or digitally to bring with them to the asynchronous lesson

Synchronous: Students will use the student sheets to record their observations and complete the pre unit assessment and submit through Schoology.

Some Types of Written Work in Amplify Science

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

Completing 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)

Submitting Written Work

- 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.)

Supports:

- Encourage students to engage in student-to-student discussion
- Provide students with the Multi-Language Glossary where appropriate, add images
- Leverage primary language for discussions
- Strategic grouping

Day _____	
Minutes for science: _____ Instructional format: <input type="checkbox"/> Asynchronous <input type="checkbox"/> Synchronous	Minutes for science: _____ Instructional format: <input type="checkbox"/> Asynchronous <input type="checkbox"/> Synchronous
Lesson or part of lesson: Mode of instruction: <input type="checkbox"/> Preview <input type="checkbox"/> Review <input type="checkbox"/> Teach full lesson live <input type="checkbox"/> Teach using synchronous suggestions <input type="checkbox"/> Students work independently using: <input type="checkbox"/> Printed @Home Slides <input type="checkbox"/> Digital @Home Slides <input type="checkbox"/> @Home Videos	Lesson or part of lesson: Mode of instruction: <input type="checkbox"/> Preview <input type="checkbox"/> Review <input type="checkbox"/> Teach full lesson live <input type="checkbox"/> Teach using synchronous suggestions <input type="checkbox"/> Students work independently using: <input type="checkbox"/> Printed @Home Slides <input type="checkbox"/> Digital @Home Slides <input type="checkbox"/> @Home Videos
Students will...	Teacher will...

<p>Look at the <i>Students will</i> 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.</p> <p>If there isn't a work product listed above, do you want to add one? Make notes below.</p>	<p>Some Types of Written Work in Amplify Science</p> <ul style="list-style-type: none"> • 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 	
<p>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.</p>	<p>Completing Written Work</p> <ul style="list-style-type: none"> • 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) 	<p>Submitting Written Work</p> <ul style="list-style-type: none"> • 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
<p>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.)</p>		

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

Day _____			
Minutes for science: _____		Minutes for science: _____	
Instructional format: <input type="checkbox"/> Asynchronous <input type="checkbox"/> Synchronous		Instructional format: <input type="checkbox"/> Asynchronous <input type="checkbox"/> Synchronous	
Lesson or part of lesson:		Lesson or part of lesson:	
Mode of instruction: <input type="checkbox"/> Preview <input type="checkbox"/> Review <input type="checkbox"/> Teach full lesson live <input type="checkbox"/> Teach using synchronous suggestions <input type="checkbox"/> Students work independently using: <input type="checkbox"/> Printed @Home Slides <input type="checkbox"/> Digital @Home Slides <input type="checkbox"/> @Home Videos		Mode of instruction: <input type="checkbox"/> Preview <input type="checkbox"/> Review <input type="checkbox"/> Teach full lesson live <input type="checkbox"/> Teach using synchronous suggestions <input type="checkbox"/> Students work independently using: <input type="checkbox"/> Printed @Home Slides <input type="checkbox"/> Digital @Home Slides <input type="checkbox"/> @Home Videos	
Students will...	Teacher will...	Students will...	Teacher will...

<p>Look at the <i>Students will</i> 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.</p> <p>If there isn't a work product listed above, do you want to add one? Make notes below.</p>	<p>Some Types of Written Work in Amplify Science</p> <ul style="list-style-type: none"> • 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 	
<p>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.</p>	<p>Completing Written Work</p> <ul style="list-style-type: none"> • 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) 	<p>Submitting Written Work</p> <ul style="list-style-type: none"> • 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
<p>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.)</p>		

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.