ASSESSMENT SYSTEM OVERVIEW

Each OpenSciEd unit includes an assessment system that offers many opportunities for different types of assessments throughout the lessons, including pre-assessment, formative assessment, summative assessment, and student self assessment. Formative assessments are embedded and called out directly in the lesson plans. Please look for the "Assessment Icon" in the teacher support boxes to identify places for assessments. In addition, the table below outlines where each type of assessment can be found in the unit.

Overall Unit Assessment

When	Assessment and Scoring Guidance	Purpose of Assessment
Lesson 1	Initial design solutions in science notebooks Driving Question Board	**Pre-Assessment** The student work in Lesson 1 should be considered a pre-assessment, as it is an opportunity to learn more about the ideas your students bring to this unit. Surfacing these ideas early on can help you to be strategic in building upon and leveraging student ideas across the unit. Students will spend time in Lesson 1 developing their ideas around initial design solutions for detecting tsunamis, warning people, and reducing damage. This is a good place to assess their thinking about what a design solution would need to be able to do to protect communities. You can leverage these ideas when they begin to evaluate design solutions in Lessons 5-7. The Driving Question Board is another opportunity for pre-assessment. Encourage students to generate open-ended questions, such as how and why questions. However, any questions students share, even if they are close-ended questions, can be valuable. Make note of any close-ended questions and use navigation time throughout the unit to have your students practice turning these questions into open-ended questions that can be tested through lesson investigations.
Lesson 4	*Explaining and Forecasting Tsunami Risk* *Scoring Guidance for Explaining and Forecasting Tsunami Risk*	**Formative** This formative assessment can be used to understand how well students have developed ideas about (1) how tsunamis form, (2) how tsunamis move, and (3) which coastal communities might be at risk for damage. It also introduces students to their first experience evaluating the risk of different communities based on their characteristics. These initial ideas that students have for rating risk can be used and developed as they evaluate design solutions and community risk in Lessons 5-7.
Lesson 9	*Planning a hazard awareness project* Final Group Product *Obtaining and Communicating Information about Natural Hazards*	**Summative** The final task for the unit challenges student groups to develop a communication plan for a hazard that could affect their local community. Through this work, students will focus on obtaining and communicating information to community stakeholders using science ideas from Lessons 2-8. They will identify (1) critical information about how the natural hazard forms, moves, and impacts communities, (2) methods to detect, warn people, and reduce damage, and (3) how people in the community can prepare for, respond during, and recover after a natural hazard. This final assessment serves two broad purposes. The first is to determine how well students can apply science ideas from the unit to another hazard that impacts their community. Use *Obtaining and Communicating Information about Natural Hazards* to assess the final student product. The second purpose is to prepare students themselves to understand which hazards they are at risk for and how they and their family can prepare and respond in the event the natural hazard occurs in their community. It is important that students see this final product for the unit as not just a "grade," but rather as an opportunity to empower students with a communicating strategy that can protect people and save lives in their community.

When	Assessment and Scoring Guidance	Purpose of Assessment
After each lesson	Lesson Performance Expectation Assessment Guidance	**Formative Assessment** Use the lesson-level performance expectation table below in this document to see which parts of lessons or student activity sheets can be used as embedded formative assessments.
Occurs in several lessons	Progress Tracker	**Formative and Student Self Assessment** The Progress Tracker is a thinking tool that was designed to help students keep track of important discoveries that the class makes while investigating phenomena and figure out how to prioritize and use those discoveries to develop a model to explain phenomena. It is important that what the students write in the Progress Tracker reflects their own thinking at that particular moment in time. In this way, the Progress Tracker can be used to formatively assess individual student progress, or for students to assess their own understanding throughout the unit. Because the Progress Tracker is meant to be a thinking tool for kids, we strongly suggest it is not collected for a summative "grade" other than for completion. This unit adds a third column to the Progress Tracker to help students consider how they can apply the science ideas from the tsunami hazard to protect communities from other hazards. This will be an important aspect of student work for the unit.
Anytime after a discussion	Student Self Assessment Discussion Rubric *Unknown material with identifier: nh.l8.ho*	**Student Self Assessment** The student self-assessment discussion rubric can be used anytime after a discussion to help students reflect on their participation in the class that day. Choose to use this at least once a week or once every other week. Initially, you might give students ideas for what they can try to improve for the next time, such as sentence starters for discussions. As students gain practice and proficiency with discussions, ask for their ideas about how the classroom and small group discussions can be more productive. This is not required in any particular lesson for this unit, but it is recommended for use in Lessons 2 or 3, and again in Lessons 5 or 8. Additionally, this unit integrates an Engineering Self-Assessment Tool in Lesson 8 to help students reflect on the aspects of the engineering process they engaged in during Lessons 5-8.
After Students Complete Substantial, Meaningful Work	Peer Feedback Facilitation: A Guide	**Peer Feedback** There will be times in your classroom when facilitating students to give each other feedback will be very valuable for their three-dimensional learning and for learning to give and receive feedback from others. We suggest that peer review happen at least two times per unit. The Peer Feedback Guidelines, located in the "Additional Lesson References" section of the Teacher Edition, is designed to give you options for how to support this in your classroom. It also includes student-facing materials to support giving and receiving feedback along with self-assessment rubrics where students can reflect on their experience with the process. Peer feedback is most useful when there are complex and diverse ideas visible in student work and not all work is the same. Student models or explanations are good contexts for using a peer feedback protocol. They do not need to be final pieces of student work, rather, peer feedback will be more valuable to students if they have time to revise after receiving peer feedback. It should be a formative, not summative type of assessment. It is also necessary for students to have experience with past investigations, observations, and activities to use as evidence for their feedback. For this unit, Peer Feedback works best for Lesson 9 as students present the ideas for their final unit products. It could also be used in either Lessons 5 or 7, after students complete their evaluation of design solutions and communication options, respectively.

For more information about the OpenSciEd approach to assessment and general program rubrics, visit the OpenSciEd Teacher Handbook.

Lesson-by-Lesson Assessment Opportunities

Every OpenSciEd lesson includes one or more lesson-level performance expectations (LLPEs). The structure of every LLPE is designed to be a three-dimensional learning, combining elements of science and engineering practices, disciplinary core ideas and cross cutting concepts. The font used in the LLPE indicates the source/alignment of each piece of the text used in the statement as it relates to the NGSS dimensions: alignment to Science and Engineering Practice(s), alignment to Cross-Cutting Concept(s), and alignment to the Disciplinary Core Ideas.

The table below summarizes opportunities in each lesson for assessing every lesson-level performance expectation (LLPE). Examples of these opportunities include student handouts, home learning assignments, progress trackers, or student discussions. Most LLPEs are recommended as potential formative assessments. Assessing every LLPE listed can be logistically difficult. Strategically picking which LLPEs to assess and how to provide timely and informative feedback to students on their progress toward meeting these is left to the teacher's discretion.

Lesson	Lesson-Level Performance Expectation(s)	Assessment Guidance
Lesson 1	**1.A** Ask questions that arise from careful observations of a sudden natural event that causes damage to communities. **1.B** Apply scientific ideas to design an object, tool, or process that detects a tsunami when it starts (cause) and warns people or reduces damage to communities (effect).	**1.A Asking Questions; Stability and Change** **When to check for understanding:** Day 1, after students read about and watch videos of the 2011 tsunami and brainstorm engineering ideas, and day 2, when the class discusses related hazards, or day 3 when the class develops the Driving Question Board. It may be helpful to have students leave their handouts between day 1 and day 2 to quickly assess their developed engineering designs. **What to look for/listen for:** (1) tsunamis are large waves that cause damage to communities, (2) disagreement or uncertainty about what causes tsunamis, (3) disagreement or uncertainty about why a tsunami possesses such destructive power, and (4) proposed engineering solutions for responding to tsunamis involving technology that can detect the tsunami, warning systems to give people more time to move away from an approaching tsunami, and designs that may reduce the impact of the tsunami. **1.B Designing Solutions; Cause and Effect** **When to check for understanding:** day 1, after students compare their initial engineering ideas, and day 2, when the class evaluates designs, and day 3, when the class discusses how to design solutions to reduce the impact of natural hazards on communities. It may be helpful to have students leave their notebooks after day 1 and day 3 to quickly examine their ideas. **What to look for/listen for:** (1) agreement that though tsunamis may cause devastation, their effects can be reduced by systems that detect, warn, and reduce damage caused by the tsunami, (2) agreement that some engineering solutions may be more promising or challenging than others, (3) uncertainty or disagreement about what makes one engineering solution more promising or challenging than another.

Lesson	Lesson-Level Performance Expectation(s)	Assessment Guidance
Lesson 2	**2.A** Use graphical displays of large data sets to identify spatial and temporal patterns in historical tsunami occurrence. **2.B** Use maps (digital tools) to analyze large data sets to identify cause and effect relationships between related geologic forces and resulting tsunamis. **2.C** Obtain scientific information from text to connect cause and effect relationships to predict communities at risk for future tsunamis occurrence.	**2.A Analyzing and Interpreting Data; Patterns** **When to check for understanding:** day 1, as students interpret the first map of historical tsunami data and causes of tsunamis. **What to look for/listen for:** Students should notice the location of tsunamis is similar to the earthquake data from *OpenSciEd Unit 6.4: How and why does Earth's surface change? (Everest Unit)*. Tsunamis occur along coasts and they are most frequently caused by earthquakes. **2.B Mathematics and Computational Thinking; Patterns** **When to check for understanding:** days 1 and 2, as students use the second and third set of maps. **What to look for/listen for:** Students should compare recent earthquake data to tsunami-generating earthquakes and interpret a pattern that only some earthquakes cause tsunamis. This helps to motivate why looking more closely at what type of earthquakes cause tsunamis can refine their thinking. Then students use a series of more complicated maps to look at characteristics of earthquakes to determine specifically which kinds of earthquakes cause tsunamis to form. **2.C Obtaining, Evaluating, and Communicating Information; Cause and Effect** **When to check for understanding:** day 2, during the final series of maps and consensus building for the cause and effect relationship between earthquakes and tsunamis. **What to look for/listen for:** Students developing a key causal relationship between shallow, strong earthquakes along colliding boundaries and the formation of tsunamis. Communities in regions where these types of earthquakes occur are most at risk for damage from tsunamis. **What to do:** Drawing a cause and effect diagram during the day 2 whole-class share out can help make the cause and effect relationship more visible for students.
Lesson 3	**3.A** Analyze and interpret video data from different wave models to identify how changes (patterns) in the profile of the shore and ocean floor cause changes in the height of a wave (amplitude). **3.B** Evaluate different wave models, identifying limitations and benefits in what each shows for explaining how tsunamis form (causes), move, and what happens when tsunamis reach the shore (effect).	**3.A Analyze and Interpret data; Patterns** **When to check for understanding:** 1. Day one students analyze and record observations about waves and tsunamis using two different wave models from a top view perspective. 2. Day two students analyze and record observations about waves and tsunamis using two different wave models from a side view perspective. **What to look for:** After using each model, the class will pause and share what has been figured out about waves and tsunamis. After analyzing all four models, students should be able to identify some key ideas about how tsunamis form and move. See teacher guide for detailed guidance. **3.B Develop and Use Models; Cause and Effect** **When to check for understanding:** On day three of the lesson. The class develops a table to capture what was beneficial or helpful from each model in figuring out what causes a tsunami to form and move, and what were limitations of each model. There is an example table in the teacher guide on day three. **What to look for:** Students should be able to identify the benefits and limitations of each of the four wave models in explaining how an earthquake causes a tsunami.
Lesson 4	**4.A** Apply scientific ideas to construct an explanation 1) for how sudden changes in the ocean floor during an earthquake form a tsunami, and 2) to forecast which communities are most at risk for damage.	**4.A Constructing Explanations; Stability and Change** **When to check for understanding:** Use *Explaining and Forecasting Tsunami Risk* during the explanation task. **What to look for/listen for:** Students should make connections that sudden shifts in the ocean floor can form a tsunami. It can move quickly across large parts of the ocean and cause damage when it reaches the coastlines. Students should use scientific principles of how waves move and how they affect the shoreline to rank order the risk of four places and predict which communities are most at risk for damage.

Lesson	Lesson-Level Performance Expectation(s)	Assessment Guidance
Lesson 5	**5.A** Evaluate competing design solutions (structure) to reduce damage from a tsunami (function) using a systematic process with defined criteria and constraints (derived from scientific principles and relevant knowledge of tsunamis).	**5.A Engaging in Argument from Evidence; Structure and Function** **When to check for understanding**: On day 3, as students build consensus in a Scientists Circle. **What to look for/listen for:** Ideas that are both specific to the design solutions and the need for a systematic evaluation process. These ideas can include: • effective solutions account for scientific principles (e.g., how it reduces energy from a wave), the needs of the community (e.g., the economic activity), and the environmental impacts (e.g., impacts on marine life), • clearly defined and prioritized criteria and constraints can be used to evaluate and choose an effective solution for a particular community, and • different communities might prioritize criteria and constraints based on different communities needs.
Lesson 6	**6.A** Critically read scientific text to understand how a system designed to detect tsunamis follows specific criteria (related to earthquake activity) and constraints (related to signal transmission).	**6.A Obtain, Evaluate, and Communicate Information; Systems and System Models** **When to check for understanding:** In this lesson, students will read with a partner about how tsunamis are detected and how warning signals are sent. By detailing the individual parts of the detection system, students have an opportunity to understand how the parts operate in concert with one another, and how specific criteria and constraints must be met before a tsunami warning can be sent. **What to look for/listen for:** Using the scientific text, students are able to identify and communicate criteria related to a tsunami detection and warning system (e.g., types of earthquakes and wave movement that trigger the system), and also constraints to the system (e.g., related to signal transmission and maintenance and battery life of sensors).
Lesson 7	**7.A** Integrate stories and accounts of tsunami response with audio-visual tsunami warning and preparedness systems to determine the criteria and constraints of communication and education plan solutions for communities. **7.B** Evaluate communication solutions using a systematic process and agreed-upon criteria and constraints to determine how well the design solution (structure) communicates with stakeholders (function).	**7.A Obtaining, Evaluating, and Communicating Information; Systems and System Models** **When to check for understanding:** On day 1, using Part 3 of *Community Stakeholders*. **What to look for/listen for:** Look for clearly identified stakeholders with particular needs for emergency communication, and then corresponding criteria and constraints to address those needs. **7.B Arguing from Evidence; Structure and Function** **When to check for understanding:** On day 2, when students complete *Evaluation Matrix* in small groups and then as a class. **What to look for/listen for:** Listen for agreement about what their assigned communication solution does well and its limitations. Across all groups and as a whole class, listen for ideas about how some communication solutions meet some criteria very well, while others meet other criteria well. The purpose of this work is to better understand how combining multiple forms of communication can address multiple stakeholder needs.
Lesson 8	**8.A** Construct a system model to represent the interactions of subsystems designed to detect, warn communities, and reduce damage from a tsunami hazard.	**8.A Developing and Using Models; System and System Models** **When to check for understanding:** Observe partner-created system models to assess their understanding of subsystem interactions. **What to look for/listen for:** • Parts of a subsystem work together to achieve a particular function (specifically the detection/warning system with the DART II system model). • Subsystems are part of a larger system that interact together to meet the goals of the community.

Lesson	Lesson-Level Performance Expectation(s)	Assessment Guidance
Lesson 9	**9.A** Critically read scientific texts adapted for classroom use to obtain scientific and technical information related to the likely locations and severity of a local hazard and response systems designed to protect communities from damage that might result. **9.B** Communicate scientific and technical information in writing and/or oral presentations about a system designed to prepare community members before a hazard happens, respond during a hazard, and recover after the hazard.	**9.A & 9.B Obtain, Evaluate, and Communicate Information; Systems** **When to check for understanding:** Formatively, on days 1 and 2 when students are working on *Planning a hazard awareness project* and on day 3 as students complete their final project. **What to look for/listen for:** • Students obtain key information about a local hazard, including where it happens, how severe it can be, how long it can last, and what the major impacts are on people and property (ideas developed in Lessons 1-4). • Students consider how the hazard is detected and ways damage can be reduced (ideas developed in Lessons 5-6 & 8). • Students consider criteria and constraints for communication and education plans as they design their final product (ideas developed in Lesson 7 & 8).