Amplify Science

Grades 6–8

NextGen TIME Rubric

authored by THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

Rubric 1

Designed for the NGSS: Foundations
Analyze Evidence

Directions

1. Review the Designed for the NGSS: Foundations Rubric.
2. Reflect on the evidence (or lack of evidence) that you and your team gathered and represented.
3. Record strengths and limitations for each criterion based on your evidence. Cite specific examples.

Criteria	**Strengths**	**Limitations**
F1. Presence of Phenomena/Problems	In each Amplify Science unit, students are asked to inhabit the role of a scientist or engineer in order to figure out scientific phenomena through a 21st century, real-world problem context. Over the course of the unit, students collect and make sense of evidence from multiple sources and through a variety of modalities, ensuring that they have multiple vehicles through which to develop and articulate their understanding of each phenomenon. As the class progresses through their lessons, students move back and forth from first-hand investigation and inquiry to secondhand analysis and synthesis, formulating an increasingly complex explanation to help them solve the problem at hand. Finally, at the end of the unit, students are presented with a brand new problem context to consider, giving them an opportunity to take what they've learned over the course of the unit thus far and apply it to this new context, thereby demonstrating a deep understanding of the phenomenon. Evidence, grades 6–8: ● **Metabolism** unit**:** Students figure out the phenomenon of a young hospital patient who is feeling tired all of the time. They do this by inhabiting the role of medical students whose task is to diagnose the young patient. Students start the unit by watching a video about	

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the young girl to learn about her symptoms and history, and make connections to their own prior experiences, brainstorming possible reasons for her current condition. Over the course of the unit, students draw connections—through the use of physical and digital models, articles, videos, and hands-on investigations—between macroscale and microscale processes in order to investigate how the body systems work together to provide the body's cells with the molecules they need for cellular respiration (energy), growth, and repair. After providing their diagnosis, students are then given a new problem context, and must apply their understanding of metabolism to now analyze the metabolism of a world-class athlete.

- **Magnetic Fields** unit: Acting as physicists consulting for the fictional Universal Space Agency, students work to understand the function of a magnetic spacecraft launcher (a simplified version of real technology currently under development). In particular, they seek to explain why a particular test launched the spacecraft much faster than expected. To do this, they begin by exploring attracting and repelling forces with magnets and the digital simulation. As the unit progresses, students continue to conduct investigations and use physical and digital models, articles, and videos, to collect and analyze evidence as they connect increasingly complex ideas about magnetic fields, magnetic forces, potential energy, and kinetic energy. After developing a detailed explanation of the Universal Space Agency's unexpected test launch result, students apply what they've learned about magnetic force to a new problem context: evaluating roller coaster designs.
- **Ocean, Atmosphere, and Climate** unit: Students act as student climatologists helping a group of farmers near Christchurch, New Zealand figure out the cause of significantly colder air temperatures in New Zealand during the El Niño climate event. To solve the puzzle, students investigate what causes regional climates. They learn about energy from the sun and energy transfer between Earth's surface and atmosphere, ocean currents, and prevailing winds. At the end of the unit, students apply their newly acquired content knowledge to a new context as they are asked to analyze evidence to figure out if the air temperature in South China during the late Carboniferous period was warmer or cooler than the air temperature in South China today.

In addition to figuring out and explaining phenomena, students also design solutions for a variety of real world problems across 6-8. Amplify Science 6–8 has two engineering internship units per year in which students apply content from a previous unit in order to design inventive solutions for

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real-world challenges. Each engineering internship requires students to develop, test, and optimize a solution to an engineering problem. Each unit has a custom design tool that allows students to Plan, Build, Test and Analyze their designs. Students learn about the value of iterative tests, how to balance trade-offs, and how to make sense of the results in order to inform their next decisions.

Evidence, grades 6–8:

- **Natural Selection Engineering Internship** unit: Students act as biomedical engineering interns to design a malaria treatment plan. These treatment plans must reduce the population of malaria plasmodia while meeting three design criteria: 1) limiting the amount of the drug-resistance trait that develops in the population; 2) minimizing the side-effects caused by the treatment; and 3) minimizing the treatment costs as much as possible, so as many patients can be treated as possible. Students use the MalariaMed Design Tool to collect and analyze data, complete iterative tests, and learn about optimizing designs. By the end of this unit, students can describe engineering practices and compose a written proposal that supports their optimal design for making a safe and effective malaria treatment, one that also manages trade-offs between the project criteria.
- **Force and Motion Engineering Internship**: Students use the classic "egg drop model," iterative testing in a digital simulation, and quantitative data analysis to plan, design, and refine a supply pod that will be dropped from a helicopter into disaster areas. Their designs are based on their knowledge of forces, mass, and velocity, as well as the consideration of the structure and function of different features. Students then make arguments about how they have optimized their design solutions. To conclude the unit, students brainstorm problems that relate to understanding impact forces, and then define the criteria for a solution.

To make the consistent presence of phenomena clear to teachers, every lesson in Amplify Science includes at least one "phenomenon statement" on the Lesson Brief page, which will always clearly and succinctly define what design problem and/or investigative, everyday, predicted or anchor phenomenon that particular lesson is in service of.

Evidence, grades 6–8:

- **Metabolism** unit: Lesson 2.3-
  - Anchor Phenomenon: Elisa, a young patient, feels tired all the time.
  - Investigative Phenomenon: Anemia, asthma, diabetes, and injury to the pancreas

	are conditions that lead to cells not getting the molecules that they need. ● **Phase Change** unit: Lesson 1.6- ○ Anchor Phenomenon: Images taken by a space probe show that a methane lake on Titan disappeared. ○ Everyday Phenomenon: Condensation appears on a cup of ice water, a puddle of mud evaporates, an ice pop melts, and ice forms on tree branches.	
F2. Presence of Three Dimensions	Amplify Science's real-world problems provide relevant, 21st-century contexts through which students will investigate different scientific phenomena and develop a deeper understanding of Disciplinary Core Ideas (DCIs), acquire more experience with Science and Engineering Practices (SEPs), and observe the interconnectedness of various science disciplines through the Cross-Cutting Concepts (CCCs). The Amplify Science curriculum developers at UC Berkeley's Lawrence Hall of Science crafted each unit, chapter, and lesson with the following questions in mind: What do we want students to figure out (what DCI or part of a DCI)?; How do we want them to figure it out? (what scientific and engineering practice will they engage in to figure it out); and what crosscutting concept can scaffold students' understanding and connect it to other ideas about the natural world that they have learned? This resulted in a curriculum that incorporates a strategic, well balanced integration of the three dimensions. In order to help teachers recognize the three dimensional structure of every unit, chapter, and lesson, each unit contains a "3-D Statement" document that makes the integration clear. The "3-D Statement" document is made all the more effective by color-coding the three dimensions for easy recognition. This color-coded information is also made available to teachers at the individual lesson level, within the "Standards" section of the Lesson Brief. Evidence, grades 6–8: 3-D statements from the **Evolutionary History** unit include: ● **Unit Level:** Students obtain information from science texts and analyze and interpret data from digital and physical models as they investigate the body structures of both extinct and living species (structure and function). Students identify similarities and differences, figure out how common body structures are evidence of common ancestry, and how natural selection can lead to changes in body structures and the evolution of new species over time (stability and change). ● **Chapter Level:** Chapter 2, "Investigating Body Structure Differences"- Students gather	

	evidence from science texts and a digital model to investigate how different body structures with different functions can be adaptive in different environments (structure and function) and how small changes can accumulate over evolutionary time, resulting in speciation and large differences in body structures between species (stability and change). ● **Lesson Level:** Lesson 1.2, "Welcome to the Natural History Museum"- Students are introduced to a mystery fossil and are charged with constructing explanations about its origins. Students complete a card sort in which they analyze and interpret images in order to group different species, both living and extinct, according to similar patterns in body structure (patterns). 3-D statements from the **Light Waves** unit include: ● **Unit Level:** Students use a digital model, obtain information from articles, and conduct hands-on investigations to discover how different types of light interact with different types of matter (energy and matter). They use these ideas and analyze data to construct explanations about the cause of Australia's high rate of skin cancer (cause and effect) ● **Chapter Level:** Chapter 3, "More Light Interactions"- Students use a digital model and hands-on materials to investigate how energy from light can be absorbed, transmitted, or reflected by different materials (energy and matter). They use this knowledge to analyze and interpret evidence and construct explanations about the cause of Australia's high rate of skin cancer. ● **Lesson Level:** Lesson 2.2, "Harvesting Sunlight"- Students ask questions and obtain and evaluate information as they actively read "Harvesting Sunlight," an article about the different types of light from the sun that plants use for photosynthesis (energy and matter). This three dimensionality extends to engineering design focused units, as well. For example: 3-D statements from the **Waves, Energy, and Information** unit (grade 4) include: ● **Unit Level:** Using physical and computer models to observe and analyze patterns (patterns), students figure out how sound travels as a wave (energy and matter). They apply that knowledge to explain how dolphins in the fictional Blue Bay send and receive signals underwater when separated (energy and matter) and how humans encode, send and receive patterns of information for efficient communication across distances	

	(patterns; scale proportion and quantity). ● **Chapter level:** Chapter 1, "How does a mother dolphin communicate with her calf across a distance?"- Students use models to investigate waves and how sound travels (patterns, energy and matter). They figure out that sound energy travels as a wave from a source to a listener (patterns, energy and matter). Students create initial Sound Diagrams, and the class constructs an initial scientific explanation about how a mother dolphin uses sound to communicate underwater with her calf across a distance (energy and matter; scale proportion and quantity) ● **Lesson level:** Lesson 4.3, "Communicating with Codes"- Students use the Code Communicator Tool to encode and image in binary code (patterns) and design a plan to communicate the image across a distance (patterns, energy and matter). 3-D statements from the **Natural Selection Engineering Internship** unit include: ● **Unit Level**: Students use a digital model and analyze iterative tests to design a biomedical engineering solution. Their designs must treat malaria without creating a selection pressure that causes an increase in drug-resistant malaria parasites (cause and effect) through natural selection. Students construct arguments about how they have optimized their design solutions. ● **Lesson Level**: Day 1, "Introducing the Engineering Internship"-Students obtain and evaluate information and define their engineering problem by reading in their Dossier about the causes of malaria and the effects of treatments (cause and effect). ● **Lesson Level**: Day 5, "Designing Malaria Treatments"-Students iteratively test their design solutions and analyze the effects of changes they make (cause and effect). They communicate their strongest design solutions to the project director for feedback.	
F3. Presence of Logical Sequence	In creating Amplify Science, the curriculum development team at the Lawrence Hall of Science did not treat each PE separately as a box to be checked. Rather, developers bundled a variety of performance expectations together, then crafted instructional units that would allow students to explore these standards meaningfully and coherently through investigation of each unit's real world problem and overarching scientific phenomenon.	

	In order to accomplish this, developers analyzed each PE, along with its constituent dimensions, in order to fully understand the intent of the standard. Developers then analyzed across PEs and their dimensions to consider how ideas could be put to work to explain phenomena in the natural world. Developers then bundled the PEs into meaningful groups for instructional units that support students in making a deep, causal explanation of what they judged to be the key phenomenon for the PE bundle. Finally, developers created unit Progress Builds based on that target explanation, and organized the units around those Progress Builds. Through the use of these “Progress Builds,” or PBs, each successive lesson in a unit furthers student understanding of the phenomena they are investigating (and the targeted Performance Expectations) in a structured and considered way. Progress Builds are explicitly designed cognitive models for a given unit that express how students will develop their knowledge and competence in the domain. Amplify Science measures how well students can explain how and why things happen as they do, rather than merely measuring students’ ability to describe science phenomena or recall isolated facts. This explanatory understanding of the world forms the basis for the levels of a PB. Each PB level characterizes an increasingly complex causal explanation of the unit’s phenomenon. Each level also builds upon the knowledge and skills from lower levels toward a more complete, mechanistic understanding of that phenomenon. Evidence, grades 6–8: **Rock Transformations** unit: ● Progress Build Level 1: Rocks that form in different ways are different types of rock. ○ Description: Rock formations can be made in different ways, which cause them to become different rock types. One type is made from small pieces of rock material called sediment. When the sediment gets buried and pressed together, over time it hardens into one type of rock formation called sedimentary rock. Another type of rock formation is made from liquid rock material called magma; when it cools, it hardens into a rock type called igneous rock. ● Progress Build Level 2: Material for rock formations can come from rock formations that are weathered or melted. ○ Description: Rock formations can be made in different ways, which cause them to become different rock types. One type is made from small pieces of rock material	

	called sediment. When the sediment gets buried and pressed together, over time it hardens into one type of rock formation called sedimentary rock. Another type of rock formation is made from liquid rock material called magma; when it cools, it hardens into a rock type called igneous rock. **The material that forms new rock comes from existing rock formations. Sediment is small pieces of rock that have been broken down from a rock formation at the surface of Earth. The small pieces are created by the movement of wind and water. The energy for this comes from the sun, and therefore these processes can only happen at the surface, where there is sun energy, air, and water. The melted rock (magma) that hardens to form new rock comes from existing rock deep below the surface of Earth. Energy from inside Earth melts the existing rock into magma.** ● Progress Build Level 3: Rock formations can move between Earth's surface and its interior, which can lead to their transformation. ○ Description: Rock formations can be made in different ways, which cause them to become different rock types. One type is made from small pieces of rock material called sediment. When the sediment gets buried and pressed together, over time it hardens into one type of rock formation called sedimentary rock. Another type of rock formation is made from liquid rock material called magma; when it cools, it hardens into a rock type called igneous rock. The material that forms new rock comes from existing rock formations. Sediment is small pieces of rock that have been broken down from a rock formation at the surface of Earth. The small pieces are created by the movement of wind and water. The energy for this comes from the sun, and therefore these processes can only happen at the surface, where there is sun energy, air, and water. The melted rock (magma) that hardens to form new rock comes from existing rock deep below the surface of Earth. Energy from inside Earth melts the existing rock into magma. **Any type of rock can be transformed into any type of rock because of plate motion. A rock can be transformed when it is moved to a place where a different energy source can affect it, and therefore it can go through a different process. Plate motion can cause both subduction and uplift of rock. In subduction, rock (and rock material) is carried from the top of the outer layer to beneath it, where it is exposed to energy from Earth's interior. Uplift brings rock material toward the top of the outer layer, where it can be exposed to sun energy and weathering.**	

Rubric 2

Designed for the NGSS: Student Work
Analyze Evidence

Directions

1. Review the Designed for the NGSS: Student Work Rubric.
2. Reflect on the evidence (or lack of evidence) that you and your team gathered.
3. Record strengths and limitations for each criterion based on your observations. Cite specific examples.

Criteria	**Strengths**	**Limitations**
SW1: Phenomena/ Problems	In each Amplify Science unit, students are asked to inhabit the role of a scientist or engineer in order to figure out scientific phenomena through a 21st century, real-world problem context. Over the course of the unit, students collect and make sense of evidence from multiple sources and through a variety of modalities, ensuring that they have multiple vehicles through which to develop and articulate their understanding of each phenomenon. As the class progresses through their lessons, students move back and forth from first-hand investigation and inquiry to secondhand analysis and synthesis, formulating an increasingly complex explanation to help them solve the problem at hand. Finally, at the end of the unit, students are presented with a brand new problem context to consider, giving them an opportunity to take what they've learned over the	

	course of the unit thus far and apply it to this new context, thereby demonstrating a deep understanding of the phenomenon. Evidence, grades 6–8: ● **Metabolism** unit**:** Students figure out the phenomenon of a young hospital patient who is feeling tired all of the time. They do this by inhabiting the role of medical students whose task is to diagnose the young patient. Students start the unit by watching a video about the young girl to learn about her symptoms and history, and make connections to their own prior experiences, brainstorming possible reasons for her current condition. Over the course of the unit, students draw connections—through the use of physical and digital models, articles, videos, and hands-on investigations—between macroscale and microscale processes in order to investigate how the body systems work together to provide the body’s cells with the molecules they need for cellular respiration (energy), growth, and repair. After providing their diagnosis, students are then given a new problem context, and must apply their understanding of metabolism to now analyze the metabolism of a world-class athlete. ● **Magnetic Fields** unit: Acting as physicists consulting for the fictional Universal Space Agency, students work to understand the function of a magnetic spacecraft launcher (a simplified version of real technology currently under development). In particular, they seek to explain why a particular test launched the spacecraft much faster than expected. To do this, they begin by exploring attracting and repelling forces with magnets and the digital simulation. As the unit progresses, students continue to conduct investigations and use physical and digital models, articles, and videos, to collect and analyze evidence as they connect increasingly complex ideas about magnetic fields, magnetic forces, potential energy, and kinetic energy. After developing a detailed explanation of the Universal Space Agency’s unexpected test launch result, students apply what they’ve learned about magnetic force to a new problem context: evaluating roller coaster designs. ● **Ocean, Atmosphere, and Climate** unit: Students act as student climatologists helping a group of farmers near Christchurch, New Zealand figure out the cause of significantly colder air temperatures in New Zealand during the El Niño	

	climate event. To solve the puzzle, students investigate what causes regional climates. They learn about energy from the sun and energy transfer between Earth's surface and atmosphere, ocean currents, and prevailing winds. At the end of the unit, students apply their newly acquired content knowledge to a new context as they are asked to analyze evidence to figure out if the air temperature in South China during the late Carboniferous period was warmer or cooler than the air temperature in South China today. In addition to figuring out and explaining phenomena, students also design solutions for a variety of real world problems across 6-8. Amplify Science 6–8 has two engineering internship units per year in which students apply content from a previous unit in order to design inventive solutions for real-world challenges. Each engineering internship requires students to develop, test, and optimize a solution to an engineering problem. Each unit has a custom design tool that allows students to Plan, Build, Test and Analyze their designs. Students learn about the value of iterative tests, how to balance trade-offs, and how to make sense of the results in order to inform their next decisions. Evidence, grades 6-8: ● **Natural Selection Engineering Internship** unit: Students act as biomedical engineering interns to design a malaria treatment plan. These treatment plans must reduce the population of malaria plasmodia while meeting three design criteria: 1) limiting the amount of the drug-resistance trait that develops in the population; 2) minimizing the side-effects caused by the treatment; and 3) minimizing the treatment costs as much as possible, so as many patients can be treated as possible. Students use the MalariaMed Design Tool to collect and analyze data, complete iterative tests, and learn about optimizing designs. By the end of this unit, students can describe engineering practices and compose a written proposal that supports their optimal design for making a safe and effective malaria treatment, one that also manages trade-offs between the project criteria. ● **Force and Motion Engineering Internship**: Students use the classic "egg drop model," iterative testing in a digital simulation, and quantitative data analysis to plan, design, and refine a supply pod that will be dropped from a helicopter into	

	disaster areas. Their designs are based on their knowledge of forces, mass, and velocity, as well as the consideration of the structure and function of different features. Students then make arguments about how they have optimized their design solutions. To conclude the unit, students brainstorm problems that relate to understanding impact forces, and then define the criteria for a solution. ● **Earth's Changing Climate Engineering Internship** unit: Students act as civil engineering interns to design a plan to modify a city's roofs in order to reduce the city's impact on climate change. These plans must meet three design criteria: 1) reducing impact on the climate; 2) preserving the city's historic character; and 3) minimizing costs. Students focus on the practice of isolating variables in planning and conducting tests to deepen their understanding of climate changes. Students also learn about the cause-and-effect mechanisms involved as changes to albedo and changes to combustion of fossil fuels affect climate.	
SW2: Three-Dimensional Conceptual Framework	Students consistently use all three dimensions to figure out these questions, and negotiate increasingly sophisticated understandings of unit concepts as they do. In fact, the Amplify Science curriculum developers at UC Berkeley's Lawrence Hall of Science crafted each unit, chapter, and lesson with the following questions in mind: What do we want students to figure out (what DCI or part of a DCI)?; How do we want them to figure it out? (what scientific and engineering practice will they engage in to figure it out); and what crosscutting concept can scaffold students' understanding and connect it to other ideas about the natural world that they have learned? This resulted in a curriculum that incorporates a strategic, well balanced integration of the three dimensions. In order to help teachers recognize the three dimensional structure of every unit, chapter, and lesson, each unit contains a "3-D Statement" document that makes the integration clear. The "3-D Statement" document is made all the more effective by color-coding the three dimensions for easy recognition. This color-coded information is also made available to teachers at the individual lesson level, within the "Standards" section of the Lesson Brief. Evidence, grades 6–8: 3-D statements from the **Evolutionary History** unit include: ● **Unit Level:** Students obtain information from science texts and analyze and interpret data from digital and physical models as they investigate the body	

	structures of both extinct and living species (structure and function). Students identify similarities and differences, figure out how common body structures are evidence of common ancestry, and how natural selection can lead to changes in body structures and the evolution of new species over time (stability and change). ● **Chapter Level:** Chapter 2, “Investigating Body Structure Differences”- Students gather evidence from science texts and a digital model to investigate how different body structures with different functions can be adaptive in different environments (structure and function) and how small changes can accumulate over evolutionary time, resulting in speciation and large differences in body structures between species (stability and change). ● **Lesson Level:** Lesson 1.2, “Welcome to the Natural History Museum”- Students are introduced to a mystery fossil and are charged with constructing explanations about its origins. Students complete a card sort in which they analyze and interpret images in order to group different species, both living and extinct, according to similar patterns in body structure (patterns). 3-D statements from the **Light Waves** unit include: ● **Unit Level:** Students use a digital model, obtain information from articles, and conduct hands-on investigations to discover how different types of light interact with different types of matter (energy and matter). They use these ideas and analyze data to construct explanations about the cause of Australia’s high rate of skin cancer (cause and effect) ● **Chapter Level:** Chapter 3, “More Light Interactions”- Students use a digital model and hands-on materials to investigate how energy from light can be absorbed, transmitted, or reflected by different materials (energy and matter). They use this knowledge to analyze and interpret evidence and construct explanations about the cause of Australia’s high rate of skin cancer. ● **Lesson Level:** Lesson 2.2, “Harvesting Sunlight”- Students ask questions and obtain and evaluate information as they actively read “Harvesting Sunlight,” an article about the different types of light from the sun that plants use for photosynthesis (energy and matter).	

As they work to figure out the focal phenomena of each unit, students have frequent opportunities to develop and explore their own questions. At all grade levels, for example, students are encouraged to ask, record, and discuss questions they have while reading the program’s science texts.Doing so enables students to discuss their own connections and pursue answers to their questions collaboratively, thereby promoting a culture of inquiry that will facilitate deeper science learning. The sense-making strategy of asking questions is developed throughout the Amplify Science program, including in activities that give students practice with creating and critiquing investigation questions and determining whether a question is investigable.

Evidence, grades 6–8

- **Magnetic Fields** unit: Lesson 3.5 contains a Family Homework Experience in which students work with a member of their household to come up with new investigation questions about magnets, forces, and energy. Students share questions they have been exploring in the unit, then record one new question that they could investigate with the Simulation and science materials in their classroom. They then make a plan for the investigation and record hypothesis, as well as their reasoning for that hypothesis.
- **Ocean, Atmosphere, and Climate** unit: students read and annotate an article about ocean currents, focusing on asking deeper questions. Afterwards, students share their questions and ideas from the “The Ocean in Motion" article, first with a partner, then with the class as a whole.

Furthermore, in Amplify Science, students’ investigation of each unit’s phenomena is guided by questions that get introduced, discussed, and posted to the Classroom Wall as the unit progresses. These questions, which include Unit, Chapter, and Investigation Questions, serve to focus student inquisitiveness and help students reach the unit’s targeted learning goals. In designing the questions, the curriculum developers at the Lawrence Hall of Science worked systematically to anticipate students’ natural curiosity, and to use that curiosity strategically to guide students further along the unit’s prescribed learning progression. This means that while guiding questions are provided pre-written in the curriculum, they mirror the questions that are elicited from students as their understanding of the unit’s phenomena evolves. Furthermore, the Teacher’s

	Guide helps teachers effectively lead discussions that provoke students' formulation of questions that echo the provided Chapter and Investigation Questions. In this way, the research questions feel organically generated in each classroom despite the fact that they are supplied. Example: Some of the guiding questions in the **Matter and Energy in Ecosystems** unit include: ● Unit Question: How do all the organisms in an ecosystem get the resources they need to release energy? ● Chapter 1 Question: Why didn't the plants and animals in the biodome have enough energy storage molecules? ○ Investigation Questions: ■ Where do the energy storage molecules in an ecosystem come from? ■ What factors affect how many energy storage molecules producers are able to make? ● Chapter 2 Question: What caused carbon dioxide to decrease in the air (abiotic matter) of the biodome? ○ Investigation Questions: ■ Where does the carbon dioxide in abiotic matter come from? ■ How do organisms give off carbon dioxide? ● Chapter 3 Question: What happened to the carbon that used to be in the air (abiotic matter) of the biodome? ○ Investigation Question: ■ If the amount of carbon changed in one part of a closed ecosystem, what happened to the carbon in the rest of the ecosystem? ● Chapter 4 Question: Why does deforestation lead to increased carbon dioxide in the air?	
SW3: Prior Knowledge	Our approach to leveraging students' prior knowledge and experiences includes the following: 1. Basing the unit design, in particular the entry level of the Progress Build (learning progression), on extensive research into the most common student	

	preconceptions (using both the literature and the Lawrence Hall of Science's own cognitive labs and classroom pilots).
	2. Summarizing the most important aspects of that research for the teacher's awareness
	    a. Example: the following note appears in the Progress Build overview document in the **Phase Change** unit: "Prior Knowledge (preconceptions): At the start of the *Phase Change* unit, middle school students will likely have some everyday experience with the phase changes of water. However, few students will have experience thinking about the molecular-scale changes that characterize phase changes. Students often think of molecular motion as being mirrored by macroscopic flow. From the *Thermal Energy* unit, students will be familiar with how energy transfer changes the kinetic energy of the molecules in a substance and how this affects a substance's temperature, though they will not have had experience thinking about how energy transfers relate to phase changes. This experience and prior knowledge can be built on and refined, which the Phase Change Progress Build and unit structure are designed to do."
	3. Providing students with opportunities to express and activate their prior knowledge and experiences. For instance, when students are introduced to the context of each unit and the role they will be taking on it, they are invited to share their initial ideas and connections with it.
	4. Bringing in carefully chosen everyday examples and real-world phenomena that are likely to be familiar to students and help them make connections to less familiar concepts and phenomena
	    a. Example: Lesson 1.3 of the **Light Waves** unit employs everyday examples (likely to be familiar to students) to introduce the concept of absorption. This includes a projection of a paper towel absorbing grease from bacon, a sponge absorbing water, and skin absorbing lotion. A Teacher Support note provides additional support for helping students make connections.
	5. Providing the teacher with support in key cases where students' prior knowledge can be a support, or in some cases, a hindrance, with suggestions for how to use that information.	

	a. Example: Lesson 1.4 of the unit **Weather Patterns** includes advice for the teacher to help them build on students' experience with everyday examples of energy transfer: "Instructional Suggestion, Going Further: If you have concerns that your students need more support with the connection between temperature and energy transfer, take more time to discuss and use real-world examples, such as how the sidewalk is warmer on warm days; colder on cold days, and how this is related to energy transfer."	
SW4: Metacognitive Abilities	Students in Amplify Science have frequent opportunities to reflect on and make sense of what they are learning. At the end of every chapter of every unit, students engage in a metacognitive self-assessment. This quick yet important activity asks students to monitor their own learning by reflecting on what they do or do not yet understand about the core concepts from the unit. Reviewing students' responses can give teachers a sense of what students think they know. Importantly, engaging in self-assessment may increase students' motivation, intentionality, and focus throughout the unit. In addition to self-assessments, students in Amplify Science are guided to reflect on their learning by consistently building on their experiences to develop increasingly sophisticated ideas. For instance, students regularly return to earlier iterations of models, claims, scientific explanations, classroom charts, and/or annotations to update them amidst their newer, deeper understanding. Evidence, grades 6–8: ● **Plate Motion** unit (grades 6-8): In Activity 2 of Lesson 2.4, students create cross-section models of convergent and divergent plate boundaries and add arrows to indicate the direction of plate motion. In Activity 3, students use the Simulation to gather evidence about plate-mantle interactions and add this information to their Plate Boundary Comparison Charts, which they had begun in the previous lesson and will continue to update in lessons that follow. Using their Comparison Charts and what they learned from the Sim, students revise their models from Activity 2, adding labels to indicate where rock is added to the edges of plates or where the plate sinks into the mantle and is destroyed.	

	• **Earth, Moon, and Sun** unit: In Chapter 4 of the unit, students engage in a Science Seminar sequence in which they consider evidence then debate whether the moon of Kepler-47c, a newly-discovered planet outside our solar system, is likely to have a lunar eclipse during a given year and debate which claim is best supported. In the Warm-up of Lesson 4.2, when the debate occurs, each student chooses which claim they think is most convincing and writes about why they chose the particular evidence they plan to use to support their argument. For homework, students reflect on the seminar and again choose which of the two claims they think most convincing, this time explaining if, how, and why the seminar changed their thinking.	
SW5: Equitable Learning Opportunities	Amplify Science units provide many varied learning opportunities as well as timely supports to ensure that diverse learners can be successful with the language and content demands of science, ultimately becoming more independent learners and thinkers. First, Amplify Science is rooted in the research-based, multimodal approach of *Do, Talk, Read, Write, Visualize*. This approach provides diverse learners multiple entry points to rich science content. Students engage with SEPs, figure out DCIs, and notice and reflect upon CCCs in thoughtful, structured activities for each lesson. • **DO:** “Do” means collecting firsthand evidence. This can include conducting hands-on investigations, making observations of a video clip, or collecting data using a digital simulation, all of which can then be used as evidence in formulating a convincing scientific argument. • **TALK:** Student-to-student discourse is a key indicator of a productive learning environment, and talking is a key modality for instruction in an Amplify Science class. This is more than just partner activities or group work (though there's plenty of that, too). For example, reading activities are followed by a student-to-student discussion where students share their insights and questions with each other and with the whole class. Through talking and developing a collaborative environment, students feel comfortable asking questions of each other, challenging assumptions, and learning from each other. • **READ:** Student books, written by the Lawrence Hall of Science, serve multiple purposes: they help students make connections between science concepts and real-world contexts; provide students with secondhand data to analyze; and	

	model science practices, showing real scientists in action. Students also learn to read actively, with explicit instruction on how to record their questions, seek evidence from text, and monitor their understanding as they read. ● **WRITE:** Students in Amplify Science have frequent opportunities to write in order to help them reflect and make sense of what they are learning. Across the program students learn how to express their scientific thinking by leveraging evidence and using relevant vocabulary as they apply their thinking to writing. Frequent reflective writing help students to gain a deepening understanding of the genres of scientific arguments and explanations, both of which embody the foundation of scientific understanding and expression. ● **VISUALIZE:** Through a combination of sims, media, hands-on activities, readings, and digital and physical models, students are empowered to visualize scientific phenomena in ways never possible before. The **Do, Talk, Read, Write, Visualiz** approach has been extensively assessed by outside evaluators from the National Center for Research on Evaluation, Standards, and Student Testing (CRESST) at the University of California, Los Angeles (UCLA), 2005; by Mark Girod at Western Oregon University, 2005; and by David Hanauer at Indiana University of Pennsylvania, 2005. These gold standard studies showed that students who received instruction based on this multimodal learning approach instruction saw the following benefits: ● English Language Learners (ELLs) significantly outperformed other ELLs in reading comprehension, science vocabulary, and science content knowledge. ● Students significantly outperformed other students receiving their usual science instruction in Science Vocabulary, and Science Content Knowledge. In addition to employing the Do, Talk, Read, Write approach, which serves to provide repeated opportunities for students to access content, every lesson of Amplify Science includes a **Differentiation** section in the Lesson Brief. The Differentiation Brief describes what is built into the lesson to support diverse learning needs; highlights potential challenges teachers should be aware of; and provides specific strategies for differentiating instruction. The Differentiation Brief contains the following sections:	

	Embedded Supports for Diverse Learners: Every unit is designed with diverse learners in mind, with the goal of providing rigorous yet accessible science instruction. Each lesson is intentionally planned to provide multiple entry points for students, and to enable all students to be successful with all of the activities. This section of the Differentiation Brief highlights the scaffolds already embedded within the lesson so that teachers can take advantage of the power of these carefully designed activities. **Potential Challenges in This Lesson:** This section of the Differentiation Brief highlights aspects of the lesson that may present particular cognitive, linguistic, or social challenges for students. **Specific differentiation strategies for English Learners (ELs)**: This section of the Differentiation Brief points out activities that could pose linguistic challenges for ELs or reduce their access to science content, and suggests supports and modifications accordingly. Suggestions include linguistic supports to bolster students' understanding of science content, supports for engaging with science texts, ideas for helping students participate in discussions, multiple ways students can express their ideas in writing, and more. **Specific differentiation strategies for students who need more support:** Every lesson includes ways for teachers to support those students who are struggling or who have special needs. These additional scaffolds are to be used entirely at the discretion of the teacher, and provide targeted suggestions tailored for the activities in that particular lesson. **Specific differentiation strategies for students who need more challenge**: Every lesson has ways for a teacher to expand upon the lesson, or go beyond the scope of what is expected in that lesson. This section of the Differentiation Brief provides suggestions that allow students to engage with content more deeply, explore the material with a new purpose, pursue more independent research on a topic, and more. Amplify Science also supports diverse learners by embedding scaffolding throughout the curriculum with the use of the Gradual Release of Responsibility model. With the Gradual Release of Responsibility there is an emphasis on teacher modeling and direction at the beginning of the unit, but much of the scaffolds that existed earlier in the	

	unit are thoughtfully and meaningfully removed as the unit progresses. This enables students to become more independent and confident in their own abilities over time. Evidence, grades 6–8: ● **Metabolism** unit: When students use the Modeling Tool in Lesson 1.3, they receive explicit instruction about the purpose of the modeling tool and how to use it, and complete a very simple model (placing molecules in the cell). By Lesson 2.2, students independently complete a somewhat more complex model showing a path that one molecule travels. By Lesson 2.6, students independently complete often complex models during Differentiation Day and discuss them with partners as a means of reviewing key content or exploring advanced content. By the end of the unit, they are writing sophisticated, evidence-based scientific arguments. ● **Harnessing Human Energy** unit: In Lesson 1.4, students are introduced to the strategy of Active Reading, a method of careful, attentive reading and discussion. After reviewing sample annotations, students create their own annotations, including questions they have and connections they observe, as they actively read an article about about how real-world scientists and inventors solve energy problems. By the last chapter of the unit, in Lesson 3.1, students independently read and annotate one article in a set of four, then share what they learned with their group members, who each read and annotated a different article. ● **Weather Patterns** unit: In Lesson 1.6, students engage in a Word Relationships discourse routine in which they use a set of cards to support them as they construct sentences together in small groups. To get them started, the teacher first models a sentence. Providing students with the vocabulary words, time to discuss with a small group, and exposure to responses from their peers supports students in their acquisition and utilization of academic language. Using this scaffolding, students then write a scientific explanation that demonstrates their understanding of Chapter 1 content to conclude the lesson. As the unit progresses, students will write with increased independence, ultimately developing a final written argument in Lesson 4.3. Finally, in addition to encouraging and validating diversity within the classroom, Amplify	

	Science makes science more relatable to a variety of students by making sure its content reflects the diversity seen in the real world. For example: ● **Force and Motion** unit (grades 6-8): The article, “Designing Wheelchairs for All Shapes and Sizes,” features Rory Cooper, an engineer who designs wheelchairs and is a wheelchair user himself. We are proud to say students encounter many more examples of diverse peoples throughout the curriculum**.**	

Rubric 3

Designed for the NGSS: Student Progress
Analyze Evidence

Directions

1. Review the Designed for the NGSS: Student Progress Rubric.
2. Reflect on the evidence (or lack of evidence) that you and your team gathered.
3. Record strengths and limitations for each criterion based on your observations. Cite specific examples.

Criteria	Strengths	Limitations
SP1: Three-Dimensional Performance	The Amplify Science assessment system is grounded in the principle that students benefit from regular and varied opportunities to demonstrate understanding through performance. In practice, this means that for the overwhelming majority of assessment opportunities in each unit, student conceptual understanding is revealed through engagement in the science and engineering practices. For example, each grade level includes one Investigation Assessment, and each core unit (grades 6–8) includes a Science Seminar sequence that serves as a culminating 3D performance task. This commitment to multidimensional, NGSS-aligned performance is clear in the embedded assessment opportunities that occur in nearly every lesson: Students investigate phenomena, construct scientific explanations, develop and use models, and engage in argumentation as a core part of the problem-based deep dives in each unit. Careful consideration is given to ensure that each unit includes multiple opportunities to provide evidence of understanding of the focal concepts and practices in a given unit, as well as instructional suggestions for taking action based on that evidence. Evidence, grades 6–8: ● **Metabolism** unit: In lesson 4.3, students engage in oral argumentation as they grapple with ideas about how energy is released in the body, in the context of a controversial claim that an athlete might be blood doping. Students prepare for their discussion by creating paper organizers with the evidence they are considering. They then participate in the Science Seminar, a group discussion in which students make sense of evidence and debate which claims are best supported. The Science Seminar provides a unique student-centered argumentation experience and gives teachers a chance to formatively assess their students' facility with the SEP of scientific argumentation. Afterwards, students build on their oral argumentation experience to produce a final written scientific argument, requiring them to employ scientific practices to explain disciplinary core ideas and crosscutting concepts. The lesson includes a downloadable document for teachers to use in assessing this written argument. The PDF includes two rubrics. The first rubric may be used summatively to assess students' understanding of DCIs and CCCs from the unit. The second rubric is	

	designed to formatively assess the SEP of constructing arguments. Relevant to both rubrics, possible student responses are provided that illustrate how a student's written work may demonstrate different levels of understanding. ● **Force and Motion** unit: In Lesson 2.1, to investigate whether a specific pod's failure to doc was a result of the pod collecting a different number of asteroid samples than pods on other missions, students work with physical materials to plan and conduct an investigation about how exerting the same force affects objects of different mass. This investigation also serves as an assessment that is designed to reveal students' facility with the practices of Planning and Conducting Investigations and Analyzing and Interpreting Data, and with their understanding of unit-specific science concepts and the crosscutting concept of Cause and Effect. ● **Rock Transformations** unit: In Lesson 2.5, students complete a Critical Juncture Assessment consisting of 12 multiple-choice questions and 2 written-response questions. This Critical Juncture Assessment, like the other formal assessments in Amplify Science, is quite different from traditional multiple choice tests. Rather than testing recall of isolated facts, the questions are designed to assess the deep, explanatory understanding called for in the NGSS. Therefore, the questions require students to figure out and explain or make predictions about the scientific phenomena investigated in the unit—in effect, each question functions as a mini performance task. Reviewing students' responses to the 2 written response questions using the provided rubrics offers additional evidence of student understanding. When used in conjunction with the Pre- and End-of Unit Assessments, the CJ provides teachers with actionable, diagnostic information about student progress toward the three dimensional learning goals for the unit.	
SP2: Variety of Measures	Amplify Science's multiple measure approach to assessment is designed to minimize bias by providing a wide variety of opportunities for students to demonstrate understanding--not just text, but also talk, diagramming and modeling, and hands-on modalities. Evidence, grades 6–8: ● **Natural Selection** unit: In Lesson 4.2, students demonstrate their knowledge of natural selection through a collaborative group discussion (Science Seminar) in which they discuss evidence to determine which claim best explains why the	

	stickleback population has changed. The Science Seminar discussion provides an informal opportunity to gauge students' ability to use evidence to make arguments. It also provides the opportunity to assess their grasp on the content learned over the course of the unit. Furthermore, in the following lesson (Lesson 4.3), students get the opportunity to build on their experience by independently writing a convincing scientific argument that explains why the stickleback population has less armor and has become faster compared to the sticklebacks 13 generations ago. Two rubrics are provided for teachers to evaluate these Final Written Arguments. The first rubric may be used summatively to assess students' understanding of science concepts from the unit. The second rubric is designed to formatively assess the practice of constructing arguments (note: students' facility with this practice takes time to develop, and students will have opportunities to practice argumentation in each unit) ● **Thermal Energy** unit: In Lesson 1.1, students complete a Pre-Unit Assessment consisting of 16 multiple-choice questions and 2 written-response questions. The assessment is designed to be used formatively and provides insight into a student's understanding of the key concepts before encountering them in the unit. ● **Oceans, Atmosphere, and Climate** unit: In Lesson 2.4, Students use the *Ocean, Atmosphere, and Climate* Modeling Tool to demonstrate how the ocean current that passes near the city of Christchurch, New Zealand affects its air temperature. This modeling activity is a good opportunity to formatively assess individual student understanding of how ocean currents can affect both the ocean and air temperature of a location (i.e. level 2 of the Progress Build). It is also an opportunity to check on how students reflect on the crosscutting concept of Cause and Effect as it relates to what determines the air temperature of a location.	
SP3: Student Progress Over Time	The assessment system for each Amplify Science unit is designed to provide teachers with actionable diagnostic information about student progress toward the learning goals for the unit. Assessment of unit learning goals is grounded in the unit's Progress Build, which describes how student understanding is likely to develop and deepen through engagement with the unit's learning experiences. The assessment system includes formal and informal opportunities for students to demonstrate understanding and for teachers to gather information throughout the unit — all while giving teachers flexibility in deciding what to score and what to simply review. Built largely around instructionally embedded	

	performances, these opportunities encompass a range of modalities that, as a system, attend to research on effective assessment strategies and the NRC *Framework for K–12 Science Education*. The variety of assessment options for Amplify Science include: ● **Pre-Unit Assessment** (formative): a combination of auto-scored multiple-choice questions and rubric-scored written responses ● **On-the-Fly Assessments** formative): 3–4 per chapter; each On-the-Fly Assessment includes guidance on what to look for in student activity or work products, and offers suggestions on how to adjust instruction accordingly. ● **End-of-Chapter Scientific Explanations** (formative)**:** Three-dimensional performance tasks to support students’ understanding of ideas encountered in each chapter. ● **Self-assessments** (formative): One per chapter; brief opportunities for students to reflect on their own learning, ask questions, and reveal ongoing thoughts about unit content. ● **Critical Juncture Assessment** (formative)**:** Occurring toward the midpoint of each unit, similar in format to the Pre-Unit and End-of-Unit assessments. ● **End-of-Unit Assessment** (summative): a combination of auto-scored multiple-choice questions and rubric-scored written responses ● **Science Seminar & Final Written Argument** (summative for unit concepts; formative for the practice of scientific argumentation)**:** Culminating performance task for each unit, includes a rubric for assessing core unit concepts and a rubric for assessing students’ developing facility with the practice of scientific argumentation. ● **Investigation assessment (summative):** In each grade, there is one opportunity to summatively assess an embedded performance in which students plan and conduct investigations. This three-dimensional assessment provides an opportunity for teachers to assess students’ facility with the practices of Planning and Conducting Investigations and Analyzing and Interpreting Data as well as students’ understanding of disciplinary core ideas and crosscutting concepts. ● **Portfolio assessment (summative):** Through the portfolio assessment students have an opportunity to reflect on their goals and growth throughout the school year as they compile and reflect on work products from each unit. Guidance is provided for teachers and students on selecting work and reflecting on and evaluating growth	

	across the year. ● **Benchmark Assessments***: Delivered three to four times per year, benchmark assessments report on students' facility with each of the grade-level appropriate DCIs, SEPs, CCCs, and performance expectations of the NGSS. Evidence, grades 6–8: ● **Light Waves** unit, select examples: In Lesson 1.1, students complete a Pre-Unit Assessment consisting of 16 multiple-choice questions and 2 written-response questions. The assessment is designed to be used formatively and provides insight into a student's understanding of the key concepts before encountering them in the unit. Prior to instruction, students' understanding is not expected to reach any level of the Progress Build. In Lesson 3.4, students complete a Critical Juncture Assessment consisting of 12 multiple-choice questions and 2 written-response questions. The Critical Juncture Assessment provides formative information about students' progress in the unit, aligned to the Progress Build, and can be used to group students for the differentiated lesson that follows it. In Lesson 4.4, students complete an End-of-Unit Assessment, consisting of the same 16 multiple choice questions and 2 written-response questions as are in the Pre-Unit Assessment. This assessment indicates where student understanding is located along the levels of the Progress Build after instruction. The End-of-Unit Assessment also measures students' understanding of important supporting content not explicitly included in the Progress Build. When analyzed with the Pre-Unit Assessment and Critical Juncture Assessment, results from the End-of-Unit Assessment indicate students' growth over the course of the unit. In between the formal assessments, a range of assessment opportunities are embedded in instruction, including On-the-Fly Assessments in Lessons 1.2, 1.4, 3.2, and 4.4 (among others); Self-Assessments in Lessons 1.4, 2.5, 3.6, and 4.3; end-of-chapter written explanations in Lessons 1.4, 2.5, and 3.6; a final written argument in lesson 4.3; and more. **The Amplify NGSS Benchmark Assessments were authored by Amplify and were not developed as part of the Amplify Science program or created by the Lawrence Hall of Science.*	
SP4: Equitable Access	In addition to the multiple measure approach, described above, all assessments are carefully reviewed to improve accessibility and to eliminate bias. The review process is supported by	

	psychometricians, assessment experts, science educators, literacy experts, and educators with deep experience in the grade level in which particular assessments occur. As a part of this process to create unbiased assessments, language in assessment items is carefully chosen to be grade-level appropriate and to avoid common pitfalls of assessment design, like false cognates and complex grammatical structure or tense. As an important element of construct validity, contexts used for assessment items and performance tasks are carefully chosen to avoid advantaging or disadvantaging students from different backgrounds—we want student performance to be a function of the understanding and practices being learned and assessed, not the set of experiences they are familiar with.	

Rubric 4

Designed for the NGSS: Foundations
Teacher Support Evidence Chart

Teacher Materials	Strong	Adequate	Weak
F1. Presence of Phenomena/Problems. Identify and provide background information about the phenomena/problems in the unit and how they match the targeted learning goals.	X		
F2. Presence of Three Dimensions. Identify and provide background			

information about each of the three dimensions in the unit. Also take note of any support for nature of science and engineering, technology, and applications of science.			
The SEPS	X		
The DCIs (including engineering)	X		
The CCCs	X		
also note NoS and ETS	X		
F3. Presence of Logical Sequence. Identify and provide background information on the sequence of learning in the unit.	X		

Strengths related to these Teacher Supports	**Limitations related to these Teacher Supports**
In addition to a range of formalized professional development opportunities that are offered, Amplify Science provides ample instructional support and background information embedded within the curriculum itself. In fact, the Teacher's Guide includes a wealth of resources through which Amplify Science teachers can develop and extend their knowledge on the items noted above and more. For example: ● **Unit-level resources**, just some of which include: ○ **Unit Overview**: A few paragraphs outlining the unit, including what the unit is about, why it was written this particular way, and how students experience the unit. ○ **Lesson Summaries**: 1–2 pages on each lesson in the unit, aimed at facilitating planning and explaining the logic behind lesson sequencing. ○ **Unit Map**: A short one-page summary of the unit, showing how student investigations grow increasingly sophisticated over the course of the unit. ○ **Progress Build**: A thorough explanation of the unit's learning progression. ○ **Standards and Goals**: An in-depth explanation of the targeted NGSS performance expectations, DCIs, emphasized science and engineering practices, and focal crosscutting concepts in the unit, as well as a list of supported CCSS ELA and CCSS Math standards.	

○ **Science Background**: A teacher-facing document that gives valuable science content information and calls out common student misconceptions and preconceptions. ● **Embedded lesson-level teacher supports** in the lessons, such as: ○ Clear step-by-step instructions for each activity ○ Differentiation strategies for each lesson (see next section for more details) ○ Teacher Support notes for activities within the lessons, including background knowledge on the scientific information being taught, pedagogical rationale, and suggestions on technology usage For NOS and ETS connections, the Teacher Support notes are especially helpful. When lessons present particularly useful opportunities to address the nature of science, the Teacher's Guide will contain a Teacher Support tab, to which teachers can refer for insight into how that specific activity facilitates and highlights those connections. Evidence, grades 6–8: ● **Weather Patterns** unit: In Lesson 1.4, students read the article "What Are Clouds?" and the Teacher Support tab includes the note: "The article describes the work of Dr. Joanne Simpson, one of the most famous meteorologists in history, who started studying clouds because she loved their shapes—and because her male colleagues thought she should study something they considered unimportant. The text illustrates the idea that scientists and engineers rely on human qualities such as persistence, precision, reasoning, logic, imagination and creativity. The other activities throughout the unit also give students an opportunity to experience the understanding that Science is a Human Endeavor."	

Teacher Materials	Strong	Adequate	Weak

SW1. Phenomena/Problems. Provide support and strategies for how to help students figure out/solve authentic and relevant phenomena/problems using the three dimensions.	X		
SW2. Three-Dimensional Conceptual Framework. Provide support and strategies for how teachers • help students develop a conceptual framework of scientifically accurate understandings and abilities related to:			
The SEPS	X		
The DCIs (including engineering)	X		
The CCCs	X		
also note NoS and ETS	X		
• create a learning environment that values students' ideas, motivates learning, and helps students negotiate new meaning as they interact with others' ideas, new information, and new experiences.	X		
SW3. Prior Knowledge. Provide support and strategies to leverage students' prior knowledge and experiences to motivate learning.	X		
SW4. Metacognitive Abilities. Provide support and strategies for how to help students develop metacognitive abilities.	X		
SW5. Equitable Learning Opportunities. Provide resources and strategies for how to ensure that all students, including those from nondominant groups and with diverse learning needs, have access to the targeted learning goals and experiences.	X		

Strengths related to these Teacher Supports	**Limitations related to these**

	Teacher Supports
To support teachers in providing the best possible instruction, every lesson includes a **Differentiation** section in the Lesson Brief. The Differentiation Brief describes what is built into the lesson to support diverse learning needs; highlights potential challenges teachers should be aware of; and provides specific strategies for differentiating instruction. The Differentiation Brief contains the following sections: ● **Embedded Supports for Diverse Learners:** Every unit is designed with diverse learners in mind, with the goal of providing rigorous yet accessible science instruction. Each lesson is intentionally planned to provide multiple entry points for students, and to enable all students to be successful with all of the activities. This section of the Differentiation Brief highlights the scaffolds already embedded within the lesson so that teachers can take advantage of the power of these carefully designed activities. ● **Potential Challenges in This Lesson:** This section of the Differentiation Brief highlights aspects of the lesson that may present particular cognitive, linguistic, or social challenges for students. ● **Specific differentiation strategies for English Learners (ELs)**: This section of the Differentiation Brief points out activities that could pose linguistic challenges for ELLs or reduce their access to science content, and suggests supports and modifications accordingly. Suggestions include linguistic supports to bolster students' understanding of science content, supports for engaging with science texts, ideas for helping students participate in discussions, multiple ways students can express their ideas in writing, and more. ● **Specific differentiation strategies for students who need more support:** Every lesson includes ways for teachers to support those students who are struggling or who have special needs. These additional scaffolds are to be used entirely at the discretion of the teacher, and provide targeted suggestions tailored for the activities in that particular lesson. ● **Specific differentiation strategies for students who need more challenge**: Every lesson has ways for a teacher to expand upon the lesson, or go beyond the scope of what is expected in that lesson. This section of the Differentiation Brief provides suggestions that allow students to engage with content more deeply, explore the material with a new purpose, pursue more independent research on a topic, and more. To help students develop metacognitive abilities, the instructional materials provide regular opportunities for teachers to have students take included self-assessments. These quick yet important activity asks students to reflect on what they do or do not yet understand about the core concepts from	

the unit. Reviewing students' responses can give teachers a sense of what students think they know. Students' responses can also provide insight into what students are curious about, and this insight can help teachers provide motivation for the investigations that follow. **Example**: Each curriculum unit provides students with a problem to solve. In the **Ocean, Atmosphere, and Climate** unit, the problem is to figure out why Christchurch's air temperature is cooler during El Niño years. Providing regular opportunities for students to assess their own learning progress in understanding this problem can help students develop habits of self-reflection as well as remind them of the immediate purpose for learning about the ocean, atmosphere, and climate. At the end of each chapter, students are invited to check their progress in understanding what determines the temperature of a location on Earth, using the following prompts: ● I understand how energy is transferred to the air of Christchurch, New Zealand. ● I understand what happens to the amount of energy in the air of Christchurch in El Niño years. ● I understand how Christchurch's distance from the equator affects its air temperature. ● I understand why the ocean near Christchurch is a different temperature than we'd expect for its latitude (distance from the equator). ● I understand why the ocean temperature near Christchurch changes in El Niño years and how it affects the air temperature there. ● I understand that scientists revise claims as new evidence becomes available. For guidance on helping students develop scientifically accurate understandings and abilities, and strategies for leveraging students' prior experiences, teachers have access to the following for individual activities in each Amplify Science lesson: ● **Instructional Guide**: Teacher-facing instructions for delivering that specific activity. Within the Instructional Guide, teachers will see step-by-step instructions, optional model language to use, and quick access to any images intended for projection to students. This aids teachers in guiding students to increasingly sophisticated understandings of grade level concepts, as well as leveraging students' prior experiences. For instance, when students are introduced to the problem context for the unit, and the role they will be inhabiting to figure that problem out, the Instructional Guide provides questions teachers can pose to elicit a student discussion of related experiences they may have had, and their initial ideas related to the context.The Instructional Guide is not intended to be a "script;" teachers are encouraged to adapt the lessons as needed to make the lessons fit their teaching style. The Instructional Guide ensures that every teacher,	

no matter their training in NGSS or experience in the classroom, has all the tools and instructions they need to deliver effective, research-based, three-dimensional instruction to their students. ● The Instructional Guide also provides **Teacher Support**: Helpful insights into the activity, such as pedagogical rationale, classroom management suggestions, recommendations on managing technology, extensions to the activity, literacy supports, and more. Teacher Supports also include Instructional Suggestions that teachers should plan on incorporating into the lesson as they see fit. Example: ● **Weather Patterns** unit: Lesson 3.1 includes the following advice for teachers to help students build on their real-world experience with wind, and for helping them think about their own thinking: “Providing Additional Support: Some students may find that the extrapolation needed to understand how a model is related to their real-world experiences needs more scaffolding. If you’d like to help students develop this kind of scientific thinking, or you would like to take more time to help them work through their thinking in order to avoid creating alternate scientific conceptions, you may want to take extra time to talk about the ways the model does and does not explain what happens on Earth. For example, you may want to discuss you may want to discuss students’ direct experiences with wind, and call attention to the fact that in their own lives they mostly feel wind from one direction. This is because they are experiencing wind on a small scale and only feel the pressure effects from the one small area they are in at that moment...[etc.]” The instructional materials also help teachers incorporate strategies that support students in developing literacy and math competencies. The Teacher’s Guide of every unit of Amplify Science contains a “Standards and Goals” document that outlines not only the Next Generation Science Standards that are addressed in that unit, but the Common Core Language Arts and Mathematics Standards, as well. Furthermore, the Instructional Guide of each lesson also indicates which of these standards that particular lesson’s activities address. For math connections, teachers have multiple opportunities for math extensions throughout the program. These are noted in the Teacher Support notes of appropriate activities. ● Evidence, grades 6–8: ○ **Populations and Resources** unit: In Lesson 1.3, the Teacher Support tab of the	

Instructional Guide includes a suggestion that after students complete the activity “Birth and Death Token Model,” teachers could *“challenge students to create a rule using inequalities for how populations change based on the number of deaths and births. Prompt students to use variables to represent the number of births and the number of deaths and write an inequality using the two variables for a population increase, a population decrease, and a stable population. [...]”* ○ **Chemical Reactions** unit: In Lesson 1.4, students rewatch the “Everything Is Made of Atoms” video and use the Scale Tool to answer a question about the size of atoms. As a math extension, the Teacher Support tab of the Instructional Guide includes the suggestion, *“to support students in understanding the scale of atoms and molecules mathematically, consider the following activity before they open the Scale Tool for homework. Have students write out the length of a carbon atom (150 pm) and the length of a water molecule (280 pm) in decimal form and scientific notation. Then, have students calculate how much larger the average human (1.7 m) is compared to a carbon atom and water molecule. [...].”* ○ **Weather Patterns** unit: In Lesson 1.3, students use a digital simulation to examine the factors affecting condensation and the amount of energy transfer. As a math extension, the Teacher Support tab of the Instructional Guide includes the suggestion, *“to further students’ understanding of the relationships between different variables such as temperature change, energy released, amount of cloud formed, and amount of rain formed, have students use the Data Tool to graph their data. This will allow them to model mathematically the relationship between the variables and see how one variable can affect another. […]”* Amplify Science also provides instructional support for literacy, and provides instructions on how to read scientific texts, write scientific explanations and arguments from evidence, and engage in scientific discourse. ● Reading: In Amplify Science, students don’t simply “read the text and answer the questions that follow.” Rather, students are always approaching their readings with a purpose in mind, from looking for pieces of evidence to support their scientific argument, to asking and recording questions as they read through the text. ○ Evidence, grades 6-8:	

Geology on Mars unit: In Lesson 2.1, Students are introduced to the strategy of Active Reading, a method of careful, attentive reading and discussion. After reviewing sample annotations of a different text, students create their own annotations, including questions they have and connections they observe, as they actively read an article about how scientists use computer models to explore landforms on Venus. **Metabolism:** Lesson 2.2 includes a jigsaw routine in which students develop their Active Reading skills, with one student in each group becoming an expert on one of four medical conditions presented in the article set. **Magnetic Fields:** In Lesson 2.1, students read the article “The Potential for Speed” in order to obtain and evaluate information that will help them answer the Investigation Question, *How can magnets cause objects to have kinetic energy?* As they carefully read the article, students create annotations, paying particular attention to identifying challenging words or phrases. Afterwards, students discuss their questions and ideas from the article set and reflect on words they annotated. - Writing: In addition to vocabulary development, students will engage in a variety of writing activities, from quick warm ups that start the class, to end of chapter scientific explanations, and finally, end of unit scientific arguments. - Evidence, grades 6–8: **Matter and Energy in Ecosystems** unit: The pre-unit assessment in Lesson 1.1 includes two writing prompts. The next lesson then begins with a warm up in which students respond in writing to a video about a biosphere that is similar to the closed and self-sustaining ecosystem featured in this unit. Later in the lesson, students read an article then write down some initial ideas about the Chapter 1 question: *Why didn’t the plants and animals in the biodome have enough energy storage molecules?* **Phase Change** unit: Chapter 2 concludes with a written scientific explanation in which students apply ideas about phase change and energy to construct an argument about what happened to the “disappearing” lake on Titan. Afterwards, they get the chance to reflect on their learning in the unit so far by responding to writing prompts in an optional Self-Assessment activity.	

■ **Earth, Moon, Sun** unit: In Lesson 4.3, having discussed pertinent claims and evidence in the previous lesson, students conclude the Science Seminar (and the unit) by writing a scientific argument about whether or not there will be a lunar eclipse of the moon of Kepler-47c. As a homework activity, students engage in an important part of the writing process by reviewing and revising their written arguments. They also have an opportunity for metacognition in an optional self-assessment activity, when they reflect on their learning by responding to two brief written questions. ● Vocabulary: Developing a robust scientific vocabulary is an important aspect of our approach to literacy development. For each unit, a carefully selected set of conceptually important words has been identified, and students get repeated exposure to these words through multiple modalities: reading, writing, listening, and student-to-student talk. ○ Evidence, grades 6–8: ■ **Traits and Reproduction** unit: In Lesson 2.2, the word *mutation* is introduced and codified for students with a video, a brief discussion that activates prior knowledge, and a modeling activity. ■ **Thermal Energy** unit: In Lesson 1.3, the word *molecule* is introduced and codified for students with a free exploration of the digital simulation that is followed up with a class discussion about what they observed. After the discussion, students return to the simulation to investigate the relationship between temperature and the movement of molecules, thereby reinforcing the conceptual meaning of the word *molecule*. The lesson ends with a reading of a science article ("Absolute Zero") , which gives students more exposure to the word in the context of scientific texts. ■ **Earth's Changing Climate** unit: In Lesson 2.1, the words *stability* and *change* are formally introduced to students directly after they engage in a physical model of energy entering and exiting the Earth system. The conceptual meaning of the words are then further reinforced with a short video that demonstrates how both the flow into and out of a system can affect what is held in the system, as well as with an investigation using the digital simulation. ● Discourse: Students in Amplify Science have numerous opportunities for structured student-to-student discourse, with low-stakes and high-stakes opportunities to share ideas, use newly	

acquired vocabulary, and craft oral scientific arguments. ○ Evidence, grades 6–8: ■ **Evolutionary History** unit: In Lesson 2.5, students engage in a Word Relationships discourse routine. This routine supports students in incorporating scientific language with their discussions. Students discuss possible answers to explain how wolves, whales, and the Mystery Fossil became so different even though they evolved from a common ancestor population. Working with a small group, students use the given vocabulary words in their discussions. Providing students with the vocabulary words, time to discuss with a small group, and exposure to responses from their peers all support students in their acquisition and utilization of scientific language. ■ **Light Waves** unit: In Chapter 4, students apply their understanding of how light interacts with materials to a new context in the Science Seminar sequence. They are asked to investigate whether a species of crabs can see the plankton they eat near the ocean floor. Students analyze evidence about visible light, then sort the evidence based on which claim it supports. In the Science Seminar (Lesson 4.2), students debate whether the evidence indicates that the crabs can see the plankton and, if so, what color the plankton appear. This provides a unique, student-driven experience that gives students practice with oral argumentation. ■ **Rock Transformations** unit: In Lesson 3.4, students use a Write and Share discourse routine to apply their understanding of how uplift and subduction move rock formations. In the activity, students are assigned to a group in which each group member will respond to a different prompt, using the same vocabulary words. By having different prompts, students will not rely on their partners for an answer. Each student is responsible for her own prompt and response. However, as students are all using the same vocabulary, they will have the opportunity to write, speak, and listen to the same words repeatedly.	

Designed for the NGSS: Student Progress
Teacher Support Evidence Chart

Teacher Materials	Strong	Adequate	Weak
SP1. Three-Dimensional Performances. Provide support with a range of sample student responses and/or rubrics for interpreting evidence of student learning across the three dimensions, specific to the element of each dimension, and related to the phenomenon/problem that provides context for the student performance.	X		
SP2. Variety of Measure. Provide guidance and scoring tools for using a variety of measures matched to the targeted learning goals to help students monitor their progress toward learning goals and reflect on what they have learned, how they learn it, and how to use metacognition productively.	X		
SP3. Student Progress Over Time. Provide guidance for using formative and summative assessments to monitor student progress over time. Examples include support for capturing student growth, interpreting results, adjusting instruction and planning for future instruction, providing feedback to students, and prompting students to consider what and how they've learned.	X		
SP4. Equitable Access. Provide support and strategies for ensuring that assessments are accessible to students from diverse backgrounds and with diverse learning needs.	X		

Strengths related to these Teacher Supports	**Limitations related to these**

	Teacher Supports
The assessment system for each Amplify Science unit is designed to provide teachers with actionable diagnostic information about student progress toward the learning goals for the unit. Assessment of unit learning goals is grounded in the unit's Progress Build, which describes how student understanding is likely to develop and deepen through engagement with the unit's learning experiences. The assessment system includes formal and informal opportunities for students to demonstrate understanding and for teachers to gather information throughout the unit — all while giving teachers flexibility in deciding what to score and what to simply review. Built largely around instructionally embedded performances, these opportunities encompass a range of modalities that, as a system, attend to research on effective assessment strategies and the NRC *Framework for K–12 Science Education*. The variety of assessment options in Amplify Science include: ● **Pre-Unit Assessment** (formative): a combination of auto-scored multiple-choice questions and rubric-scored written responses. ● **On-the-Fly Assessments** (formative): 3–4 per chapter; each On-the-Fly Assessment includes guidance on what to look for in student activity or work products, and offers suggestions on how to adjust instruction accordingly. ● **End-of-Chapter Scientific Explanations** (formative)**:** Three-dimensional performance tasks to support students' understanding of ideas encountered in each chapter. ● **Self-assessments** (formative): One per chapter; brief opportunities for students to reflect on their own learning, ask questions, and reveal ongoing thoughts about unit content. ● **Critical Juncture Assessment** (formative)**:** Occurring toward the midpoint of each unit, similar in format to the Pre-Unit and End-of-Unit assessments. ● **Middle School Science Seminar & Final Written Argument** (summative for unit concepts; formative for the practice of scientific argumentation)**:** Culminating performance task for each unit, includes a rubric for assessing core unit concepts and a rubric for assessing students' developing facility with the practice of scientific argumentation. ● **End-of-Unit Assessment** (summative): a combination of auto-scored multiple-choice questions and rubric-scored written responses. ● **Investigation assessment (summative):** In each grade, there is one opportunity to summatively assess an embedded performance in which students plan and conduct investigations. This three-dimensional assessment provides an opportunity for teachers to assess students' facility with the practices of Planning and Conducting Investigations and Analyzing and Interpreting Data as well	

as students' understanding of disciplinary core ideas and crosscutting concepts. ● **Portfolio assessment (summative):** Through the portfolio assessment students have an opportunity to reflect on their goals and growth throughout the school year as they compile and reflect on work products from each unit. Guidance is provided for teachers and students on selecting work and reflecting on and evaluating growth across the year. ● **Benchmark Assessments***: Delivered three to four times per year, benchmark assessments report on students' facility with each of the grade-level appropriate DCIs, SEPs, CCCs, and performance expectations of the NGSS. **The Amplify NGSS Benchmark Assessments were authored by Amplify and were not developed as part of the Amplify Science program or created by the Lawrence Hall of Science.* Amplify Science's multiple measure approach to assessment is designed to minimize bias by providing a wide variety of opportunities for students to demonstrate understanding--not just text, but also talk, diagramming and modeling, and hands-on modalities. Evidence, grades 6–8: ● **Natural Selection** unit: In Lesson 4.2, students demonstrate their knowledge of natural selection through a collaborative group discussion (Science Seminar) in which they discuss evidence to determine which claim best explains why the stickleback population has changed. The Science Seminar discussion provides an informal opportunity to gauge students' ability to use evidence to make arguments. It also provides the opportunity to assess their grasp of the content learned over the course of the unit. Furthermore, in the following lesson (Lesson 4.3), students get the opportunity to build on their experience by independently writing a convincing scientific argument that explains why the stickleback population has less armor and has become faster compared to the sticklebacks 13 generations ago. Two rubrics are provided for teachers to evaluate these Final Written Arguments. The first rubric may be used summatively to assess students' understanding of science concepts from the unit. The second rubric is designed to formatively assess the practice of constructing arguments (note: students' facility with this practice takes time to develop, and students will have opportunities to practice argumentation in each unit) ● **Thermal Energy** unit: In Lesson 1.1, students complete a Pre-Unit Assessment consisting of 16 multiple-choice questions and 2 written-response questions. The assessment is designed to be used formatively and provides insight into a student's understanding of the key concepts before encountering them in the unit. ● **Oceans, Atmosphere, and Climate** unit: In Lesson 2.4, Students use the *Ocean, Atmosphere, and*	

Climate Modeling Tool to demonstrate how the ocean current that passes near the city of Christchurch, New Zealand affects its air temperature. This modeling activity is a good opportunity to formatively assess individual student understanding of how ocean currents can affect both the ocean and air temperature of a location (i.e. level 2 of the Progress Build). It is also an opportunity to check on how students reflect on the crosscutting concept of Cause and Effect as it relates to what determines the air temperature of a location.

In addition to the multiple measure approach, all assessments are carefully reviewed to improve accessibility and to eliminate bias. The review process is supported by psychometricians, assessment experts, science educators, literacy experts, and educators with deep experience in the grade level in which particular assessments occur.

As a part of this process to create unbiased assessments, language in assessment items is carefully chosen to be grade-level appropriate and to avoid common pitfalls of assessment design, like false cognates and complex grammatical structure or tense. As an important element of construct validity, contexts used for assessment items and performance tasks are carefully chosen to avoid advantaging or disadvantaging students from different backgrounds—we want student performance to be a function of the understanding and practices being learned and assessed, not the set of experiences they are familiar with.

Guidance on interpreting student performance along the three dimensions is included through Amplify Science units. Categories of evaluation guidance found throughout the program include:

- Assessment guides/rubrics: Guidance is provided to gauge the level of student performance on the assessment task, with suggestions for student feedback and questioning strategies to advance learning, revise performance, or elicit and clarify student thinking. Assessment guides/rubrics are available as a digital resource in the Lesson Brief for the lesson in which the task occurs.
- Possible student responses: Possible student responses are provided to model how evidence of understanding, or partial understanding, may be demonstrated by the student for the specific task. Possible student responses are provided in the Possible Responses tab in the activity where there is an applicable notebook page. Possible student responses also appear in the Assessment Guide for the End-of-Unit Assessment (in Digital Resources).

● Look for/Now what? notes: Each On-the-Fly Assessment includes a two-part description of what evidence of understanding would look like for the task (Look for) and how instruction may be adjusted in response (Now what?). These are accessible by pressing the orange hummingbird icon in the activity in which they appear. ● Assess understanding/Tailor instruction notes: Each Critical Juncture Assessment includes a two-part description of how the expected level of student understanding may be demonstrated in the task (Assess understanding) and how instruction may be adjusted in response (Tailor instruction) at the class, group, and student level. These are accessible by pressing the orange hummingbird icon for the activity in which they appear. Evidence, grades 6–8: ● **Populations and Resources** unit: In Lesson 2.5, students complete a Critical Juncture Assessment consisting of 12 multiple-choice questions and 2 written-response questions. The Critical Juncture Assessment provides formative information about students' progress in the unit and can be used to group students for the differentiated lesson that follows it. This offers an opportunity to provide more personalized learning experiences to students with different levels of content understanding. A group assignment recommendation will be made automatically, based on auto-scoring of the Critical Juncture Assessment multiple-choice questions. Reviewing students' responses to the 2 written response questions using the provided rubrics offers additional evidence of student understanding. ● **Chemical Reactions** unit: In Lesson 4.4, students complete an End-of-Unit Assessment, consisting of the same 12 multiple choice questions and 2 written-response questions as are in the Pre-Unit Assessment. The assessment indicates where student understanding is located along the levels of the Progress Build after instruction. The "End-of-Unit Assessment Scoring Guide and Answer Key" (located in the Digital Resources of Lesson 4.4) provides detailed information on the assessment design as well as on how to evaluate student performance on both the multiple choice and written items. Rubrics and possible responses are provided for use in interpreting the written responses. When analyzed with the Pre-Unit Assessment and Critical Juncture Assessment, results from the End-of-Unit Assessment indicate students' growth over the course of the unit. ● **Plate Motion** unit: In the third activity of Lesson 1.4, students demonstrate their understanding of how earthquake patterns are related to plate boundaries by creating a model depicting this relationship along the plate boundary between Africa and South America. The Possible Responses tab in the Instructional Guide provides an example of a proficient model.	

Furthermore, the teacher can use this opportunity as an On-the-Fly Assessment of students' understanding of what plates are and that plates can move, and to that end the On-the-Fly reference information includes the guidance, "As you circulate the classroom, observe students' models to see if students are drawing the plate boundary between South America and Africa along the line of earthquakes […]. When students share their thinking, they should be using earthquakes as evidence of plate movement, and they should consider the pattern of earthquakes as evidence of where a plate boundary is. If students are challenged by the synthesis of unit content required to complete their models, you may wish to guide them through the process of building their models in smaller conceptual pieces. You may wish to provide this support to a small group of students, or take this scaffolded approach with the whole class." Instructions on doing so follow, enabling teachers to not only gauge students' learning, but to provide feedback and tailor instruction effectively, as well.	

Rubric 5

Designed for the NGSS: Program
Analyze Evidence

Directions

1. Review Designed for the NGSS: Program Rubric.
2. Review the teacher materials and/or student materials to assess the strength of each element.
3. Record strengths and limitations for each component based on your evidence. Cite specific examples.

PROGRESSIONS OF LEARNING. Within a program, learning experiences are more likely to help students	Strong	Adequate	Weak

develop a greater sophistication of understanding of the elements of SEPs, CCCs, and DCIs when teacher materials			
• make it clear how each of the three dimensions builds logically and progressively over the course of the program and make clear how students	X		
• engage in the science and engineering practices with increasing grade-level-appropriate complexity over the course of the program.	X		
• utilize the crosscutting concepts with increasing grade-level-appropriate complexity over the course of the program.	X		
• engage in grade-level/band-appropriate disciplinary core ideas.	X		
• provide a rationale for a logical sequence and treatment of ETS and NoS.	X		

Strengths	**Limitations**
Amplify Science was designed with an emphasis on coherence. The Amplify Science Program Guide provides ample program-level information, including how each of the three dimensions are addressed across grade levels. In addition, every unit comes with a Standards and Goals resource in the Teacher's Guide that clearly outlines how that particular unit fits into the Amplify Science program as a whole. This makes it easy for teachers to see how their students will have been prepared for the unit, and how they will continue to build on the understanding and experience developed in the unit after they complete it. The units in Amplify Science are designed and sequenced to build students' expertise with each of the three	

dimensions. First, throughout the curriculum, crosscutting concepts are infused into students' learning experiences and provide students with the tools they need to approach new content and integrate ideas across the sciences. For example, in the grade 3 unit **Balancing Forces**, students explore the CCC of Stability and Change through a variety of modalities with grade level appropriate complexity. In their role as scientists, students investigate systems of interacting forces. Sometimes, the forces acting on objects cause those objects to move. This happens when the forces acting on an object are unbalanced—this lack of balance causes the position of the object to change. Other times, the forces acting on objects are balanced—their position is stable. Students return to the ideas of stability and change again and again across the unit. In middle school, the CCC of Stability and Change is also emphasized in several units, such as **Thermal Energy**. In this unit, students' exploration of Stability and Change is increasingly complex as they observe closed systems of two or more samples changing temperature via transfer of thermal energy, as well as how those systems become stable when the samples reach the same temperature (at equilibrium). They consider this by using the Simulation and a physical token model, and by reading articles about thermal energy transfer within systems. As students move through each grade, they have additional opportunities to build expertise with Stability and Change in the **Weather Patterns** and **Earth's Changing Climate** units.

Amplify Science also addresses all science and engineering practices with increasing complexity as students move through each grade level. One example of this can be found in how the practice of Designing Solutions to Problems is addressed from 6-8.

- students engage in a special type of unit called **Engineering Internships**. Each Engineering Internship unit of Amplify Science asks students to design solutions for a real-world problem that requires them to figure out how to help those in need through the application of engineering and design practices. For example, students study Earth's Changing Climate in a core unit, and then apply these understandings in the Earth's Changing Climate Engineering Internship. In this latter unit, students take on the role of civil engineering interns to design a plan to modify a city's roofs in order to reduce the city's impact on climate change.

As an example of the DCI coherence Amplify Science facilitates across grade levels, below we show how, across the 6–8 grade span, units are designed to support increasingly complex reasoning about the ideas that matter cycles and energy flows through ecosystems:

- students go on to learn more about ecosystems and about the flow of matter and energy. In the Populations and Resources unit, students apply their understanding from the **Metabolism** unit to ecosystems to develop a more mechanistic understanding of how food relationships transfer molecules that (with oxygen) store energy that can be released for survival, growth, and reproduction. Students investigate ecosystems at the population level to see how the transfer of these energy-storage molecules can impact population sizes both directly and indirectly. In the **Matter and Energy in Ecosystems** unit, students learn that carbon is a necessary component for glucose—an energy-storage molecule made by plants. Students track the flow of energy and the cycling of matter and discover that because matter is conserved, in a closed system, population growth and survival is limited by the cycle of carbon between biotic and abiotic matter.

Opportunities for students to develop understandings about the Nature of Science are embedded within all Amplify Science units. Students engage in oral and/or written reflections on their science learning, as well as on the nature and history of science, as they work to figure out the unit's focal phenomena. Students are also continuously supported in addressing applications of science via the real world contexts employed in each unit, as well as via the books, articles, and media that present applications of science.

Evidence, grades 6–8:

- **Earth's Changing Climate Engineering Internship** unit: Students take on the role of civil engineers.
- **Phase Change** unit: This unit gives students an opportunity to experience the understanding that Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena. For example, in Lesson 1.2, students read "Air Pressure and Boyle's Law," which illustrates the idea that laws are regularities or mathematical descriptions of natural phenomena. Students are also continuously supported in addressing applications of science via the real world contexts employed in each unit, as well as via the books, articles, and media that present applications of science. The Unit Overview and Unit Map resources, both of which are available in the Unit Guide of every unit, outlines for teachers how students will take on roles that will enable them to experience the application of science, and engineering.

Evidence, grades 6–8:

- **Earth's Changing Climate Engineering Internship** unit: Students take on the role of civil engineers.
- **Phase Change** unit: This unit gives students an opportunity to experience the understanding that Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena. For example, in Lesson 1.2, students read "Air Pressure and Boyle's Law," which illustrates the idea that laws are regularities or mathematical descriptions of natural phenomena.

Additionally, when lessons present particularly useful opportunities to address the nature of science, the Teacher's Guide will contain a Teacher Support tab, to which teachers can refer for insight into how that specific activity facilitates those connections.

Evidence, grades 6–8:

• **Weather Patterns** unit: In Lesson 1.4, students read the article “What Are Clouds?” and the Teacher Support tab includes the note: “The article describes the work of Dr. Joanne Simpson, one of the most famous meteorologists in history, who started studying clouds because she loved their shapes—and because her male colleagues thought she should study something they considered unimportant. The text illustrates the idea that scientists and engineers rely on human qualities such as persistence, precision, reasoning, logic, imagination and creativity. The other activities throughout the unit also give students an opportunity to experience the understanding that Science is a Human Endeavor.”	

UNIT-TO-UNIT COHERENCE. Units across a program demonstrate coherence when student materials	Strong	Adequate	Weak
• are designed with an appropriate sequence and development of DCIs, CCCs, and SEPs to support students in demonstrating learning across a program as they figure out phenomena/problems.	X		
• make explicit connections from one unit to the next across the three dimensions to connect prior learning, current learning, and future learning as students figure out phenomena/problems.	X		
• support students in making connections across units and disciplines by helping students negotiate more sophisticated understandings and abilities.	X		

Strengths	**Limitations**
Every unit of Amplify Science includes a “Standards and Goals” resource that clearly outlines how that particular unit fits into the Amplify Science program as a whole. This makes it easy for teachers to see how their students will have been prepared for the unit, and how they will continue to build on the understanding and experience	

developed in the unit after they complete it. Additionally, the Program Guide includes a supplementary list of opportunities for students to demonstrate their proficiency with grade level performance expectations. One aspect of the unit-to-unit coherence that is incorporated into Amplify Science units is the facilitation of students making connections across disciplines. The program organizes student learning around the exploration and explanation of real-world phenomena. Many real-world phenomena, by their very nature, cross the domain boundaries of life, physical, or earth and space science. Thus, when appropriate, strong links are made across the science domains in Amplify Science units. Evidence, grades 6–8: ● **Metabolism** unit: Students are presented with a patient who has an undiagnosed medical condition. In order to explain what is going wrong in their patient's body, students must investigate how body systems work together to carry molecules to the cells. Students are thus introduced to the physical science concepts of energy and chemical reactions in everyday life (cellular respiration), which they will be able to explore more deeply later in the Chemical Reactions unit, using the Cross Cutting Concepts of Energy and Matter and Scale, Proportion, and Quantity as bridges. ● **Light Waves** unit: This unit focuses on wave properties and electromagnetic radiation, in the context of explaining the high rate of skin cancer in Australia. The crosscutting concept of Energy and Matter serves as a powerful lens through which students will investigate the unit's central phenomenon. Students will need to learn about the wave properties of light and also how light energy interacts with matter, both in the atmosphere where UV light destroys ozone and how UV light damages DNA in cells. Thus, this unit directly helps students connect the physical science of light with important phenomena in Earth and space science (the ozone hole) and life science (mutations that cause disease). ● **Plate Motion** unit: This unit helps students work towards mastery of disciplinary core ideas from Earth science (plate tectonics; the history of planet earth), but uses a real-world problem context from life science (i.e. fossils) to do so. The unit thus serves as a clear example of how real scientists must make linkages across domains in order to solve problems and explain phenomena.	

PROGRAM ASSESSMENT SYSTEM. Over the course of the program, teacher materials will demonstrate a system of assessments that	Strong	Adequate	Weak

• coordinates the variety of ways student learning is monitored to provide information to students and teachers regarding student progress for all three dimensions of the standards and toward proficiency at the identified grade-level/band performance expectations.	X		
• includes support for teachers and other leaders to make program-level decisions based on unit, interim, and/or year-long summative assessment data.	X		
• is driven by an assessment framework and provides a structured conceptual map of student learning along with details of how achievement of the outcomes can be measured.	X		

Strengths	**Limitations**
The assessment system for each Amplify Science unit is designed to provide teachers with actionable diagnostic information about student progress toward the learning goals for the unit. Assessment of unit learning goals is grounded in the unit's Progress Build, which describes how student understanding is likely to develop and deepen through engagement with the unit's learning experiences. The assessment system includes formal and informal opportunities for students to demonstrate understanding and for teachers to gather information throughout the unit — all while giving teachers flexibility in deciding what to score and what to simply review. Built largely around instructionally embedded performances, these opportunities encompass a range of modalities that, as a system, attend to research on effective assessment strategies and the NRC *Framework for K–12 Science Education*. The variety of assessment options for Amplify Science include: • **Pre-Unit Assessment** (formative): a combination of auto-scored multiple-choice questions and rubric-scored written responses. • **On-the-Fly Assessments** (formative): 3–4 per chapter; each On-the-Fly Assessment includes guidance on what to look for in student activity or work products, and offers suggestions on how to adjust instruction accordingly. • **End-of-Chapter Scientific Explanations** (formative)**:** Three-dimensional performance tasks to support	

students' understanding of ideas encountered in each chapter. ● **Self-assessments** (formative): One per chapter; brief opportunities for students to reflect on their own learning, ask questions, and reveal ongoing thoughts about unit content. ● **Critical Juncture Assessment (CJ)** (formative)**:** Occurring toward the midpoint of each unit, similar in format to the Pre-Unit and End-of-Unit assessments. ● **Middle School Science Seminar & Final Written Argument** (summative for unit concepts; formative for the practice of scientific argumentation)**:** Culminating performance task for each unit, includes a rubric for assessing core unit concepts and a rubric for assessing students' developing facility with the practice of scientific argumentation. ● **End-of-Unit Assessment** (summative): a combination of auto-scored multiple-choice questions and rubric-scored written responses. ● **Benchmark Assessments***: Delivered three to four times per year, benchmark assessments report on students' facility with each of the grade-level appropriate DCIs, SEPs, CCCs, and performance expectations of the NGSS. **The Amplify NGSS Benchmark Assessments were authored by Amplify and were not developed as part of the Amplify Science program or created by the Lawrence Hall of Science.* Evidence, grades 6–8: ● **Earth, Moon, and Sun** unit: Embedded On-the-Fly assessments can be seen in Lesson 1.2, when students explore the *Earth, Moon, and Sun* Simulation to gather evidence that will help answer the first Investigation Question; in Lesson 1.3, when students engage in a physical Moon Sphere Model to demonstrate understanding of the concepts of models and scale; and in Lesson 1.4, when students communicate their knowledge of why part of the Moon is dark by gathering and presenting evidence related to a new Investigation Question. These are just a few of the many opportunities students have to show their developing understanding of the unit's core concepts and facility with focal science and engineering practices. ● **Populations and Resources** unit: In Lesson 2.4, students engage in a performance task that requires integrated engagement with the science and engineering practices of Planning and Conducting Investigations and Analyzing and Interpreting Data along with the application of disciplinary core ideas and crosscutting concepts. Students work individually and then in pairs to create plans for an investigation to determine what change(s) would decrease the number of deaths in the weebug population. They conduct their investigations and write conclusions based on their findings. Rubrics are provided to evaluate students' written investigation plans and conclusions. The provided rubrics support evaluation of the science and engineering practices of Planning and Conducting Investigations and Analyzing and Interpreting	

Data and evaluation of students’ application of the disciplinary core ideas and crosscutting concepts relevant to the investigation. Guidance on interpreting student performance along the three dimensions is included through Amplify Science units. Categories of evaluation guidance found throughout the program include: ● Assessment guides/rubrics: Guidance is provided to gauge the level of student performance on the assessment task, with suggestions for student feedback and questioning strategies to advance learning, revise performance, or elicit and clarify student thinking. Assessment guides/rubrics are available as a digital resource in the Lesson Brief for the lesson in which the task occurs. ● Possible student responses: Possible student responses are provided to model how evidence of understanding, or partial understanding, may be demonstrated by the student for the specific task. Possible student responses are provided in the Possible Responses tab in the activity where there is an applicable notebook page. Possible student responses also appear in the Assessment Guide for the End-of-Unit Assessment (in Digital Resources). ● Look for/Now what? notes: Each On-the-Fly Assessment includes a two-part description of what evidence of understanding would look like for the task (Look for) and how instruction may be adjusted in response (Now what?). These are accessible by pressing the orange hummingbird icon in the activity in which they appear. ● Assess understanding/Tailor instruction notes: Each Critical Juncture Assessment includes a two-part description of how the expected level of student understanding may be demonstrated in the task (Assess understanding) and how instruction may be adjusted in response (Tailor instruction) at the class, group, and student level. These are accessible by pressing the orange hummingbird icon for the activity in which they appear.	

Amplify.