# Integrated STEM Unit Planner

# Grade 4 Science

# Withstand an Earthquake

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PreK-12STEM
Community Training & Assistance Center (CTAC)
Tracy Unified School District

## About the Integrated STEM Units

The integrated STEM units are a product of the partnership between Community Training and Assistance Center (CTAC) and Tracy Unified School District (TUSD) in California, funded in part through the Education Innovation and Research (EIR) program of the U.S. Department of Education in 2018. Teacher leaders came together to develop innovative units that align to STEM standards for student learning—namely the Next Generation Science Standards (NGSS) for California Public Schools, the Computer Science Content Standards derived from the national K-12 Computer Science Framework, and the California Common Core State Standards.

Each integrated unit brings together the following:

- an engineering design challenge
- one or more computational artifacts
- core science and math content
- language building opportunities
- engagement supports

Students in each grade level, pre-kindergarten through twelve, engage with the unit for about one or two months as part of their required coursework. The units are integrated and self-contained as a means to provide all students with equitable STEM experiences.

## About the Partners

Community Training and Assistance Center (CTAC) is a national not-for-profit organization with a demonstrated record of success in the fields of education and community development. Tracy Unified School District, located in California's Central Valley, serves approximately 15,000 students. Fifty leading teachers from the district contributed to the development of the units. Computer Science integrations resulted with support from the San Joaquin County Office of Education and Bootstrap of Brown University.

## Terms of Use

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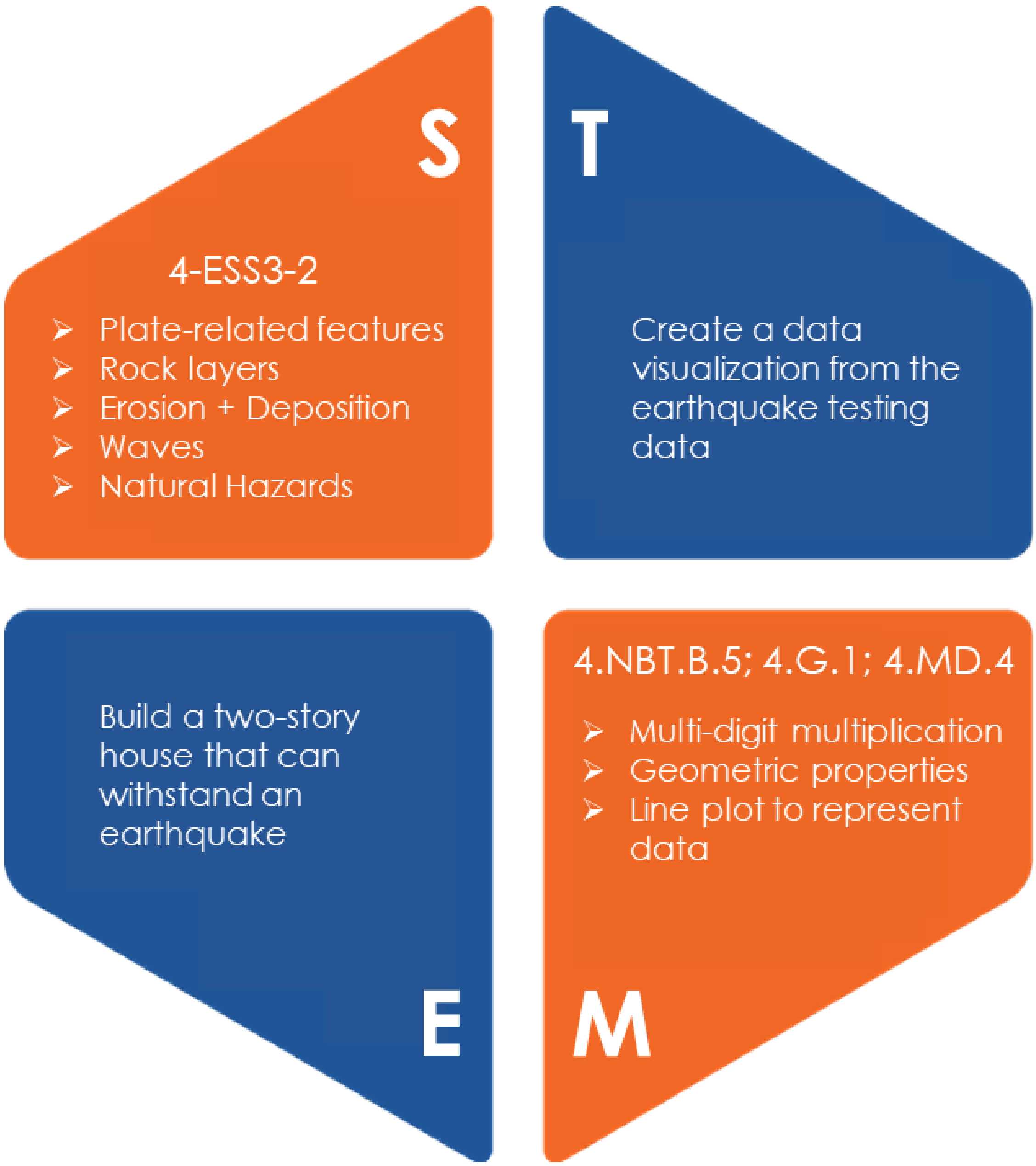
# Big Picture

## Unit Emblem




### Focal Standard

**4-ESS3-2. Generate and compute multiple solutions to reduce the impacts of natural Earth processes on humans**. [Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.] [*Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.*]

## Overview

Sequence 1: Students view a video clip of an earthquake causing damage and react by recording their observations and questions in their sense-making notebooks.

- (This video captures five earthquakes from around the world.) (Underworld, 2021)[i]
- (This video captures footage and witness accounts from of the 1964 earthquake in Alaska.) (U.S. Geological Survey, 2014)[ii].

Students are presented with the design challenge: Design a two-story home that can withstand an earthquake. Students ***ask*** questions about earthquakes which might include "What kind of damage can an earthquake do?" and "What can we do to prevent a lot of damage?" Students explore earthquakes and the effects they can bring to various locations. Students also learn about other plate-related features around the globe and use maps to draw conclusions about where they appear on earth.

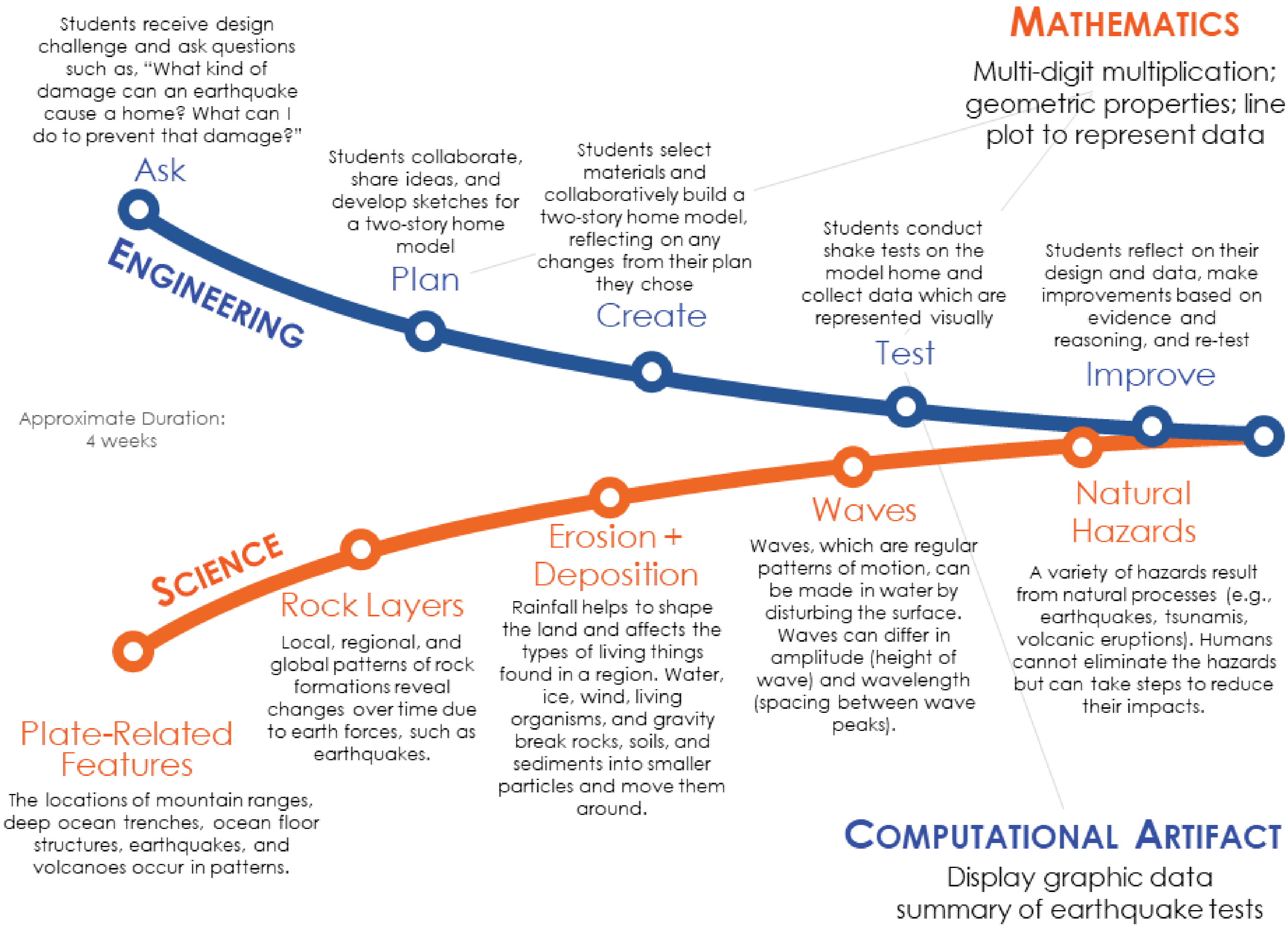
Sequence 2: Students then get a sense of rock layers forming over time by seeing an example of a crammed student desk. Students draw conclusions that layers of material are formed over time, and then connect that to rock layers in various locations, including fossils. As students explore materials, they also make ***plan***s for their model home structure, computing multi-digit numbers for their home dimensions and noting geometric features in their homes, such as angles, parallel, and perpendicular structures.

Sequence 3: In this sequence, students conduct simulations in the classroom to see the various ways materials are broken up and moved around. This adds to students learning for how to protect their model homes against various impacts as they begin to ***create*** their homes in this sequence.

Sequence 4: Students then begin to explore water waves and make connections to the impact of earthquakes, as they begin to ***test*** their model by conducting shake tests of their homes and collecting data that they represent graphically.

Sequence 5: Students reflect on their data to ***improve*** their model homes and then conduct follow-up tests on their improved homes. Students learn about other natural hazards beyond earthquakes, so they can extrapolate how they might construct other mitigating structures for other hazards.

## Integrated Unit Storyline



## Integrated Unit Wayfinder

Inventory the experiences of students

Present the anchoring phenomenon

Students collaborate with each other

Students read, hear, and view source material

Students and teachers reflect on the work and processes of students to assess learning progress

| | | | | |
|---|---|---|---|---|
| Launch design challenge; elicit and record questions students ***ask*** about the challenge | Facilitate 5E science lesson sequence for plate-related features | Give students time to ***plan*** their design solution | Facilitate 5E science lesson sequence for rock layers | Provide time and materials for students to ***create*** their design |
| Embed computing dimensions of an object and recognizing geometric features in an object | Introduce expectations for computational artifact | Connect students with a STEM-related professional to inform their design solution | Let students conduct ***tests*** of their design solution and collect data | Support students in developing their computational artifact |
| Facilitate 5E science lesson sequence for erosion + deposition | Designate time for students to ***improve*** and re-test their design solution | Facilitate 5E science lesson sequence for waves | Facilitate 5E science lesson sequence for natural hazards | Students write and speak to share their design solution and learning beyond the classroom |

Engineering or Computer Science | Math or Science | Student Connections | Ongoing Actions

## Engineering

Design Challenge: Build a two-story home that can withstand an earthquake.

Type of Engineering: Architect

### The Engineering Design Process (EDP) and Engineering Standards

<table>
<tr><th>EDP Step</th><th>Standard and Grade Band End Points from the Framework</th></tr>
<tr><td>Ask<br>What kind of damage can an earthquake cause a home? What can I do to a home to prevent that damage?</td><td>3-5-ETS1-1. Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.<ul><li>Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)</li></ul></td></tr>
<tr><td>Plan<br>Sketch ideas for building the home</td><td rowspan="2">3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.<ul><li>Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2)</li><li>At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2)</li></ul></td></tr>
<tr><td>Create<br>Build the two-story house</td></tr>
<tr><td>Test<br>Simulate an earthquake affecting the house; collect data</td><td rowspan="2">3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.<ul><li>Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)</li><li>Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)</li></ul></td></tr>
<tr><td>Improve<br>Make refinements to the house</td></tr>
</table>

# Computer Science (Technology)

## Computer Science Integrations

### *Description of Student Engagement*

Students collect data from their tests in a spreadsheet to determine how much of their home remained after shake testing and use the spreadsheet software and other applications as appropriate to translate the data into a data visualization.

### *Computational Artifact*

Definition: Anything created by a human using a computational thinking process and a computing device. A computational artifact can be, but is not limited to, a program, image, audio, video, presentation, or web page file. (Source: College Board, 2016)

- Students create a data visualization from the earthquake testing data

### *Hardware*

Definition: The physical components that make up a computing system, computer, or computing device. (Source: MDESE, 2016)

- Computer

### *Software (includes programs, applications, websites, etc.)*

Definition: Programs that run on a computing system, computer, or other computing device. (Source: k12cs.org)

- Microsoft Excel
- Microsoft PowerPoint
- Other as appropriate

### *Standards*

- **3-5.DA.8** Organize and present collected data visually to highlight relationships and support a claim.
- **3-5.DA.9** Use data to highlight and/or propose relationships, predict outcomes, or communicate ideas.

## Science

### Focal Standard

**4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.*** [Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.] [*Assessment Boundary: Assessment does not include specific rock formations and layers. Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.*]

*The performance expectations marked with an asterisk integrate traditional science content with engineering through a practice or disciplinary core idea.

### Related Content Standards

**4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.** [Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.] [*Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.*]

**4-ESS1-1. Identify evidence from patterns in rock formations, fossils in rock formations, and fossils in rock layers to support an explanation for changes in a landscape over time.** [Clarification Statement: Examples of evidence from patterns could include rock layers with shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and, a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.] [*Assessment Boundary: Assessment does not include specific rock formations and layers. Assessment is limited to relative time.*]

**4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.** [Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.] [*Assessment Boundary: Assessment is limited to a single form of weathering or erosion.*]

**4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.** [Clarification Statement: Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.]

### Anchoring Phenomenon

Students view a video clip of an earthquake causing damage and react by recording their observations and questions in their sense-making notebooks.

## Content Outline

Below is a content outline for the science content in this unit. It includes the key concepts within the unit along with an approximate number of days it would take to facilitate a sufficient amount of student learning experiences. For each key concept, key learnings appear, which come from the grade band endpoints in *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* (source: https://www.nextgenscience.org/framework-k-12-science-education). The storyline begins with an anchoring phenomenon.

| Key Concept | Key Learnings | # of Days |
|---|---|---|
| Plate-Related Features | • The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. (4-ESS2-2, ESS2.B) | 4 days |
| Rock Layers | • Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (4-ESS1-1, ESS1.C) | 3 days |
| Erosion + Deposition | • Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4-ESS2-1, ESS2.A) | 5 days |
| Waves | • Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach. *(Note: This grade band endpoint was moved from K–2.)* (4-PS4-1, PS4.A)<br>• Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1, PS4.A) | 5 days |
| Natural Hazards | • A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. *(Note: This Disciplinary Core Idea can also be found in 3.WC.)* (4-ESS3-2, ESS3.B)<br>• Living things affect the physical characteristics of their regions. (4-ESS2-1, ESS2.E) | 5 days |

*Students should be observing the position of the sun, moon, and stars throughout the year to see seasonal and annual patterns in addition to daily patterns.

| Science and Engineering Practices | Crosscutting Concepts |
| --- | --- |
| 1. **Asking questions and defining problems**<br>2. **Developing and using models**<br>3. **Planning and carrying out investigations**<br>4. **Analyzing and interpreting data**<br>5. Using mathematics and computational thinking<br>6. **Constructing explanations and designing solutions**<br>7. ***Engaging in argument from evidence***<br>8. Obtaining, evaluating, and communicating information | 1. **Patterns**<br>2. **Cause and effect**<br>3. Scale, proportion, and quantity<br>4. Systems and system models<br>5. Energy and matter<br>6. Structure and function<br>7. Stability and change |

*Note*. Bolded items are called out specifically in the standards cluster for this unit.

# Mathematics

## Description of Student Engagement

Students will compute the dimensions of their homes and also identify geometric features of their homes. Students will also collect data from their shake tests to make a line plot to determine how much of their home remains after shake testing.

## Standards for Mathematical Content

**4.NBT.5** Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

**4.G.1** Draw points, lines, segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.

**4.MD.4** Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition of subtraction of fractions by using information presented in line plots.

## Standards for Mathematical Practice

MP.1 Make sense of problems and persevere in solving them.

**MP.2 Reason abstractly and quantitatively.**

MP.3 Construct viable arguments and critique the reasoning of others.

**MP.4 Model with mathematics.**

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

*Note*. Bolded items are emphasized in this unit.

## English Language Arts and Development

### Reading Standard: Integration of Knowledge and Ideas

**RI.4.7** Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

### Writing Standard: Text Type and Purposes

**W.4.2** Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

### Speaking and Listening Standard: Presentation and Knowledge of Ideas

**SL.4.4** Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

> **SL.4.4.a** Plan and deliver a narrative presentation that: relates ideas, observations, or recollections; provides a clear context; and includes clear insight into why the event or experience is memorable.

## Unit Vocabulary

The following terms reflect the core vocabulary students should understand and use in this unit.

- **amplitude**: Amplitude is the height of the wave from crest to trough (resting position)(Sourced from NASA: https://go.nasa.gov/2VjUHSK)
- **deposition**: Deposition is the action of depositing something (such as sand, snow, or mud) on a surface or area especially over a period of time. (Source: https://www.merriam-webster.com/dictionary/deposition
- **earthquake**: An earthquake is an intense shaking of Earth's surface. The shaking is caused by movements in Earth's outermost layer. (Sourced from NASA: https://go.nasa.gov/38ITtUn)
- **erosion**: Erosion is the gradual destruction of something by natural forces (such as water, wind, or ice). (Source: https://www.merriam-webster.com/dictionary/erosion)
- **fossil**: A fossil is a trace or print or the remains of a plant or animal of a past age preserved in earth or rock (Source: https://www.merriam-webster.com/dictionary/fossil)
- **gravity**: Gravity is the force by which a planet or other body draws objects toward its center (Sourced from NASA: https://go.nasa.gov/38KQXNb
- **mountain range**: A mountain range is a series of landmasses that project conspicuously above their surroundings and are higher than a hill (adapted from: https://www.merriam-webster.com/dictionary/mountain)
- **natural hazard**: Natural hazards include such things as earthquakes, tsunamis, volcanic eruptions, landslides, hurricanes, droughts, floods, wildfires, geomagnetic storms, and pandemics. These hazards can claim lives and cause billions of dollars in damage to homes and infrastructure (Sourced from USGS[1]: https://pubs.er.usgs.gov/publication/cir1444)
- **ocean floor structures**: Ocean floor structures are underwater landforms that include continental shelf, continental slope, abyssal plain, abyssal hill, seamount (underwater mountain), mid-ocean ridge, volcanic island, ocean trench, hydrothermal vent, and methane seep (Sourced from NOAA[2]: https://bit.ly/3yOZOYS
- **ocean trench**: Ocean trenches are the deepest places in the ocean floor. (Adapted from NOAA: https://bit.ly/3h5s8Ak
- **sediment**: Sediments are small pieces of rock or soil that are carried by erosion and deposited in another location. This can also include the remains of plants and animals. (Source: adapted from BLM[3]: https://on.doi.gov/3zTI80K)

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[1] USGS = U.S. Geological Survey
[2] NOAA = National Oceanic and Atmospheric Administration
[3] BLM = Bureau of Land Management

- **topographic map**: A topographic map is distinctive because it uses elevation contour lines to show the shape of the Earth's surface. (Adapted from USGS: https://on.doi.gov/3tlXZI5
- **tsunami**: A tsunami is a series of waves caused by earthquakes or undersea volcanic eruptions. (Sourced from NOAA: https://bit.ly/3tlNu13)
- **volcanic eruption**: A volcanic eruption occurs when magma, which is very hot melted rock rises above solid rock and pushes through vents and fissures to the Earth's surface to become lava; this may or may not be explosive (Sourced from USGS: https://on.doi.gov/3zPg6SM)
- **volcano**: A volcano is an opening or vent where lava, tephra (small rocks), and steam erupt on to the Earth's surface (Sourced from USGS: https://on.doi.gov/3A2nxWI)
- **wave**: A wave is a way energy moves from one place to another. Sometimes waves move materials the way water ripples in a pond move the water. Other times, waves don't move anything around when they transfer energy. For example, X-rays and other waves on the electromagnetic spectrum don't make any ripples when they move energy from place to place. (Sourced from NASA: https://go.nasa.gov/3n6X3zX)
- **wavelength**: A wavelength is the distance from peak to peak (or valley to valley) of the wave. (Sourced from NASA: : https://go.nasa.gov/3n6X3zX)
- **wave peak**: A wave peak is the highest point reached by a wave.
- **weathering**: Weathering is the breaking up of earth's surfaces into smaller and smaller pieces by forces of water and air in the atmosphere. (Source:  adapted from BLM: https://on.doi.gov/3zTl80K)

# Assessment Tools

## Student Experience Inventory

Teachers can use the following prompts with students prior to the beginning of the unit or early in the unit in order to learn about students' experiences that relate to the unit. Teachers can make informed instructional decisions based on this learning, enabling tailored opportunities for students to make their own meaning.

### Student Prompts

1. Think about a time you or someone you know used a map. What was that like? (Additional prompts: What kind of a map was it? How did you use it?)

2. Think about a time that you or someone else cleaned out a desk that was crammed full of stuff. What was that like?

3. Think about a time you saw something get broken up into pieces that got scattered or moved around. What broke apart and what did you notice about the pieces as they moved around?

4. Tell about a time you built something and then made it better. (Additional prompts: What did you build? How did you make it better? How did you know it was better?)

5. Think about waves moving in water that you have seen. It might be waves outside like in the ocean or on a lake, or inside like in a sink or bathtub. What did you notice about the waves as they moved?

### Aligned Learnings

1. Responses to this item provide insight into students' experiences with maps. 4-ESS2-2

2. Responses to this item provide insight into students' experiences with layers of material over time. 4-ESS1-1

3. Responses to this item provide insight into students' experiences with objects breaking into pieces and moving around. 4-ESS2-1

4. Responses to this item provide insight into students' experiences with multiple solutions to a problem, need, or desire. 4-ESS3-2

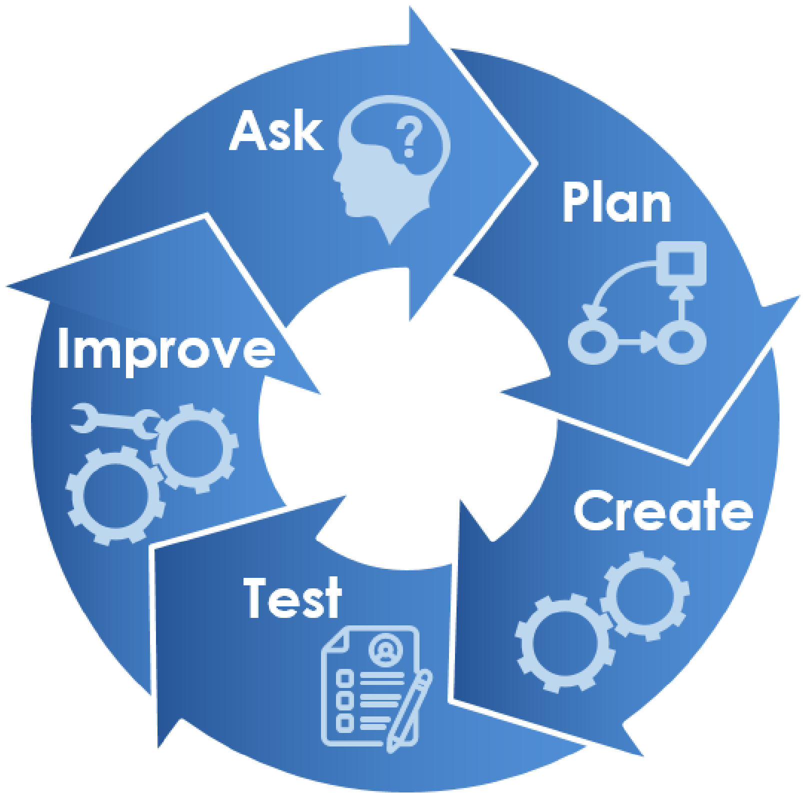
5. Responses to this item provide insight into students' experiences with waves. 4-PS4-1

## Student Self-Assessment of Engineering

**Improve:**
Here is what would make my design better and why…

**Ask:**
Here is what I am wondering about before I plan my design…

**Plan:**
Here are my design ideas for the project…




**Test:**
Here are the data I collected…

**Create:**
Here is what I think about what I made compared to what I planned, and here is what I think will happen when I test it…

I am doing the work of a civil engineer.

## One-Point Design Challenge Rubric

**Criteria** serve as a primary reference point throughout the engineering design process. Teachers use the criteria **to communicate expectations** and **to guide students**. With teacher guidance, students use the criteria to inform and reflect on their work.

| **Approaches Expectations**<br>*Notes on how to improve the project* | **Meets Expectations**<br>*Criteria indicating success* | **Exceeds Expectations**<br>*Notes on how project goes beyond expectations* |
|---|---|---|
| | **Engineering**<br>Students participate in the 5-part engineering design process, use data, and make thoughtful improvements to their design. (3-5-ETS1-1, 3-5-ETS1-2, 3-5-ETS1-3) | |
| | **Computer Science**<br>Students create a data visualization of their shake test data to highlight the outcome of their design. (3-5.DA.8, 3-5.DA.9) | |
| | **Collaboration**<br>Students give and receive input with kindness and honesty. | |
| | **Communication**<br>Students speak and write about their ideas clearly using accurate vocabulary. (W.4.2) Students interpret information shared visually, orally, and quantitatively. (RI.4.7) | |
| | **Science**<br>Students develop a solution that reduces an earthquake's impact on a model home. Students compare highlights multiple solutions. (4-ESS3-2) | |

# Engagement

## Community and Career Connections

During the unit, students engage with STEM professionals who can inform students' work at some point during the engineering design process. The interaction with STEM professionals serves a few purposes:

- Expose students to STEM as it applies in various careers
- Enrich student learning through collaborating with STEM professionals
- Help students see themselves doing the actual work of STEM

Below are a few potential STEM-related professionals that align to one of California's 15 industry sectors for Career and Technical Education:

- **Geologist** (Agriculture and Natural Resources)
- **Architect** (Engineering and Architecture)
- **Building Inspector** (Public Services)

The interactive experience will ideally be co-constructed by the teacher and professional. In coordinating with the professional, a few questions appear below that can be used to guide the planning and live interaction with students:

- **Geologist** (Agriculture and Natural Resources)
  - How do you determine when an earthquake has occurred?
  - What damage does an earthquake cause? What do you use to measure earthquakes?
  - Is there any way to know if an earthquake is going to occur? If so, what are the potential signs to look for?
  - How does the earth change as the result of an earthquake? Can you look at layers of earth sediment and determine if an earthquake has occurred?
- **Architect** (Engineering and Architecture)
  - What goes into a good architectural design that make a building earthquake-proof?
  - What tools do architects use to design things?
  - How do you test a design to make sure it is as structurally sound as possible?
  - Are buildings designed differently depending upon location? Are there any special considerations when designing building in our area?
- **Building Inspector** (Public Services)
  - What features of a building do you inspect? How do you decide if the building is safe?
  - What tools does a building inspector use?
  - What happens if an inspection finds many problems or failures in a building?
  - What would you have to see in order to declare a building unsafe for people to use?

## Materials List

The items in the materials list below reflect total quantities for a class of 32 students, allowing for 8 groups of 4 students.

### Permanent Equipment (classroom totals):

- ☐ 8 yards of wire (for exploring waves)
- ☐ 8 Slinky® toys (for exploring waves)
- ☐ 96 washers (for weight)
- ☐ 1 shake table (table to shake with care) Materials to create are below:
    - 1 (2 ft. x 2 ft.) piece of plywood
    - 2 (30 inch x ¾" diameter) PVC pipe
    - 2 (24 inch x ¾" diameter) PVC pipe
    - 4 elbow pieces PVC pipe
    - 2 (3-foot) wood dowels (3/4" diameter)
    - Four eye bolts
    - 4 regular bolds (1/4 x 1.25")
    - 8 nuts (hex nuts to work with eye hook bolts)
    - 8 strong rubber bands

### Consumable Equipment (classroom totals):

- ☐ 96 sheets of cardstock paper
- ☐ 640 index cards
- ☐ 320 large paper clips
- ☐ 320 brads (paper fasteners)
- ☐ 1280 coffee stirrers
- ☐ 320 paper straws
- ☐ 320 pipe cleaners
- ☐ 8 rolls of blue painter's or clear tape

## Distance Learning Modifications

In distance learning, the design challenge will be conducted by students individually at home. Student collaboration will need to occur remotely with a modified materials list.

### Modified Materials List (student totals):

- ☐ 10 sheets of cardstock paper
- ☐ 20 index cards
- ☐ 10 large paper clips
- ☐ 10 brads
- ☐ 30 coffee stirrers
- ☐ 8 paper straws
- ☐ 6 pipe cleaners
- ☐ 1 roll of clear tape
- ☐ 3 washers
- ☐ table to shake with care (from home)

## Endnotes


[i] Underworld. (2021, September 9). *5 powerful earthquakes caught on camera.* YouTube. https://www.youtube.com/watch?v=EPGnB3gqTYw

[ii] U.S. Geological Survey. (2014, February 21). *1964 Quake: The great Alaska earthquake*. https://www.usgs.gov/media/videos/1964-quake-great-alaska-earthquake