

# From Grass to Bridge



**Unit 4**  
Creative  
Solutions



## Lesson Plan

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## Answer Key: From Grass to Bridge

### page 10—Context Clues

Responses may vary. Examples:

1. **Word:** *cords*

**Location of clues:** All options are acceptable.

**Types of clues:** comparison, description, or example

**Meaning of word:** a thin, weak rope made from twisting threads

2. **Word:** *festival*

**Location of clues:** sentence with the word, sentences after the word, image

**Types of clues:** description or example

**Meaning of word:** a celebration of something with many people and activities

### page 11—Tempting Tourists

Responses may vary. Example:

1. The bridge has been in the same spot for at least 500 years.
2. A grass called ichu is the basic building block for the bridge.
3. People braid ropes to make thick cables.
4. The bridge's architect takes the lead to remake the bridge.

**Conclusion:** Remaking the bridge together is a way to honor the past.

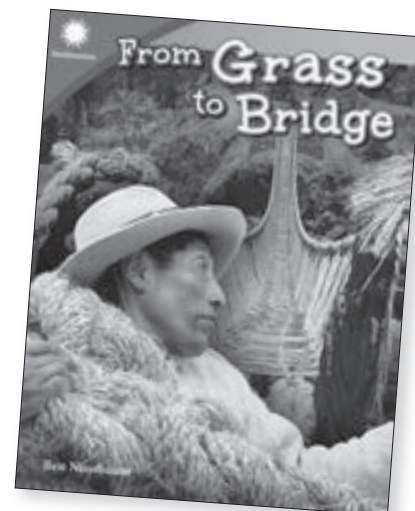
### page 17—From Grass to Bridge Quiz

- |      |   |
|------|---|
| 1. D | 4. B  |
| 2. C | 5. <i>Ichu</i> is a grass with long stalks used to build the Q'ueswachaka bridge. |
| 3. A |   |

# From Grass to Bridge

## Materials

- ▶ *From Grass to Bridge* books
- ▶ copies of student activity sheets (pages 9–19)
- ▶ plastic markers for bingo
- ▶ **STEAM Challenge materials include but are not limited to the following:**
  - ✓ 2 desks or chairs, separated 7 inches (drying time)
  - ✓ craft sticks (200 per team)
  - ✓ masking tape (1 roll per team)
  - ✓ notebook or small textbook
  - ✓ PVA glue (may be used in place of masking tape; requires
  - ✓ ruler
  - ✓ scissors
  - ✓ sticky notes (3 per team)
  - ✓ stopwatch



## Learning Objectives

- ▶ **Reading:** Determine the meaning of general academic and domain-specific words and phrases in a text.
- ▶ **Writing:** Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
- ▶ **Speaking and Listening:** Engage effectively in a range of collaborative discussions with diverse partners on grade-appropriate topics and texts, building on and expressing ideas clearly.
- ▶ **Engineering:** Define an engineering problem, design and evaluate solutions, and optimize a design based on test results.

## Phenomena

Well-designed bridges remain stable and support weight.

## Lesson Timeline

Day 1	Day 2	Day 3	Day 4	Day 5–10
<b>Introductory and Before Reading Activities</b> (page 4)	<b>During Reading Activities</b> (page 5)		<b>After Reading Activities</b> (page 5)	<b>STEAM Challenge and Assessments</b> (pages 6–8)
Define the STEAM Challenge, and practice finding the meaning of new words using text features.	Research bridge types, find the meaning of new words using context clues, and brainstorm design solutions.		Write a website article describing an event.	Design, build, test, improve, reflect on, and share model bridges. Complete the assessments.

# From Grass to Bridge<sub>(cont.)</sub>

## STEAM Vocabulary

abutment architect compression foundation tension tourist

### Introductory Activity

#### Define the Problem

1. Ask students to draw a bridge. Ask them to include details, such as where the bridge is located, what it is made from, who uses it, and what the bridge connects to.
2. Sort students into pairs and have them share their drawings. Ask them to discuss similarities and differences between their drawings. Invite them to share their findings with the class.
3. Distribute the *From Grass to Bridge* books to students. Reveal the STEAM Challenge by reading aloud pages 28 and 29 of the book.
  - Display the Interactiv-eBook for a more digitally enhanced introduction to the challenge.
4. Distribute *Make a Plan* (page 9) to students. Have them summarize the challenge. Summaries should include constraints and criteria. Provide the following sentence frame to help students summarize: *Make a \_\_\_\_\_ using \_\_\_\_\_ that is \_\_\_\_\_ long and holds \_\_\_\_\_.*

**Note:** You may wish to distribute all student activity sheets as one packet. They will be used throughout the STEAM Challenge.

### Before Reading

1. Write the vocabulary words on the board and discuss their meanings. Challenge student pairs to sort the words into categories. For example, students might sort *abutment* and *foundation* into a category for *parts of a bridge*. Ask students to explain their reasoning for their groupings. Have students sort the words into new categories and discuss any categories they might not have mentioned.
2. Tell students that they are likely to encounter unfamiliar words when learning about new topics. Explain that the main text and text features, such as images and captions, give clues about the meanings of words. Point out that the text before and after the word can provide context clues about the meaning of a word. Context clues could be a comparison, description, definition, example, synonym, or antonym.
  - Have **below-level learners** practice locating text features in the *From Grass to Bridge* books.
3. Display page 22 of *From Grass to Bridge* book. Read the sentence containing the word *bridgemaster* and the sentence after it. Give students time to observe the images on the page and ask them how the two sentences and images help them determine the meaning of the word.



# From Grass to Bridge<sub>(cont.)</sub>

## During Reading

### Research and Brainstorm

1. Distribute the *From Grass to Bridge* books to students. Read pages 4–9 together. Ask students to make lists of new words as they read. Pause periodically to demonstrate how to find the meanings of words using context clues from the text and text features. For example, ask students how the images and sentences before and after *resource* on page 4 and *paved* on page 9 help explain each word's meaning.
  - ▮ Display the Interactiv-eBook for a more digitally enhanced reading experience. You may wish to have students annotate the PDFs as you read.
  - ▮ Play the audio recording as students follow along to serve as a model of fluent reading. This may be done in small groups or at a listening station. The recording will help **English language learners** practice fluency and aid in comprehension.
2. Distribute *Context Clues* (page 10) to students. Review the types and locations of context clues listed on the activity sheets. Ask students to use clues in the book to find the meanings of the words given on the activity sheets. Have students read the rest of the book in pairs. Ask them to discuss any other new words and use context clues to find their meanings.
  - ▮ Challenge **above-level learners** to find more new or interesting words in the text and identify context clues that helped them understand the meanings of the words.
3. Have students record ideas for their designs on their *Make a Plan* activity sheets.

## After Reading

1. Play vocabulary bingo to review the vocabulary words. Have students make  $3 \times 3$  grids on sheets of paper to make bingo boards. Ask students to write one vocabulary word in each square in random order. Have them fill the remaining squares with other glossary words from the book. Read descriptions of the words or show images that depict the words while students cover the appropriate places with bingo markers. Students win when they cover a row, a column, or a diagonal line.
2. Distribute the *From Grass to Bridge* books to students. Discuss with students that when authors introduce new ideas, they include facts, definitions, and details to develop the topic.
3. Distribute *Tempting Tourists* (page 11) to students. Tell students that they will record facts, definitions, and details from the text to plan articles about the annual gathering of villagers to remake the Q'ueswachaka Bridge in Peru. They should imagine the articles will be posted on a tourist website about Peru. Explain that they should include only the most important points, so tourists can get an overall idea of the event and the bridge without having to read a long article.
  - ▮ Challenge **above-level learners** to use persuasive language that encourages tourists to visit the bridge.

# From Grass to Bridge<sub>(cont.)</sub>

## Prep

- ▶ Review all designs prior to building.
- ▶ Prepare all materials for the STEAM Challenge.

## STEAM Challenge

### Design and Build

1. Discuss the following questions as a class to connect the reading to the STEAM Challenge:
  - ▶ *Why did the Inka build bridges?* Discuss how the Inka built bridges to connect roads over deep canyons, which helped people travel from place to place.
  - ▶ *What types of materials are used to build bridges?* Guide students to the idea that engineers use various types of materials (e.g., grass, concrete, iron) to build bridges around the world. Ask students to provide examples from the text.
2. Distribute previously completed activity sheets to students. Review the STEAM Challenge on pages 28 and 29. List materials on the board and show students the notebook or textbook that will be placed on their bridges for testing.
3. Show students images of different types of bridges from the book. Invite students to share what they like about different bridges and any ideas they might try in their designs.
4. Ask students to independently sketch and label two designs on their *Make a Plan* activity sheets.
5. Organize students into teams. Distribute one copy of *Collaborative Design* (page 12) to each team. Ask teams to have each member share their designs. Then, have groups choose, sketch, and label a team design. Ask students to specify the number of craft sticks used on each part of the bridge. (Team designs must be submitted for approval before building.)
6. Challenge **above-level learners** by adding constraints (e.g., limit time students have to build, limit the amount of tape).
  - ▶ You may choose to digitally record students' processes to share at a later date with students and parents.
7. Distribute *Think about It* (page 13) to students. Explain that reflection is an important part of the engineering design process. Read aloud questions 1 and 2 on the activity sheets and have students write their responses. Ask volunteers to share.



# From Grass to Bridge<sub>(cont.)</sub>

## Prep

- ▶ Review all designs prior to building.
- ▶ Prepare all materials for the STEAM Challenge.
- ▶ Prepare testing area by placing 2 desks or chairs 7 inches apart.

## STEAM Challenge

### Test and Improve

1. Discuss the following questions as a class to connect the reading to the STEAM Challenge:
  - ▶ *How did the Inka improve their bridges?*  
Discuss how Inka bridges remained in place for hundreds of years and that local people tested and rebuilt bridges using more stable methods and materials.
  - ▶ *Why is it important for villagers to work together to rebuild the Q'ueswachaka Bridge?*  
Guide students to the idea that collaboration is essential to rebuilding the bridge. Highlight that different tasks are involved and that every member of the village plays an important role.
2. Gather teams to test their bridges. Explain that they will offer friendly feedback after each test. Use *Friendly Feedback* (page 14) to review best practices for giving feedback.
3. Distribute *Bridge Test Results* (page 15) to students. Ask them to record results for each team. Allow time for each team to test their designs. Place a notebook or textbook on top of the bridge for 30 seconds. Successful bridge designs will retain their structure during and after the test. Ask volunteers to give friendly feedback and suggestions.
4. Allow time for teams to brainstorm ways to improve designs based on feedback and suggestions. Explain that teams may either rebuild their bridges or make improvements to their models.
5. Refer students back to their *Collaborative Design* activity sheets. Ask them to sketch their improved designs and explain any changes. Have students submit improved designs for approval before building.
  - ▶ Challenge **above-level learners** and successful teams with additional constraints or criteria for the second design (e.g., build models using fewer sticks, increase the number of books).
6. Have teams improve their designs. Then, have them retest their bridges.
7. Have students answer questions 3 and 4 on their *Think about It* activity sheets.



# From Grass to Bridge<sub>(cont.)</sub>

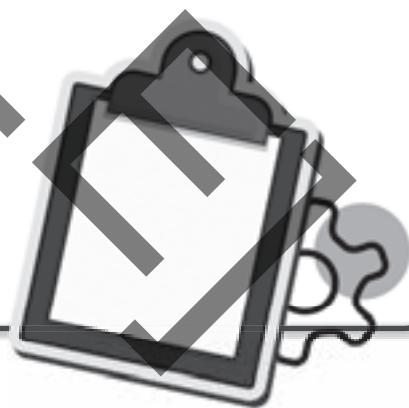
## STEAM Challenge

### Reflect and Share

1. Distribute three sticky notes to each team. On the first one, ask students to discuss and record how they used ideas from others to improve their designs. On the second one, have students suggest two materials they would like to use to improve their designs. On the last one, ask students to state what they enjoyed most about the challenge.
2. Collect the sticky notes and read the responses to the class as you place them on the board. Ask students to suggest ways to sort the sticky notes. Once sorted, ask students to share any commonalities, differences, or other patterns they notice.
3. Have students answer question 5 on their *Think about It* activity sheets.
4. Distribute *Engineering Design Process* (page 16) and review how students used each step to complete the challenge. Have them annotate the infographics with details specific to this challenge.
5. Read “Career Advice” on page 32 of the book. Ask students to brainstorm other tips for a career in architecture.

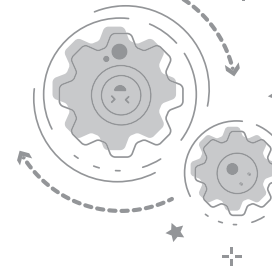
### Assessment Activities

1. Have students complete the short posttest, *From Grass to Bridge Quiz* (page 17), to assess the lesson’s objectives.
2. Students may complete the Interactiv-eBook activities in the Digital Resources for assessment purposes.
3. Have students complete *Teamwork Rubric* (page 18) and *Engineering Design Process Checklist* (page 19) to reflect on and evaluate their work and collaboration skills.
4. Have students complete the Read and Respond questions from the book. Possible answers to these questions can be found in the Digital Resources ([grassbridge\\_reproducibles.pdf](#)).



Name: \_\_\_\_\_

Date: \_\_\_\_\_



# Make a Plan

**Directions:** Summarize the challenge. Brainstorm ideas and sketch two designs. Circle your favorite.

**Challenge:** \_\_\_\_\_

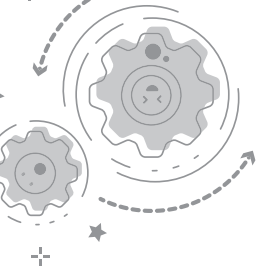
\_\_\_\_\_

\_\_\_\_\_

**Brainstorm**

**Design 1**

**Design 2**



Name: \_\_\_\_\_

Date: \_\_\_\_\_

# Context Clues

**Directions:** Find each word in the book. Mark the locations and types of context clues that helped you make meaning. Then, write the meaning of the word.

**Word:** *cords*, page 10

## Locations

- ☐ sentence with the word
- ☐ sentence before the word
- ☐ sentence after the word
- ☐ image
- ☐ caption

## Types

- ☐ comparison
- ☐ definition
- ☐ description
- ☐ example
- ☐ synonym
- ☐ antonym

**Meaning of Word:** \_\_\_\_\_

**Word:** *festival*, page 26

## Locations

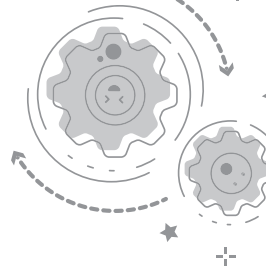
- ☐ sentence with the word
- ☐ sentence before the word
- ☐ sentence after the word
- ☐ image
- ☐ caption

## Types

- ☐ comparison
- ☐ definition
- ☐ description
- ☐ example
- ☐ synonym
- ☐ antonym

**Meaning of Word:** \_\_\_\_\_

Name: \_\_\_\_\_ Date: \_\_\_\_\_



# Tempting Tourists

**Directions:** Plan an article for a tourist website. Write at least three facts, definitions, or details from the book. Then, write a conclusion that re-states the topic.

**Title:** Remaking a Historic Bridge

**Topic:** Each year, villagers come together to remake the Q'ueswachaka Bridge.

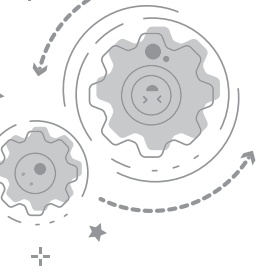
1.

2.

3.

4.

**Conclusion:**



Team Members: \_\_\_\_\_

Date: \_\_\_\_\_

# Collaborative Design

**Directions:** Sketch your team's design in the first box. Sketch your team's improved design in the second box. Label each design with materials needed and the purpose of each part.

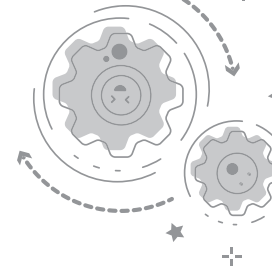
Design 1

Design 2



Name: \_\_\_\_\_

Date: \_\_\_\_\_



## Think about It

1. It was (hard/easy) to create one team design because \_\_\_\_\_

---

---

2. I helped my team by \_\_\_\_\_

---

---

3. Our design (failed/passed) the test because \_\_\_\_\_

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To improve our design, we \_\_\_\_\_

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4. Our improved design (worked/did not work). I know this because \_\_\_\_\_

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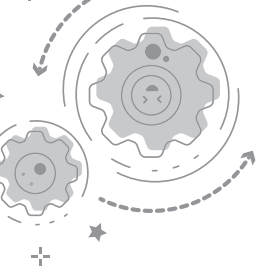
5. During the challenge, I learned \_\_\_\_\_

---

---

I liked \_\_\_\_\_

It was hard when \_\_\_\_\_



Name: \_\_\_\_\_

Date: \_\_\_\_\_

# Friendly Feedback

**Directions:** Feedback can help people improve their work. Use these sentence stems to give feedback to your peers.

## Clarify

Can you explain \_\_\_\_\_?

Why did you choose to \_\_\_\_\_?

How did you \_\_\_\_\_?

## Warm Feedback

I like \_\_\_\_\_ because \_\_\_\_\_.

It is interesting that \_\_\_\_\_.

\_\_\_\_\_ is a good idea because \_\_\_\_\_.

## Cool Feedback

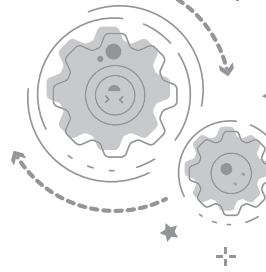
Have you thought about \_\_\_\_\_?

I wonder if \_\_\_\_\_.

You might want to try \_\_\_\_\_.

Name: \_\_\_\_\_

Date: \_\_\_\_\_



# Bridge Test Results

**Directions:** Write the data for each team's bridge. Record test results by circling yes or no. Then, answer the questions.

Team	Number of Sticks Used	Did the bridge hold the book for 30 seconds?
		yes/no
		yes/no
		yes/no
		yes/no
		yes/no
		yes/no

Where does your bridge need more support?

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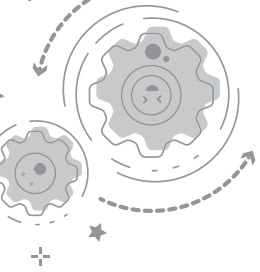
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How will you use the class data to improve your team's design?

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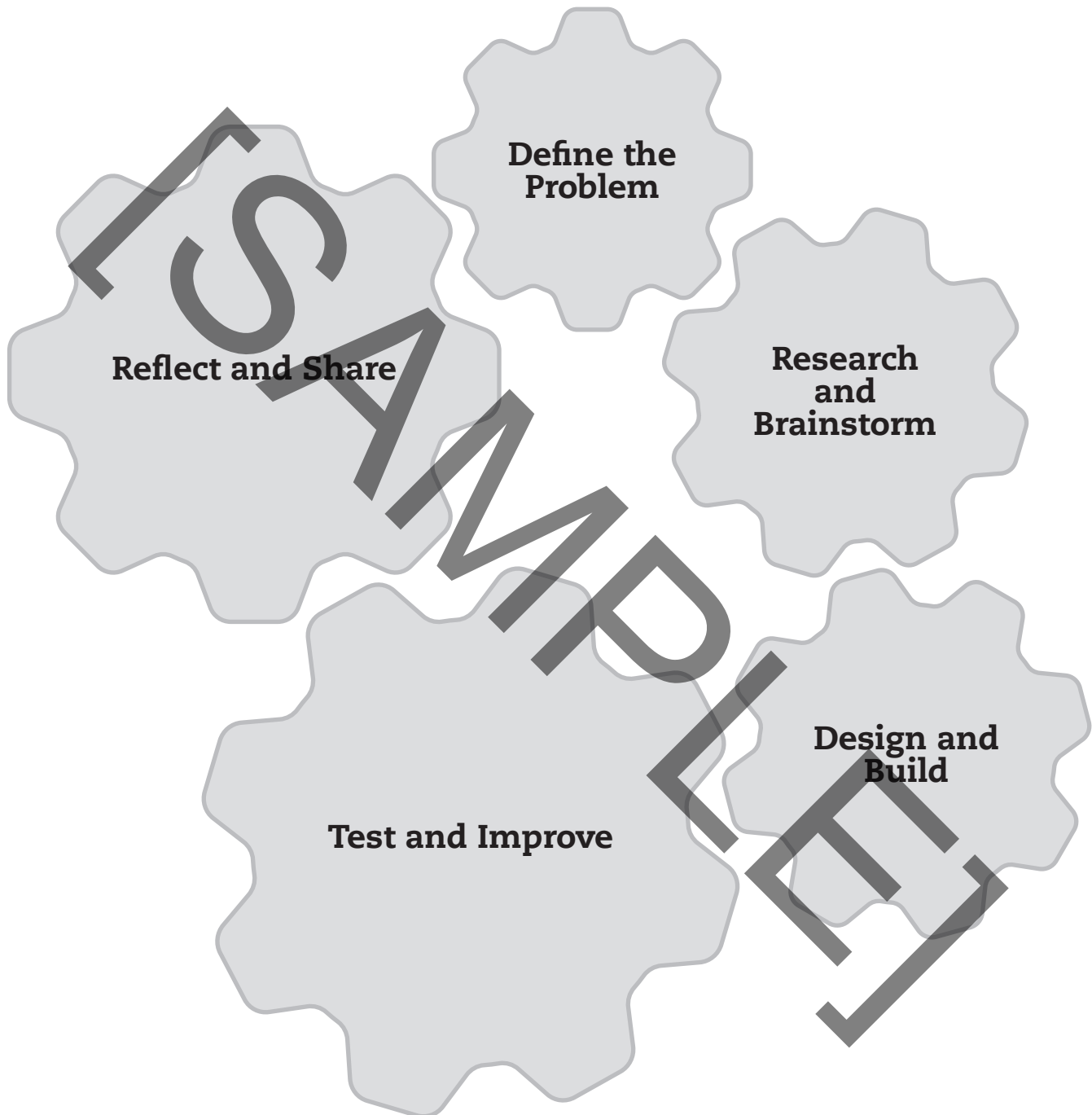
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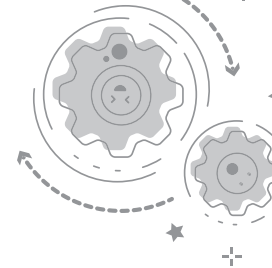


Name: \_\_\_\_\_

Date: \_\_\_\_\_

# Engineering Design Process





## From Grass to Bridge Quiz

**Directions:** Read each question. Choose the best answer. Fill in the bubble for the answer you have chosen. Answer the last question in complete sentences.

1. Which word means "able to sense very small changes"?

☐ (A) accurate  
☐ (B) retrofit  
☐ (C) intense  
☐ (D) sensitive

3. Which sentence uses a synonym to help readers understand *city-state*?

☐ (A) Each one was like a small country.  
☐ (B) There were many city-states.  
☐ (C) Cusco was a city-state.  
☐ (D) The city-state took over a large area.

2. The image on page 25 helps readers understand the meaning of which word?

☐ (A) mortar  
☐ (B) fique  
☐ (C) solar panels  
☐ (D) architect

4. The bridge's \_\_\_\_\_ directs the annual rebuilding of the Q'ueswachaka Bridge.

☐ (A) tourists  
☐ (B) architect  
☐ (C) villagers  
☐ (D) toll

5. What does the term *ichu* on page 10 mean?

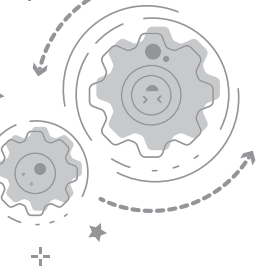
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Name: \_\_\_\_\_

Date: \_\_\_\_\_

# Teamwork Rubric

**Directions:** Think about how you worked in your team. Score each item on a scale of 1 to 4.

4 = Always    3 = Often    2 = Sometimes    1 = Never

I listened to people on my team.	4	3	2	1
I helped people on my team.	4	3	2	1
I shared ideas with people on my team.	4	3	2	1
We made choices as a team.	4	3	2	1
<b>Total</b>				

**Comments:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_



# Engineering Design Process Checklist

**Directions:** Check the boxes to show that you completed each step.

## Define the Problem

- ☐ I understood and explained the problem in my own words.

## Research and Brainstorm

- ☐ I used research to help me brainstorm solutions.

## Design and Build

- ☐ I planned and made a model.
- ☐ I thought like a mathematician.

## Test and Improve

- ☐ I used criteria to evaluate designs.
- ☐ I improved designs based on test results.
- ☐ I thought like a mathematician.

## Reflect and Share

- ☐ I shared my results and reflected on my work.



# STEAM CHALLENGE

## Define the Problem

You are a civil engineer. The city planner seeks your advice on a new bridge. She has asked you to design a model of a bridge that will be used by cars, bikes, and travelers on foot. Use what you have learned about ancient and modern bridges to complete this task!

**Constraints:** The bridge must extend 7 inches. You can use 200 craft sticks and a roll of tape to build your bridge.

**Criteria:** Your bridge must be able to hold a textbook for 30 seconds.

## 1 Research and Brainstorm

What type of bridge will you build? Which part of a bridge must withstand the most force? Will you use all the materials available?

## 2 Design and Build

Sketch your bridge design. Include how many sticks you will use to build each part of the bridge. Where will you use the tape? Build the model. Make note of any changes you make to the plan.

## 3 Test and Improve

Test your bridge by setting a textbook on the bridge. Was the model successful? Did any part of the bridge fail during the test? How can you improve it? Modify your design, and try again.

## 4 Reflect and Share

Would more of either material improve the strength and stability? Could you make a successful bridge using fewer materials? What other forces do you think engineers consider when designing bridges?





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