Strengthening Claims-based Interpretations and Uses of Local and Large-scale Science Assessment Scores (SCILLSS)

Task Construction: Example 5-PS1-1 Science Classroom-embedded Assessment Task

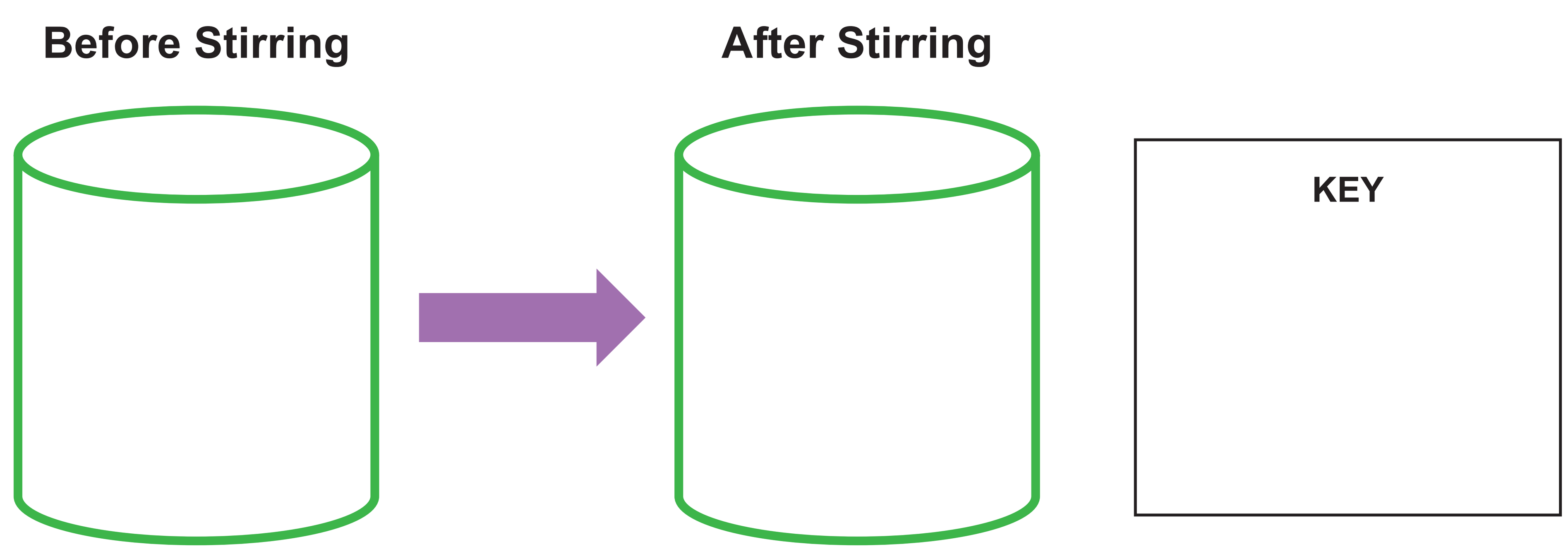
This task is about the particles of matter. Be sure to answer question 1 and question 2.

1. Jose cleaned his salt water fish tank. The water in the tank looked clear. His friend Carl visits and asks, "Why can't I see the salt in the water?" Jose creates a model to show Carl what happens to salt when stirred into water.

   Complete the model below to show:

   - the salt particles and water particles **before** stirring the mixture
   - the salt particles and water particles **after** stirring the mixture

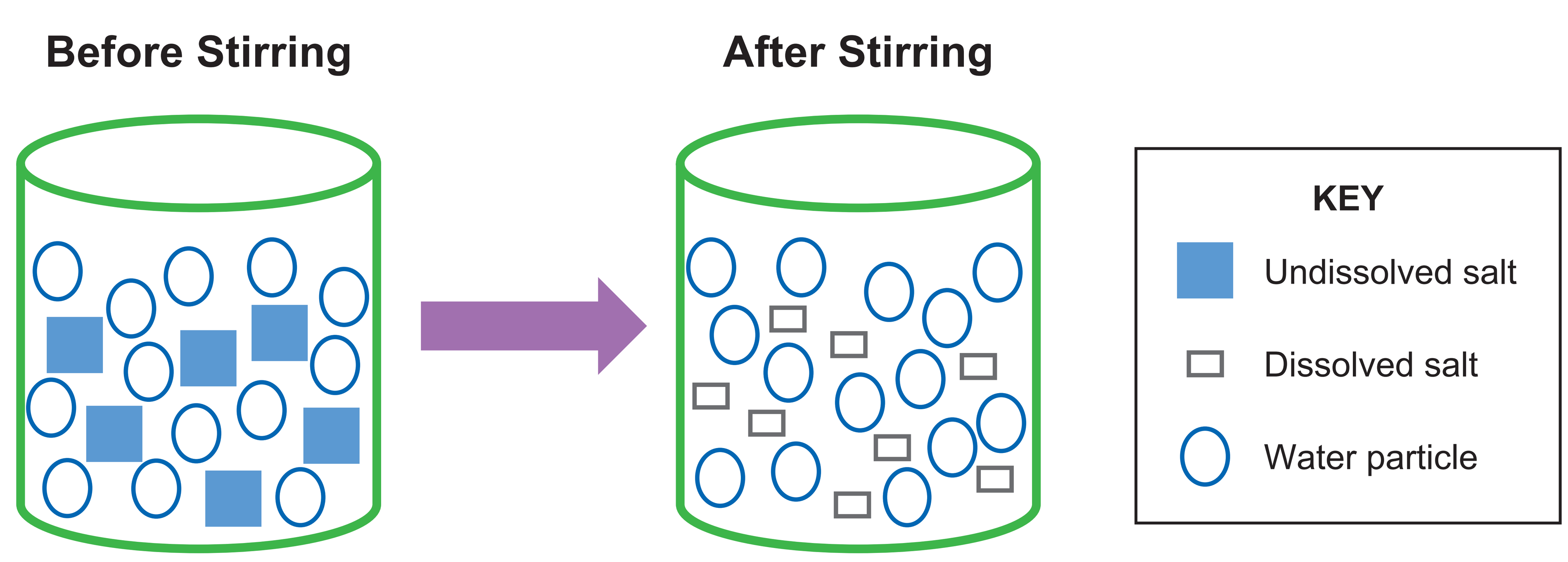
   Be sure to complete the key to show the salt particles and water particles in both conditions of your model.



2. Describe the change to the salt particles after being stirred in the water. Be sure to use information from your model to support your explanation.

Exemplar 5-PS1-1 High-level Student Response: Questions 1 and 2

1.



2. "The model shows that the salt particles dissolve. They break into smaller pieces after they are stirred into water. The salt particles are still in the water, but you can't see them. That's because they got so small."

5-PS1-1 Classroom-based NGSS Assessment Task Example Rubric

Student Expectations of Learning	1	2	3
Student uses the model to describe how matter composed of tiny particles is too small to be seen.	Student develops a model that does **not** account for observable phenomena. Description is incorrect or is not provided.	Student develops a model that shows: • a flawed connection between bulk matter and particles too small to be seen (e.g., salt particles are represented at the same size under both conditions; all salt particles are clustered in one area of the container under both conditions; key is incorrect, etc.) Description is partially correct (e.g., does not refer to the scale of the dissolved salt particles).	Student develops a model that shows: • two representations each with two different bulk matter and matter too small to see (particles) • the representations correctly position and scale the particles relative to each other • the key is correct Description is correct.

Task Construction: Example 5-PS1-3 Science Classroom-embedded Assessment Task

This task is about the identification of a powder based on its properties. Be sure to answer question 1 and question 2.

The Case of the Mystery Powder

1. A white powder was found on the kitchen floor of a crime scene. A white powder is also found on the shoes of a suspect. To solve the mystery, a detective tests different white powders often found in a kitchen.

   The detective tests how the white powders react when water, heat, and vinegar are added. The test results are shown below in the data table.

   Results of Testing White Powders

White Powder	Weight	Water	Heat	Vinegar
Sugar	15g	Dissolves	Melts, bubbles, and smokes	No change
Baking Soda	20g	Turns a milky color	No change	Bubbles
Salt	20g	Dissolves	No change	No change
Plaster of Paris	30g	Turns to a hard solid	No change	Bubbles
Cornstarch	50g	Turns to a soft solid	Turns brown	Thickens

   How could you identify if the powder found on the kitchen floor and the suspect's shoes are the same? Support your explanation by using examples from the data table and what you know about characteristic properties of matter.

2. The characteristics of the white mystery powder found at the scene of the crime match those found on the suspect's shoes. Below are the results of the tests on the two powders.

   Results of Testing White Mystery Powder

White Powder	Weight	Water	Heat	Vinegar
Mystery Powder	50g	Turns to a hard solid	No change	Bubbles

   What is the mystery powder? Be sure to support your answer with the information provided in both data tables.

Exemplar 5-PS1-3 High-level Student Response: Questions 1 and 2

1. "All the powders are white. So, color won't tell what the powder is made of. Each of the powders reacts in a different way when water, heat, or vinegar are tested. If the powder found on the kitchen floor does the same thing as the powder found on the suspect's shoes with water, heat, and vinegar, then it is the same powder."
2. "The powder found in the crime scene and the powder on the suspect's shoes are both plaster of Paris. The color and the weight of the samples don't tell which powder matches. But, the white mystery powder found at the crime scene has all the same characteristics when heat, water, and vinegar are added like plaster of Paris."

5-PS1-3 Classroom-based NGSS Assessment Task Example Rubric

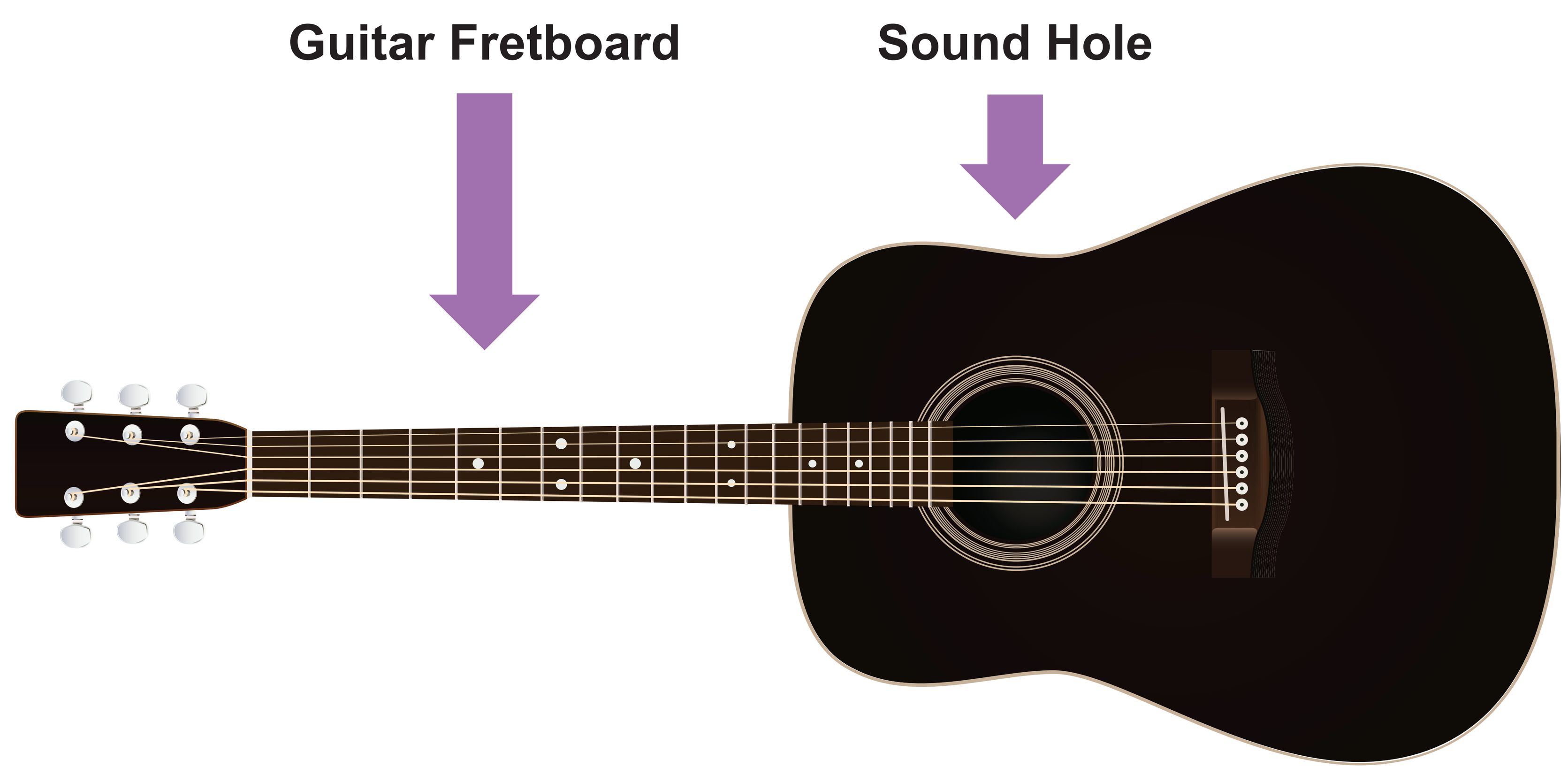
Dimension Element	1 Students can …	2 Students can …	3 Students can …
Make observations and measurements to produce data to serve as the basis for evidence for an explanation.	Interpret observations from a data table(s) to determine a partial explanation.	Interpret observations from a data table(s) to determine an explanation and link it to the scenario.	Interpret observations from a data table(s), justifying using or not using particular elements of the data to support an explanation linked to the scenario with examples.
Measure and describe physical quantities.	Describe physical properties.	Describe and interpret physical properties in the context of the scenario.	Describe and interpret physical properties in the context of the scenario, noting gaps or limitations in the data.
A variety of properties can be used to identify materials.	Explain the differences in properties of materials, but not necessarily the most relevant or most important aspect of it as it pertains to the scenario.	Explain the differences in properties of materials, in terms that are relevant as it pertains to the scenario.	Explain the differences in properties of materials being focused on and building from the relationships between those elements of the scenario.

Strengthening Claims-based Interpretations and Uses of Local and Large-scale Science Assessment Scores (SCILLSS)

Task Construction: Example MS-PS4-1 Science Classroom-based Assessment Task

This task is about sound waves.

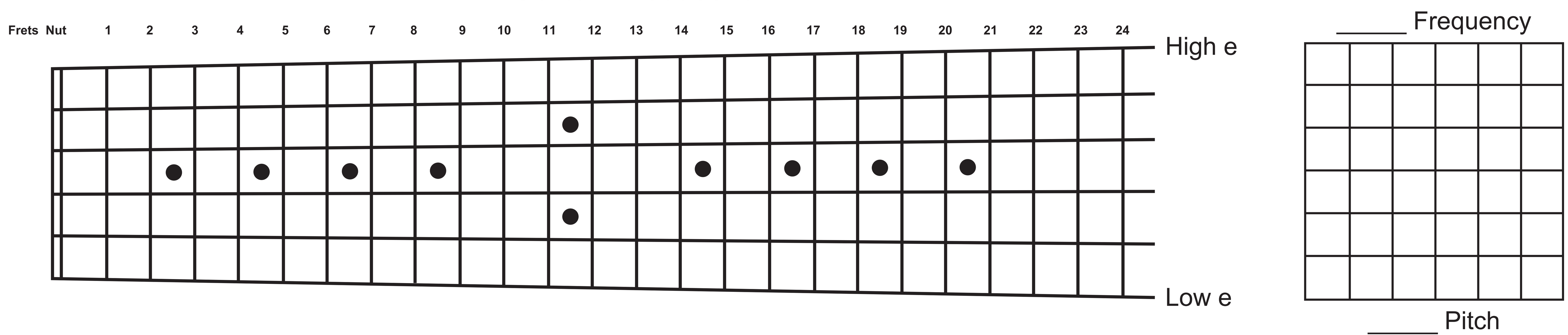
1. Jenna is learning how to play a guitar. Her guitar is shown below.



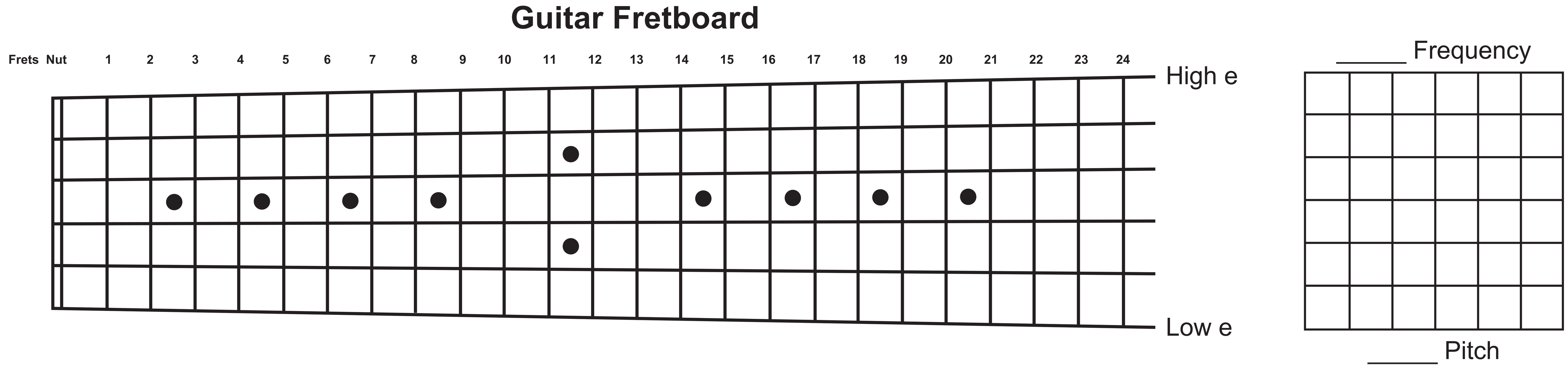
Jenna experiments by pressing down her finger on a single string at different locations on the guitar fretboard. When Jenna places her finger on a string near the sound hole, this shortens the length of string that vibrates, called the plucked string. When she places her finger on a string far away from the sound hole, the plucked string has a longer length. Jenna hears different notes.

Two models of Jenna's guitar fretboard are shown below.

Guitar Fretboard



Guitar Fretboard



Use the models to show the relationship between the frequency of a sound wave and pitch for a low note and a high note. On each model, be sure to:

- Show the place on the guitar fretboard where a string is held down.
- Label the frequency and pitch of the sound wave that is produced.
- Draw a simple sound wave of that sound on each of the models.

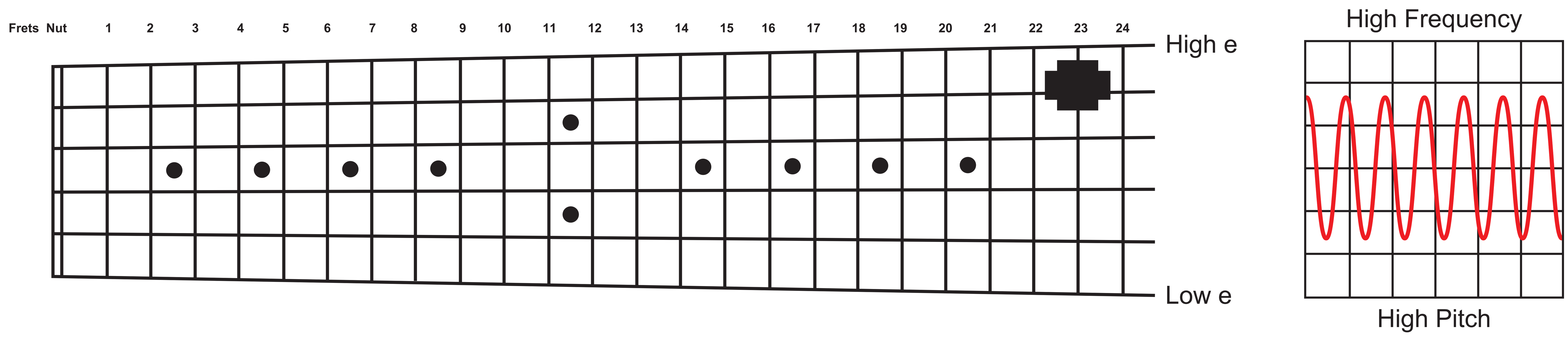
2. What is the relationship between the length of a plucked string and the low or high note produced? Use your model to support your explanation.

Strengthening Claims-based Interpretations and Uses of Local and Large-scale Science Assessment Scores (SCILLSS)

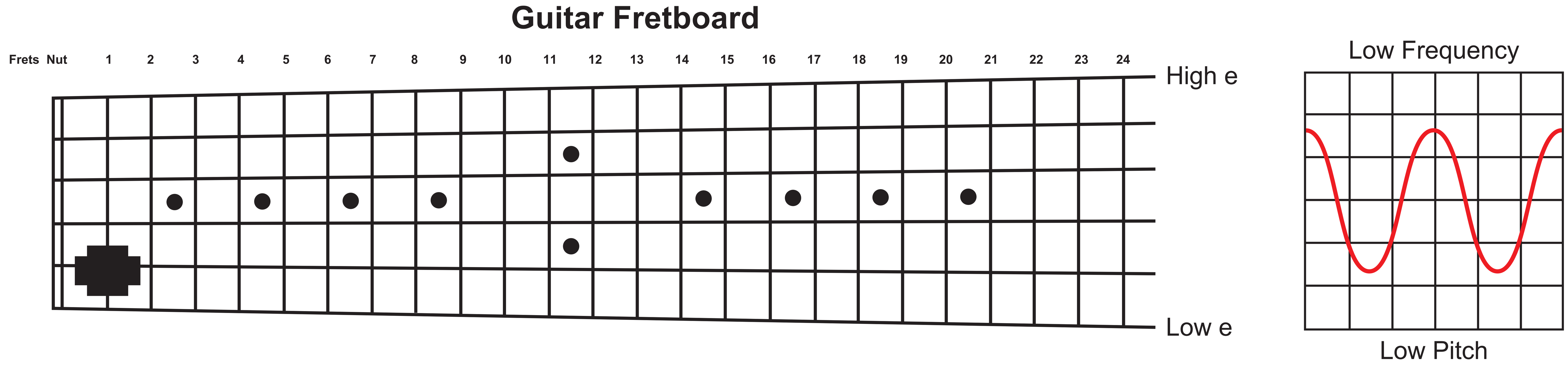
Exemplar MS-PS4-1 High-level Student Response: Questions 1 and 2

1.

Guitar Fretboard



Guitar Fretboard



2. "Stringed instruments have strings that vibrate when plucked or struck. A short string vibrates at a higher frequency and produces a high note with a high pitch. A long string vibrates at a low frequency and produces a lower pitched sound or a low note."

MS-PS4-1 Assessment Task Example Rubric

Student Response	1	2	3
Student creates a model and provides an explanation that describes the relationship between pitch and frequency and uses mathematical thinking to compare rates of vibration (frequency) between strings of different lengths.	Student develops a model that does **not** show the relationship between frequency and pitch and notes played on the guitar. Explanation is incorrect or is not provided.	Student develops a model that shows a slightly flawed connection between frequency, pitch, and the notes played on the guitar (e.g., high frequency paired with low pitch, high note matched low frequency, etc.). Explanation is partially correct (e.g., does not refer to rates of vibration and pitch of the observed sound).	Student creates a model that shows: • relationship between frequency, pitch, and notes played of the guitar • ways that vibrating strings cause differences in sounds Explanation is correct.

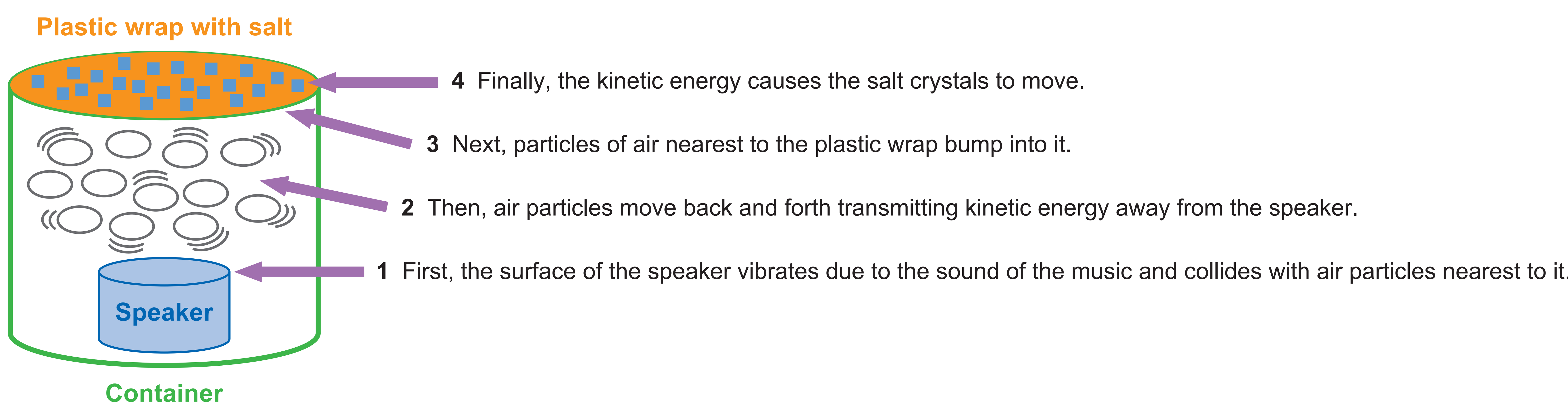
Strengthening Claims-based Interpretations and Uses of Local and Large-scale Science Assessment Scores (SCILLSS)

Task Construction: Example MS-PS4-2 Science Classroom-embedded Assessment Task

1. Can you make something move by using only sound? Watch the first 20 seconds of the video demonstration at www.youtube.com/watch?v=a08cawnJinw. Develop a model and describe this phenomenon using a bowl with plastic cling wrap as the sound detector and a radio speaker as the sound source. Be sure to label the parts of your model. Be sure your model shows:
    - what is happening at the sound source;
    - how the sound source affects the surrounding medium;
    - how the medium causes changes to the sound detector; and
    - what happens to the salt on the sound detector.
2. Based on your model, describe:
    - how sound waves are transmitted through the material;
    - why the salt appears to move differently during the song; and
    - why the plastic wrap acts as a sound detector.

Exemplar MS-PS4-2 High-level Student Response: Questions 1 and 2

1.



2. "The vibrating speaker gives out sound. The sound travels through the air as longitudinal waves. The air particles next to the plastic wrap vibrate as the sound energy reaches it, making the salt crystals move. When the sound of the music is louder, it is more intense. This causes the salt crystals to move even more. The salt stops moving when the sound stops. This is why the plastic wrap is a good sound detector."

MS-PS4-2 Assessment Task Example Rubric

Dimension Element	1 Students can ...	2 Students can ...	3 Students can ...
Develop and use a model to describe phenomena.	Develop a model, which partially describes the phenomenon without indicating relationships between components; did not follow directions to label diagram.	Identify some of the relevant components and/or describe some of the relationships between components.	Identify relative components and their relationships including: 1) sound waves, 2) materials through which the waves are reflected, absorbed, or transmitted, 3) results of the interaction of the wave and the material, and 4) source of the wave.
Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.	Develop a model with misunderstanding of the properties of the materials.	Interpret the model regarding a part of the context (e.g., no mention of the properties of the material as a sound detector).	Use the model to describe why materials with certain properties are well-suited for particular functions (e.g., a sound detector).
A sound wave needs a medium through which it is transmitted.	Provide a response, which includes major misunderstandings or includes no attempt to show how sound travels or demonstrates little understanding of how sound travels.	Partially describe how sound travels.	Describe how sound waves interact with different materials.

Strengthening Claims-based Interpretations and Uses of Local and Large-scale Science Assessment Scores (SCILLSS)

Task Construction Background: Example HS-ESS1-5 Science Classroom-based Assessment Task

This task requires the educator to engage the students in a group discussion after viewing a video related to seafloor spreading found at www.youtube.com/watch?v=GyMLILxbfa4. The video provides information about the discoveries of Harold Hess related to the process of seafloor spreading that created the oceans' seafloors.

After watching the video, the educator discusses with students how Hess' theory of seafloor spreading relates to the Alfred Wegener (i.e., the originator of the theory of continental drift by hypothesizing in 1912 that the continents are slowly drifting around the Earth).

Note: Harry Hess's hypothesis about seafloor spreading had several pieces of evidence to support the theory. One of these is polar reversals.

(Students may need clarification about polar reversal. The educator could also have students watch a video that explains this phenomenon found at www.youtube.com/watch?time_continue=274&v=5eka88IOJ-I.)

Following the group discussion, the students work in small groups to build a model of seafloor spreading. Finally, each student is presented with three questions to which individual responses are provided and evaluated by the educator.

Task Construction: Example HS-ESS1-5 Science Classroom-based Assessment Task

We watched a video about Harry Hess and his theory of seafloor spreading. Let's discuss what we learned and what questions or ideas you might have.

- What important discoveries did Hess and his fellow scientists make?
- Why are models necessary for studying Earth processes?

[After a group discussion about students' answers to the above questions, students will work in small groups to create a model, which incorporates their discussion points including seafloor spreading and the magnetic strips that occur in the seafloor.]

Now you will work with your group to build a model of seafloor spreading using the following materials:

- 1 box lid with a slit cut in the center for the paper strip
- 100 cm long paper strip to be folded in half, with the two ends emerging from the box lid
- 1 box of markers
- 1 bar magnet and 1 compass
- Meter stick

[The performance task requires students to create a group model of seafloor spreading and to pull, mark, flip, etc., using the two poles of the magnet to allow manipulation of the compass to identify the polar reversals (i.e., the magnetic stripes) and using letters (e.g., A, B, C, etc.). Upon completion of the group activity, each student answers the following three questions individually.]

This task is about seafloor spreading. Be sure to answer all three questions.

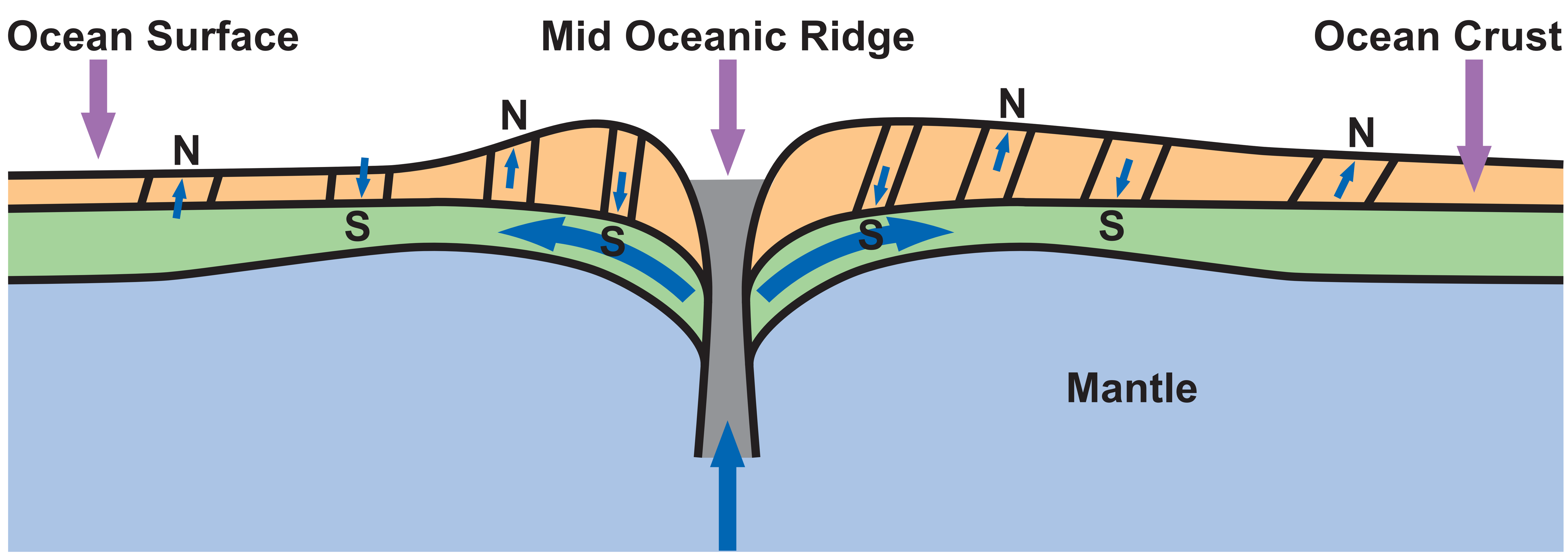
1. What do the following components of the group model represent?
   a. the process of pulling the paper strips
   b. the magnet and what flipping shows
   c. the marked sections of the paper strip (e.g., A, B, C, etc.)
2. In the space below, draw a diagram of seafloor spreading. Include the polar reversals, mid-ocean ridge, oceanic crust, seafloor surface, and direction of movement in the diagram.
3. Use your findings and evidence related to the theories of Hess and Wegner to develop an argument to support the following claim:

   "Crustal materials of different ages are arranged on Earth's surface in a pattern that can be attributed to plate tectonic activity and older rocks are located further away from the mid-ocean ridge."

Strengthening Claims-based Interpretations and Uses of Local and Large-scale Science Assessment Scores (SCILLSS)

Exemplar HS-ESS1-5 High-level Student Response: Questions 1–3

1. The components represent:
   a. Process of seafloor spreading
   b. The magnet represents Earth's magnetic field and flipping it shows Earth's magnetic reversals.
   c. The different sections are the different orientations of Earth's magnetic field when the seafloor formed.
2.



3. Crustal materials of different ages are arranged on Earth's surface in a pattern that can be attributed to plate tectonic activity. This is supported by data. This includes the magnetic patterns found along these ridges. Based on the north and south magnetic patterns and spacing of magnetic stripes the seafloor grows away from the ridge. So, the motion of the plates moves rocks further and further away from the ridge. This shows that because of that the older rocks are located further away from the mid-ocean ridge and newer rocks are nearer the ridge.

HS-ESS1-5 Assessment Task Example Rubric

Dimension Element	1 Students can …	2 Students can …	3 Students can …
Engaging in Argument from Evidence	Interpret observations from evidence and models to partially support an argument.	Interpret observations from evidence and models and link it to the argument.	Interpret relevant observations from evidence and models, justifying using or not using elements of the data to support an explanation linked to the scenario with examples.
Patterns	Describe physical properties.	Describe and interpret physical properties in the context of the scenario.	Describe and interpret patterns observed from the evidence to support the argument about the ages of crustal rocks.
The History of Planet Earth	Describe seafloor spreading, but not necessarily using the most relevant terms as it pertains to the model.	Explain the motion of continental plates as it pertains to some aspects of the model.	Synthesize the relevant evidence to describe the relationship between the seafloor, magnetic field, mid-ocean ridge, and magnetic reversals shown in the model.

Strengthening Claims-based Interpretations and Uses of Local and Large-scale Science Assessment Scores (SCILLSS)

Task Construction Background: Example HS-ESS2-7 Science Classroom-based Assessment Task

This task requires the educator to provide a handout with information about the gradual changes in Earth's atmosphere, which supports the students in an exploration of a computer-based animation found at media.hhmi.org/biointeractive/click/oxygen/.

Task Construction: Example HS-ESS2-7 Science Classroom-based Assessment Task

History of Earth's Oxygen Levels

Early Earth would have been very different and unwelcoming to living things compared to the Earth today. Not only was early Earth covered in lava and constantly erupting, its atmosphere was choked with volcanic gases like carbon dioxide and sulfur dioxide. Volcanic eruptions on land and under the oceans released a lot of iron which, over time, dissolved into seawater. The most important feature of the ancient environment was the absence of oxygen. Therefore, the iron generally stayed dissolved in the seawater.

As Earth cooled, about 4.5 billion years ago, an atmosphere formed mainly from gases spewed from volcanoes. It included hydrogen sulfide, methane, and far greater levels of carbon dioxide than today's atmosphere.

Over millions of years, tectonic movement of the Earth's mantle thrust up the ocean floor to form coastal shallows. A few colonies of bacteria must have found successful survival conditions in these shallows. That's when blue-green algae (cyanobacteria) started the photosynthesis process. The appearance of cyanobacteria is recorded in fossils that formed roughly 3.5 billion years ago. Oxygen began to appear in the oceans. When the dissolved iron interacted with oxygen it precipitated out as iron oxide minerals.

These iron oxide materials, rust, began to form 3.0–2.0 billion years ago. This created black iron oxide minerals (like hematite and magnetite). These minerals, together with iron-poor reddish-colored shales and cherts, collected at the seafloor, and eventually turned into banded iron formations. These are common in rocks 2.8–2.0 billion years old, but do not form today.

In this interactive animation of oxygen levels over time, you will learn about the complex biological and geological factors that have influenced the changes in Earth's oxygen levels. Explore only through 2.4–1.8 billion years ago in the Proterozoic Eon.

1. Thinking like a geologist, use the information from the handout and the evidence presented in the interactive activity to support the following claim.

   "Between 2.5–2.3 billion years ago, levels of oxygen on Earth began to rise."

Exemplar HS-ESS2-7 High-level Student Response: Question 1

1. There is biological and geological evidence and facts to support the claim that between 2.5–2.3 billion years ago, the levels of oxygen on Earth rose. For example, there is evidence of cyanobacteria in fossils that are approximately 3.5 billion years old. There was a lot of carbon dioxide in the atmosphere for the cyanobacteria to use for photosynthesis. Photosynthesis releases oxygen. Over millions of years, tectonic movement of the Earth's mantle thrust up the ocean floor to form coastal shallows, thus supporting the spread of more cyanobacteria colonies. This led to greater amounts of oxygen in the environment.

   Banded iron formations, a type of sedimentary rock, found in many locations on Earth today, provide evidence for the increase in oxygen released by cyanobacteria. The bands of red and black iron oxides could only have formed in the presence of a lot of oxygen. Also, this phenomenon is found in rocks 2.8–2.0 billion years old. Therefore, it took about a billion years for Earths' oxygen levels to accumulate enough to cause this to occur.

   These relationships between iron-rich deposits and Earth's early atmosphere support the claim that between 2.5–2.3 billion years ago, the levels of oxygen rose on Earth.

HS-ESS2-7 Assessment Task Example Rubric

Dimension Element	1 Students can …	2 Students can …	3 Students can …
Engaging in Argument from Evidence	Interpret observations from evidence and models to partially support an argument.	Interpret observations from evidence and models and link it to the argument.	Interpret relevant observations from evidence and models, justifying using or not using elements of the data to support an explanation linked to the scenario with examples.
Stability and Change	Describe physical properties.	Describe and interpret changes biological or geological factors in the context of the scenario.	Describe and interpret changes observed from the evidence to describe the relationship between biological and geological factors that have influenced the changes in oxygen levels during Earth's history.
Biogeology	Compare ancient Earth's atmosphere to today's atmosphere with little understanding of the co-evolution of Earth's systems and life.	Describe the relationship between biological and geological factors to some aspects of the claim that there is continuous co-evolution of Earth's systems and life.	Synthesize the relevant evidence to support the claim that there is continuous co-evolution of Earth's systems and life.

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