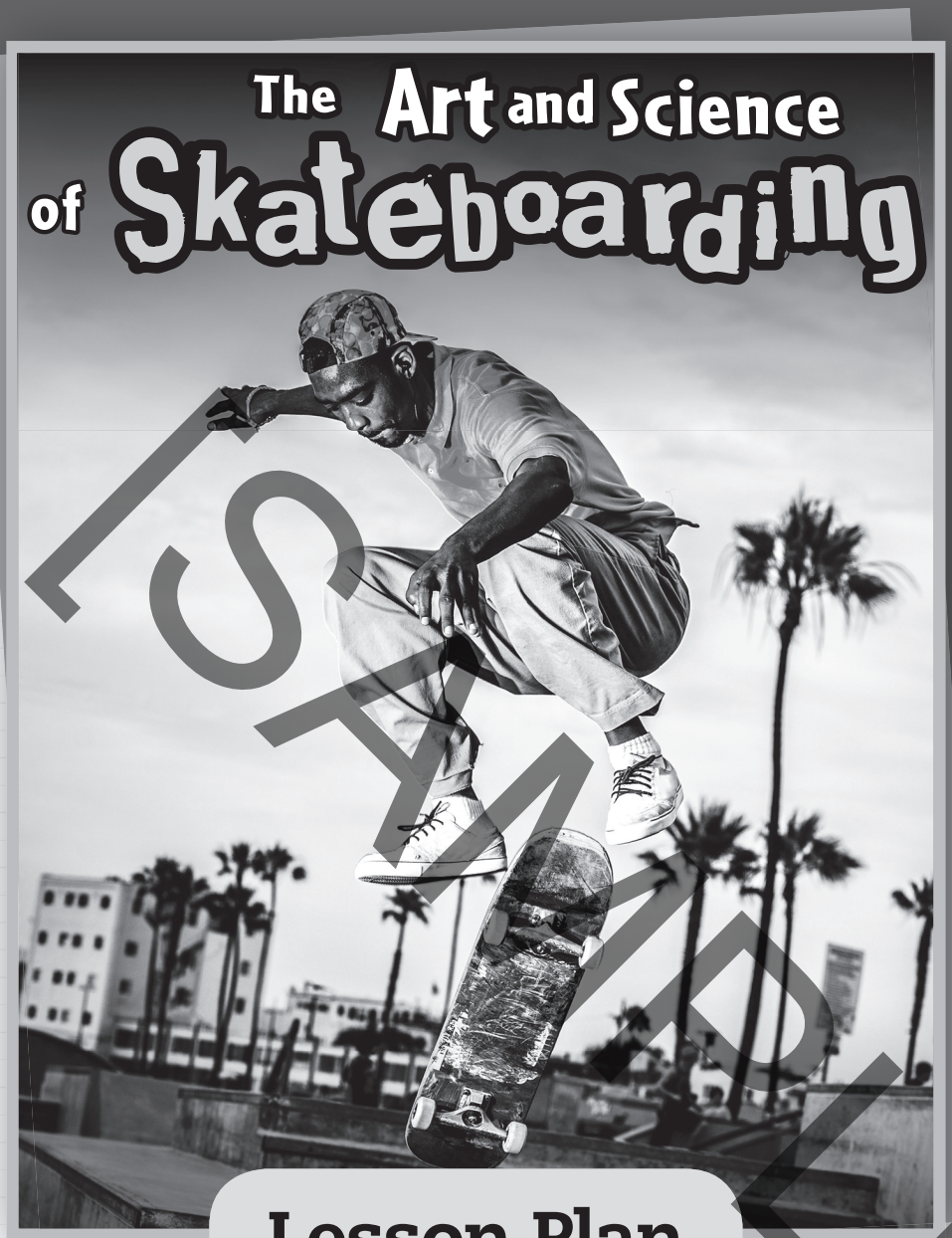


Unit 4
Creative Solutions

Lesson Plan

Author
Allison Duarte

Smithsonian STEAM Readers

Science ■ Technology ■ Engineering ■ Arts ■ Mathematics

Teacher Created Materials PUBLISHING

5301 Oceanus Drive
Huntington Beach, CA 92649-1030
www.tcmpub.com

TCM 29040 (i21057)
ISBN 978-1-4938-6825-4

Smithsonian

ISBN-13: 978-1-4938-6825-4
90000
9 781493 868254

Series Consultant

Sally Creel, Ed.D.
STEM & Innovation Supervisor/
Professional Development Consultant

Grade Level Consultant

Stephanie Anastasopoulos
TOSA, STREAM Integration
Solana Beach School District

Publishing Credits

Rachelle Cracchiolo, M.S.Ed., *Publisher*
Conni Medina, M.A.Ed., *Editor in Chief*
Diana Kenney, M.A.Ed., NBCT, *Content Director*
Véronique Bos, *Creative Director*
Melissa Laughlin, *Editor*
Robin Erickson, *Art Director*
Mindy Duits, *Senior Graphic Designer*
Marissa Dunham, M.A., *Assistant Editor*

Carol O'Donnell, *Director*, *Smithsonian Science Education Center*
Carol LeBlanc, *Senior Vice President of Consumer and Education Products*
Brigid Ferraro, *Vice President of Consumer and Education Products*
Smithsonian Science Education Center

Image credits

all images from iStock and/or Shutterstock

References to digital components are included for educators who purchased the full kit: *Smithsonian STEAM Readers: Grade 5*. Please disregard digital component references if this lesson was purchased in a different product configuration.

Answer Key: *The Art and Science of Skateboarding*

page 10—Skate Summary

Responses will vary. Example:

1950s; The first modern skateboard was made by attaching roller skate wheels to wooden planks.

1972; Frank Nasworthy used polyurethane wheels to make skateboards, which made skateboarding smoother and safer.

1976–78; Skaters started skating in empty swimming pools during a drought in California in the late 1970s.

1978; Allan "Ollie" Gelfand invented a trick now known as an ollie in which skaters jump in the air with their boards.

1995; Skateboarding was part of the first X Games, and people started viewing skateboarding as a professional sport.

page 11—Skateboarding Basics

Responses will vary. Example:

Deck; On top for skaters to stand on; piles of sugar maple wood pressed together; It has a unique, concave design which makes the board stronger, easier to control, and allows skaters to perform tricks.

Wheels; attached to trucks on the bottom; polyurethane, a type of plastic; The durable wheels allow a skateboard to roll.

Trucks; under the deck; aluminum or other metals; Trucks allow a skater to steer the skateboard.

1. Skaters can expect to see many people with different skill levels. Beginners can learn from more experienced skaters at a skate park.
2. Beginner skaters usually start by attempting the kick turn, a basic and essential trick that also helps skaters learn to stay steady on their boards.

page 17—*The Art and Science of Skateboarding* Quiz

1. B
2. D
3. B
4. C
5. Responses will vary. Example: California surfers first started making skateboards in the 1950s with wooden planks and roller skate wheels, which they used to skate on boardwalks.

The Art and Science of Skateboarding

Materials

- *The Art and Science of Skateboarding* books
- copies of student activity sheets (pages 9–19)
- index cards
- pocket chart or chart paper
- poster board (optional)
- **STEAM Challenge materials include but are not limited to the following:**
  - ✓ aluminum foil
  - ✓ cardboard pieces (various sizes)
  - ✓ construction paper
  - ✓ craft sticks or mini toy skateboards
  - ✓ glue
  - ✓ large cardboard pieces (base of designs)
  - ✓ masking tape
  - ✓ modeling clay
  - ✓ pipe cleaners
  - ✓ straws
  - ✓ toothpicks

Learning Objectives

- **Reading:** Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.
- **Writing:** Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.
- **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

Earth's gravity causes objects to fall toward Earth. Friction causes moving objects to slow.

Lesson Timeline

Day 1	Day 2	Day 3	Day 4	Days 5–10
Introductory and **Before Reading Activities** (page 4)	**During Reading Activities** (page 5)		**After Reading Activities** (page 5)	**STEAM Challenge** and **Assessments** (pages 6–8)
Define the STEAM Challenge, and practice summarizing the text.	Research skateboards, summarize key events in the history of skateboarding, and brainstorm design solutions.		Create beginner's guides to skateboarding with labeled diagrams of a skateboard.	Design, build, test, improve, reflect on, and share models of a skate park. Complete the assessments.

The Art and Science of Skateboarding (cont.)

STEAM Vocabulary

aspect durable engineers
essential urban

Introductory Activity

1. Display to students the cover of *The Art and Science of Skateboarding*, and read the title aloud. Discuss with students the types of activities that skaters perform and the equipment they use. Ask students to use their previous knowledge about the sport to predict how both art and science are involved in skateboarding.
2. Distribute *The Art and Science of Skateboarding* books to students. Reveal the STEAM Challenge by reading aloud pages 28 and 29 of the book. As you read, explain each step of the engineering design process.
   - Display the Interactiv-eBook for a more digitally enhanced introduction to the challenge.
3. 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 model of a _____ that has _____.*

   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 index cards. Discuss the meanings of the words. Create a word wall in a pocket chart or on chart paper. Have students help you arrange the words in a way that makes sense. Try several variations. Accept any arrangement as long as students can justify it. Continue to change and add to the word wall throughout the lesson.
2. Explain to students that readers can summarize texts by telling the most important parts in their own words. Point out that summaries should include the main idea of the text and any key details, but that minor details can be left out.
3. Read aloud the sidebar on page 11 of *The Art and Science of Skateboarding* book. Ask volunteers to state the main idea (i.e., "Trucks come in different heights.") and details (e.g., low trucks make a board more stable; each height is engineered for a specific riding style).
   - Discuss the word *truck* with **English language learners.** Point out how it has a different meaning than *automobile*. Help them make connections between the two, such as a skateboard truck is to steer and a truck you drive needs someone to steer it.
4. Read the text a second time. Divide the class into pairs and ask each pair to come up with a one-sentence summary of the text, such as "Trucks are made in different heights to allow skaters to use them for different purposes and riding styles."

The Art and Science of Skateboarding (cont.)

During Reading

Research and Brainstorm

1. Distribute *The Art and Science of Skateboarding* books to students. Read pages 4–11 aloud. Pause periodically to summarize sections in the text. For example, on page 10, point out that a summary of the section "The Wheels," includes the main idea (wheels are the part that make the skateboard roll) and important details (they are made of polyurethane; they come in different shapes, sizes, and hardness).
   - 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 *Skate Summary* (page 10) to students. Have students read the books in pairs. Ask them to summarize sections in the text as they read. Have students write summaries of five key events in skateboarding history on the activity sheets.
   - Support students by writing one or more of the summaries with them.
3. Have students record ideas they have for their designs on their *Make a Plan* activity sheets.

After Reading

1. Write the vocabulary words on the board and review their meanings. Have students describe personal experiences related to the words. For example, perhaps a coat was *essential* for a cold winter day, or someone used a pair of *durable* boots during a hike. Have students share their experiences with the class, using vocabulary words in their descriptions.
2. Tell students that diagrams are visual ways to share information. Explain how diagrams include images and labels that add to readers' understanding of topics. Tell them that diagrams typically don't have room for a lot of text, so they only include the most important information.
3. Distribute *Skateboarding Basics* (page 11) to students. Tell students that they will gather relevant information from the text about the features of a skateboard and explain what a skater can expect to see and do at a skate park. Have them work in pairs to plan beginner's guides for skateboarding using their graphic organizers.
4. Have students create beginner's guides for skateboarding on separate sheets of paper or poster boards. Ask students to include diagrams of skateboards based on details from the text and labels that point out features of the boards.
   - Challenge students to include research from additional sources and include a list of sources.

The Art and Science of Skateboarding (cont.)

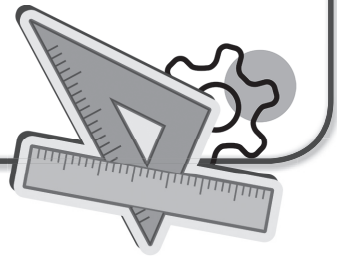
Prep

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

STEAM Challenge

Design and Build

1. As a class, discuss the following questions to connect the reading to the STEAM Challenge:
   - *How did a drought in the 1970s influence skateboarding?* Guide students to recall that people emptied their swimming pools, and skaters used them to practice vertical tricks in the 1970s. Help students recognize that swimming pools led to concrete skate parks that included similar shapes to pools.
   - *What types of surfaces do skaters use to grind?* Have students recall that skaters perform the grinding trick on an edge, such as a curb, rail, or ledge. Ask them to think about what they could include in their designs to allow skaters to grind.
2. Distribute previously completed activity sheets. Review the STEAM Challenge on pages 28 and 29. List materials on the board, and demonstrate how students will use half of a craft stick or a mini toy skateboard and their fingers to perform a kick turn, ollie, and grind (see pages 20–24 for a review of each). Explain to students that they will build their models on top of a piece of cardboard so that it can be easily transported, but that they are free to change the shape of the cardboard base if they wish.
3. Ask students to independently sketch and label two designs on their *Make a Plan* activity sheets.
4. Organize students into teams. Distribute one copy of *Collaborative Design* (page 12) to each team. Ask teams to have members share their designs. Then, have each group choose, sketch, and label a team design. (Team designs must be submitted for approval before building begins.)
   - Challenge students by adding constraints or criteria (e.g., the skate park must represent the city in some way, it must include an area for spectators).
5. Explain to students that when they build their models, they must follow their design plans. Reassure them that they will have an opportunity to change and improve their designs after they present them. Review classroom expectations for working with materials. Then, give teams time to gather materials and build models.
   - Digitally record students' processes to share at a later date with students and parents.
6. 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.



The Art and Science of Skateboarding (cont.)

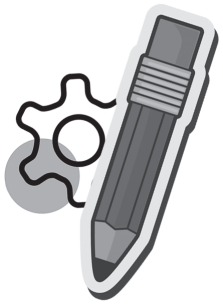
Prep

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

STEAM Challenge

Test and Improve

1. As a class, discuss the following questions to connect the reading to the STEAM Challenge:
   - *What type of technology do engineers use to design skate parks?* Lead students to the idea that engineers use computer software to design skate parks, which allows them to build 3-D models of parks, plan areas for tricks, and inspect soil under parks.
   - *How is creativity encouraged in skateboarding?* Make sure students discuss that skaters often invent new tricks, engineers look for interesting ways to design skate parks, and designers look for ways to improve equipment.
2. Gather teams for testing. Invite teams to bring their skate park models to a table for testing. Explain that teams will offer feedback after the test. Use *Friendly Feedback* (page 14) to review best practices for giving feedback.
3. Distribute *Skate Park Test Results* (page 15) to students, and ask them to record results for each team.
4. Allow time for teams to test their models. Have one member of each team use half of a craft stick or a mini toy skateboard and their fingers to show how and where tricks can be performed in the models. A successful model includes safe areas for beginners and experts, and at least three attractions where skaters can safely kick turn, ollie, and grind. Ask volunteers to give friendly feedback.
5. Provide time for teams to brainstorm ways to improve their designs based on test results and feedback. 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 successful teams with additional constraints or criteria for the second design (e.g., invent a new trick, and design a space for it in the model).
6. Have teams gather materials to improve their designs. Then, have them make improvements and retest their skate parks.
7. Have students answer questions 3 and 4 on their *Think about It* activity sheets.



The Art and Science of Skateboarding (cont.)

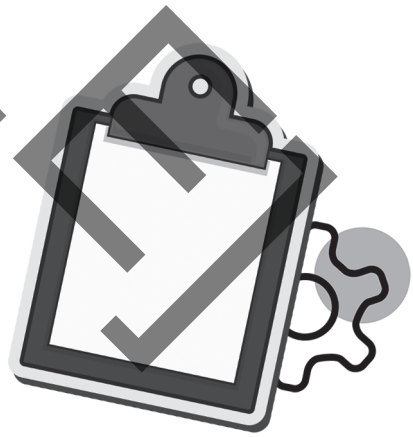
STEAM Challenge

Reflect and Share

1. Write on the board the following quote by Tony Hawk: "I love the fact that there is now a skate park in almost every city, but it will always have a rebellious/underground edge to it because it is based on individuality." Discuss with students how this quote points out that skateboarding has both a collaborative and individual nature. Ask students to suggest how the quote relates to their experiences during the STEAM Challenge. Have students provide examples of how teamwork and their individual ideas and contributions were essential for success.
2. Allow time for students to create original quotes that reflect their team experiences. Invite students to share their quotes with the class. Post or reference the quotes to motivate students during other class activities and projects.
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 working with skateboards.

Assessment Activities

1. Have students complete a short posttest, *The Art and Science of Skateboarding Quiz* (page 17), to assess the lesson's objectives.
   - Students may complete the Interactiv-eBook activities in the Digital Resources for assessment purposes.
2. Have students complete *Teamwork Rubric* (page 18) and *Engineering Design Process Checklist* (page 19) to reflect on and evaluate their work and collaboration skills.
3. Have students complete the Read and Respond questions from the book.
   - Possible answers to the questions can be found in the Digital Resources (skateboarding_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

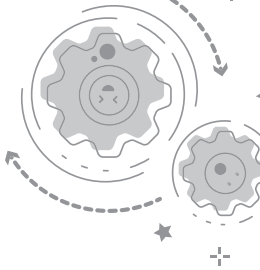
Name: _____ Date: _____

Skate Summary

Directions: Summarize five important events or time periods in the history of skateboarding.

Year or Time Period	Summary of the Event

Name: _____ Date: _____



Skateboarding Basics

Directions: Record information from the text that describes the anatomy of a skateboard. Answer the questions to explain what a beginner can expect to see and do at a skate park.

Skateboard Feature	Location	Material	What does it allow skaters to do?

1. What can a skater expect to see at a community skate park?

_____

_____

_____

_____

2. What tricks should a beginner attempt?

_____

_____

_____

Team Members: _____

Date: _____

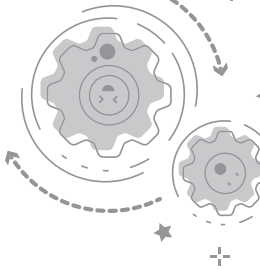
Collaborative Design

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. What did your team struggle with? How did you deal with it? _____

_____

_____

_____

2. How did you contribute to your team? _____

_____

_____

3. How did you use science, technology, engineering, the arts, and/or math in your designs? _____

_____

_____

_____

_____

_____

4. What was successful about your first design? How did you improve it? _____

_____

_____

_____

5. What is the most important thing you learned? What questions do you still have?

_____

_____

_____

_____

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 _____ .

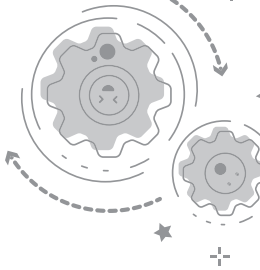
Cool Feedback

Have you thought about _____ ?

I wonder if _____ .

You might want to try _____ .

Name: _____ Date: _____



Skate Park Test Results

Directions: Write the materials each team used and which features were included. Mark the areas included in each team's model. Then, answer the question.

Team	Materials	Features (ledges, rails, curbs, etc.)	Designated Areas Included
			☐ beginner ☐ expert ☐ to kick turn, to ollie, and to grind
			☐ beginner ☐ expert ☐ to kick turn, to ollie, and to grind
			☐ beginner ☐ expert ☐ to kick turn, to ollie, and to grind
			☐ beginner ☐ expert ☐ to kick turn, to ollie, and to grind
			☐ beginner ☐ expert ☐ to kick turn, to ollie, and to grind
			☐ beginner ☐ expert ☐ to kick turn, to ollie, and to grind

Which design do you think is the most unique? Explain.

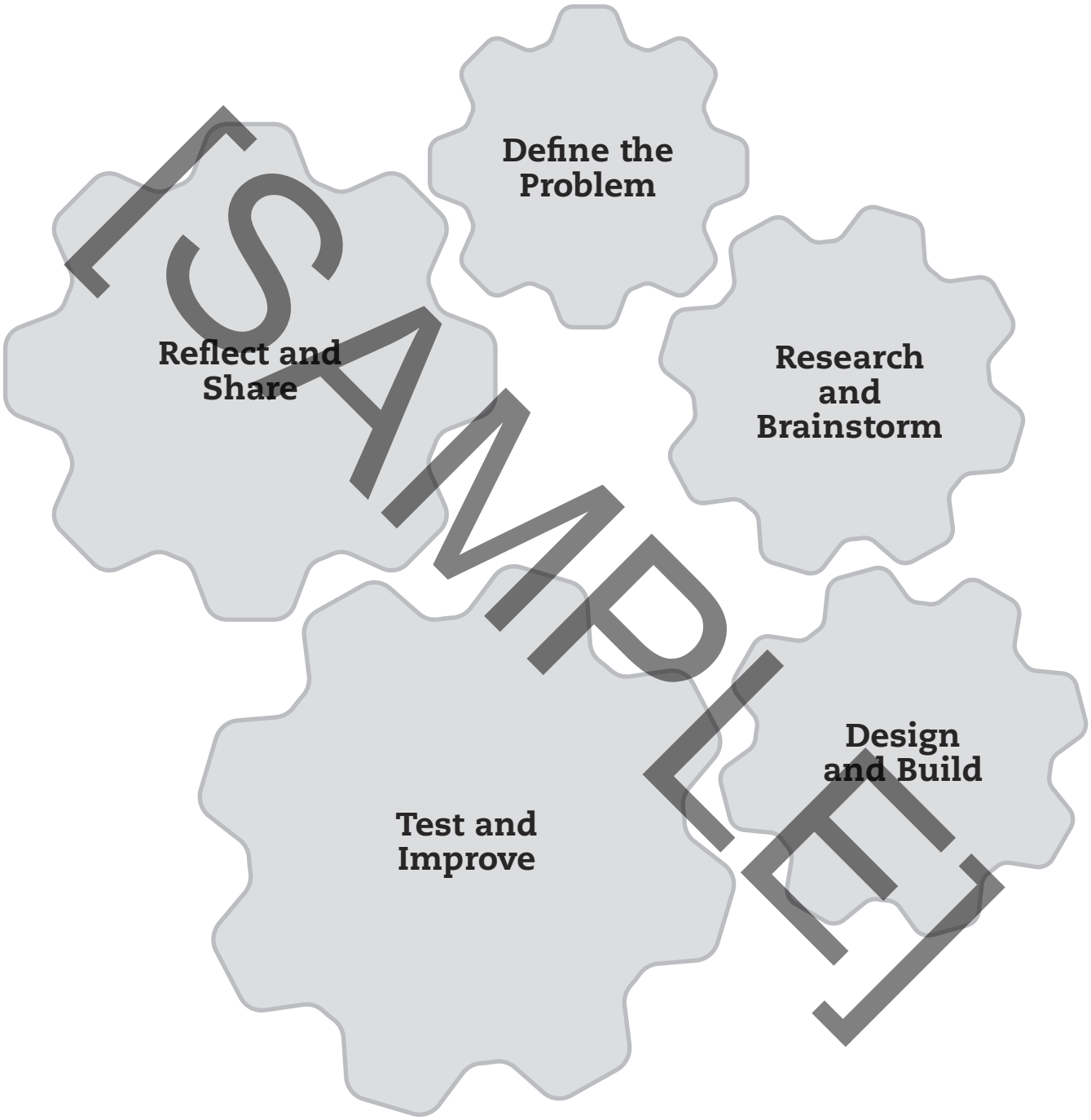
_____

_____

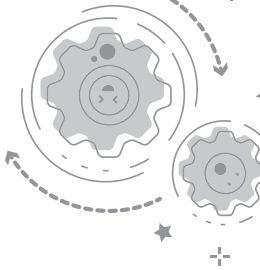
_____

Name: _____ Date: _____

Engineering Design Process



Name: _____ Date: _____



The Art and Science of Skateboarding Quiz

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

1. Which detail explains why kick turns are an essential trick?

- (A) Kick turns are when the skater pushes down on the tail of the board.
- (B) Practicing kick turns helps skaters learn to balance on their boards.
- (C) The kick turn has defined skateboarding.
- (D) Kick turns can be completed at any angle.

2. A summary of a nonfiction text includes _____.

- (A) inferences about the text
- (B) descriptions of images
- (C) minor details from a text
- (D) the most important ideas of a text

3. Which major event in the history of skateboarding happened in 1978?

- (A) The Z-boys performed at a conference.
- (B) Alan Gelfand discovered how to do an ollie.
- (C) Polyurethane wheels were invented.
- (D) California surfers created modern surfboards.

4. Each _____ of a skateboard serves a unique purpose.

- (A) traction
- (B) menace
- (C) aspect
- (D) patent

5. Summarize how skateboards were first made in the 1950s.

_____

_____

_____

_____

_____

Name: _____ Date: _____

Teamwork Rubric

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

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
Total				

What is one thing your team did well? _____

_____

_____

What could your team do better next time? _____

_____

What else do you want your teacher to know about your team? _____

_____

_____

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 or an engineer.

Test and Improve

- ❑ I used criteria to evaluate designs.
- ❑ I improved designs based on test results.
- ❑ I thought like a mathematician or an engineer.

Reflect and Share

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

STEAM CHALLENGE

Define the Problem

Engineers consider many things when designing safe and unique skate parks. They test the size, angle, surface material, and shape of ramps so that skaters can use them to practice and invent tricks. Your task is to design and build a model of a new skate park for your community.

Constraints: The design must be safe and useful for skaters. It must include at least three attractions where skaters can kick turn, ollie, and grind. There must be a safe area for both beginners and experts.

Criteria: Your model must clearly show different areas of the park where tricks can be practiced safely.

1 Research and Brainstorm

What types of tools do engineers use to design skate parks? What attractions are popular for beginners? What attractions are popular for experts?

2 Design and Build

Sketch your park design. What purpose will each part serve? What materials will work best? Build the model.

3 Test and Improve

Test your model. Use a piece of a craft stick and your fingers to show how tricks should be performed. Did they work? How can you improve the park? Modify your design, and try again.

4 Reflect and Share

How would you modify your attractions if almost all the people who visit your park are beginners? What were the biggest challenges you faced when designing your skate park?