Lesson 4.3
Explaining a Bridge
Lesson Overview

Students read *Explaining a Bridge*, which profiles Brian Maroney, a lead engineer who worked to design the new San Francisco Bay Bridge. Students set their own purpose for reading and gain insight into the role of civil engineers and learn how civil engineers apply the science of balanced forces to large-scale projects such as bridges. This book also provides a real-world context for the kinds of scientific explanations that students write during the unit because an important part of Maroney’s work is to explain to the public why the new Bay Bridge is stable and safe. The lesson concludes with a discussion about balanced forces and the scientific explanations that Maroney makes.

**Anchor phenomenon:** The floating train rises, floats above the track, then later falls back to the track.

**Investigative phenomenon:** The new Bay Bridge is safe for cars and trucks to cross.

**Students learn:**

- When two forces are exerted on an object in opposite directions, the forces can be balanced.
- Engineers must be certain that the forces on a bridge will remain balanced so the bridge is stable and safe.
- One important part of an engineer’s job can be to explain science ideas to the public so people trust that the things engineers build are safe.
Reading: Explaining a Bridge

Students set a purpose for reading and then read *Explaining a Bridge*.

**Instructional Guide**

1. **Review the Chapter Question and Investigation Question.** Read aloud each question.
   - Why does the train float, even though gravity is acting on it?
   - Why would an object not move even though a force is acting on it?
   - We have already discovered quite a bit about balanced forces that helps us with these questions.

2. **Introduce the book *Explaining a Bridge***.
   - We are going to think more about these questions by reading a book about an engineer. He works to design bridges that will remain stable and safe, even in an earthquake! To do this, he needs to know a lot about forces and how to keep them balanced.
   - He explains to people what makes a bridge safe, much like how you are explaining to the people of Faraday that their train is safe.

3. **Introduce Setting a Purpose for Reading *Explaining a Bridge*** in the notebook and have partners set a purpose. Have students turn to page 47 of the Investigation Notebook, Setting a Purpose for Reading Explaining a Bridge. Point out that pairs will decide on their own reading purpose today.
   - Choose a reading purpose that will help you explain an answer to the question we are investigating: why does the train float, even though gravity is acting on it?
   - Give pairs a few minutes to discuss and write down a purpose for reading.

4. **Volunteers share their reading purposes.** Call on a few volunteers to share their purpose for reading. Highlight purposes that are about balanced forces, gravity and things falling or not falling, or making scientific explanations.
5. Prompt students to think in terms of stability and change as they plan to read. Have students check their purpose and revise if needed.

Check and make sure you have a purpose that will help you with our task of explaining the floating train. If your purpose is not about either balanced forces or gravity or making explanations, come up with a new purpose that is about one of these.


7. On-the-Fly Assessment: Students read Explaining a Bridge with their partners. Remind students to mark with sticky notes the evidence related to their reading purpose, and add notes about what they found to the Setting a Purpose for Reading notebook page. Early finishers can complete the optional Reading Reflection activity on page 49 in the notebook (Reading Reflection: Explaining a Bridge).

Embedded Formative Assessment

On-the-Fly Assessment 15: Reading with a Purpose

Look for: As you circulate, make note of how well students are able to use their sticky notes to mark passages in the text that are relevant to the purpose for reading, and check that their purpose is related to balanced forces, gravity, or making explanations. Are students able to identify passages that might be related to their purpose? Do they relate the information in the book to what they have learned about these topics in earlier lessons?

Now what: If students have trouble focusing on their purpose as they read, ask them to state the purpose for reading, find a passage in the book that relates to that purpose, and mark it with a sticky note. Have students write a brief description on their sticky note of why they think that passage helps them with their purpose for reading. Then, ask some students who have marked passages to explain why the passages they have marked relate to the purpose. You might have students explain their choices to each other or to the class. Next time they are asked to read with a purpose, you might pair students who have been successful at this strategy with those who have needed more support.

Teacher Support

Instructional Suggestion

Providing More Experience: Today’s Daily Written Reflection

How have you acted like a scientist so far during this unit about forces and the floating train? This prompt (on page 46 in the Investigation Notebook) asks students to think back over the unit so far and consider activities they have done that scientists do as part of their work. Ideas students may mention include solving problems, asking questions, setting goals, working in teams, investigating, reading, writing, using evidence, making models and diagrams.
Background

About the Book: *Explaining a Bridge*

*Explaining a Bridge* profiles Brian Maroney, one of the lead engineers involved in the design of the new San Francisco Bay Bridge. Since part of the original Bay Bridge fell during an earthquake in 1989, some people might be concerned about the new bridge staying up. Maroney explains to the public why the new bridge is safe—just as students are working to explain that maglev trains are safe. Maroney knows a lot about balanced forces, and he explains how the forces will stay in balance to keep the bridge up even in an earthquake. The text discusses the materials and models that Maroney uses to help educate the public and includes diagrams of balanced and unbalanced forces acting on bridges. *Explaining a Bridge* gives students a model of a real-life engineer, using the very explanation skills they are learning as an essential part of his job.
Concluding Discussion

Students discuss *Explaining a Bridge* and reflect on balanced forces and making explanations, one of the unit’s key science practices.

Instructional Guide

1. Invite pairs to share the evidence they found about the reading purpose. Call on a pair to share some of the related evidence they found.

2. Project the first Think-Pair-Share Question. For each of the following two questions, conduct a Think-Pair-Share routine.

   **Think-Pair-Share Question 1**

   What forces are balanced to keep the Bay Bridge stable? Turn to page 13 of the book for a diagram that can help you answer.

   What forces are balanced to keep the Bay Bridge stable? Turn to page 13 of the book for a diagram that can help you answer.
   [An upward touching force exerted by cables and a downward force of gravity exerted by Earth.]

   Think.

   Pair.
Why is it important for scientists and engineers to explain science ideas to community members?

[People want to understand why bridges and other structures the public uses are constructed the way they are. They also want to know why they can trust that these structures are safe to use.]

4. **Introduce and post the next key concept.** Read aloud the key concept and post it to the wall.

When two forces are exerted on an object in opposite directions, the forces can be balanced.

5. **Conclude the lesson.** Tell students that in the next lesson, they will make their own explanations, describing for the people of Faraday why the train floats.
Setting a Purpose for Reading Explaining a Bridge

Directions:
1. Discuss with your partner and decide on a purpose for reading Explaining a Bridge.
2. Check to make sure that your purpose will help you explain to the people of Faraday why the train floats even though gravity is acting on it.
3. Read Explaining a Bridge and mark places in the book that have to do with your reading purpose.
4. Write notes about what you found in the book.

Reading purpose: To learn more about ______________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

Notes about what you read that has to do with your reading purpose:
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

Reading: Explaining a Bridge

Students set a purpose for reading and then read *Explaining a Bridge*.

**Instructional Guide**

1. **Review the Chapter Question and Investigation Question.** Read aloud each question.

   ¿Por qué flota el tren, a pesar de que la gravedad está actuando sobre él?

   ¿Por qué no se moverá un objeto aunque una fuerza esté actuando sobre él?

   Ya hemos descubierto bastantes cosas sobre fuerzas en balance que nos ayudan con estas preguntas.

2. **Introduce the book *Explaining a Bridge*.**

   Vamos a pensar más en estas preguntas leyendo un libro sobre un ingeniero. Él trabaja para diseñar puentes que permanezcan estables y seguros, ¡incluso durante un terremoto! Para hacer esto, necesita saber mucho sobre las fuerzas y cómo mantenerlas en balance.

   Él les explica a las personas qué hace que un puente sea seguro, muy similar a como ustedes están explicándole a la gente de Faraday que su tren es seguro.

3. **Introduce Setting a Purpose for Reading *Explaining a Bridge* in the notebook and have partners set a purpose.** Have students turn to page 47 of the Investigation Notebook, Setting a Purpose for Reading Explaining a Bridge. Point out that pairs will decide on their own reading purpose today.

   Elijan un propósito de lectura que les ayudará a explicar una respuesta a la pregunta que estamos investigando: ¿Por qué flota el tren, a pesar de que la gravedad está actuando sobre él?

   Give pairs a few minutes to discuss and write down a purpose for reading.

4. **Volunteers share their reading purposes.** Call on a few volunteers to share their purpose for reading. Highlight purposes that are about balanced forces, gravity and things falling or not falling, or making scientific explanations.
5. **Prompt students to think in terms of stability and change as they plan to read.** Have students check their purpose and revise if needed.

6. **Distribute copies of the book and sticky notes.** Distribute 1 copy of the book and 4–6 sticky notes to each pair of students.

7. **On-the-Fly Assessment: Students read Explaining a Bridge with their partners.** Remind students to mark with sticky notes the evidence related to their reading purpose, and add notes about what they found to the Setting a Purpose for Reading notebook page. Early finishers can complete the optional Reading Reflection activity on page 49 in the notebook (Reading Reflection: Explaining a Bridge).

### Embedded Formative Assessment

**On-the-Fly Assessment 15: Reading with a Purpose**

**Look for:** As you circulate, make note of how well students are able to use their sticky notes to mark passages in the text that are relevant to the purpose for reading, and check that their purpose is related to balanced forces, gravity, or making explanations. Are students able to identify passages that might be related to their purpose? Do they relate the information in the book to what they have learned about these topics in earlier lessons?

**Now what:** If students have trouble focusing on their purpose as they read, ask them to state the purpose for reading, find a passage in the book that relates to that purpose, and mark it with a sticky note. Have students write a brief description on their sticky note of why they think that passage helps them with their purpose for reading. Then, ask some students who have marked passages to explain why the passages they have marked relate to the purpose. You might have students explain their choices to each other or to the class. Next time they are asked to read with a purpose, you might pair students who have been successful at this strategy with those who have needed more support.

### Teacher Support

**Instructional Suggestion**

**Providing More Experience: Today’s Daily Written Reflection**

_How have you acted like a scientist so far during this unit about forces and the floating train?_ This prompt (on page 46 in the Investigation Notebook) asks students to think back over the unit so far and consider activities they have done that scientists do as part of their work. Ideas students may mention include solving problems, asking questions, setting goals, working in teams, investigating, reading, writing, using evidence, making models and diagrams.
Concluding Discussion

Students discuss *Explaining a Bridge* and reflect on balanced forces and making explanations, one of the unit’s key science practices.

**Instructional Guide**

1. Invite pairs to share the evidence they found about the reading purpose. Call on a pair to share some of the related evidence they found.

2. Project the first Think-Pair-Share Question. For each of the following two questions, conduct a Think-Pair-Share routine.

   **Pregunta 1 de Pensar-Juntarse-Compartir**

   ¿Qué fuerzas están en equilibrio para mantener estable el Puente de la Bahía? Vayan a la página 13 del libro para ver un diagrama que puede ayudarles a contestar.

   ¿Qué fuerzas están en balance para mantener estable el Puente de la Bahía? Ve a la página 13 del libro para que veas un diagrama que puede ayudarte a contestar.
   [Una fuerza de contacto ascendente ejercida por los cables y una fuerza de gravedad descendente ejercida por la Tierra].

   Piensen.
3. Project the second question.

**Pregunta 2 de Pensar-Juntarse-Compartir**

¿Por qué es importante para los/as científicos/as y los/as ingenieros/as explicar ideas científicas a la gente de la comunidad?

¿Por qué es importante para los científicos y los ingenieros explicar ideas científicas a los miembros de la comunidad?

[La gente quiere entender por qué los puentes y otras estructuras que usa el público están construidas de esa forma. También quiere saber por qué pueden confiar en que estas estructuras son seguras para usarse].

4. Introduce and post the next key concept. Read aloud the key concept and post it to the wall.

When two forces act on an object in opposite directions, the forces can be in balance.

5. Conclude the lesson. Tell students that in the next lesson, they will make their own explanations, describing for the people of Faraday why the train floats.
Establecer un propósito para leer Explicando un puente

Directions:
1. Discute con tu compañero/a y establece un propósito para leer Explicando un puente.
2. Chequea para verificar que tu propósito te ayudará a explicarle a la gente de Faraday por qué el tren flota aunque la gravedad está actuando sobre él.
3. Lee Explicando un puente y marca las partes en el libro que estén relacionadas con tu propósito de lectura.
4. Toma notas acerca de lo que encontraste en el libro.

Propósito de lectura: Aprender más sobre ______________________

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Notas acerca de lo que leíste que está relacionado con tu propósito de lectura:

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