

St. Patrick's Day

STEM



Rainbow Arch Bridge challenge

CREATED BY BROOKE BROWN

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How to Use

The following STEM/STEAM challenge is designed to be completed with partners or in small groups. You will need to allow 30-45 minutes for the full activity to be completed. Needed supplies are inexpensive and can be found in your classroom or at most craft stores.

Components

LESSON PLAN

- Overview
- Skills
- Read Aloud Ideas
- Supplies

STUDENT INSTRUCTIONS

QR CODE WEBSITES & VIDEOS

TEACHER ANCHOR CHART

STEM CHALLENGE: Rainbow Arch

OVERVIEW: Students will discover the strength of arched bridges by constructing a rainbow-shaped bridge out of pipe cleaners and playdough. They will attempt to balance a "pot of gold" (mini cup) on top of the arch and add pennies to the cup to test the strength of their bridge.

KEY SKILLS: Engineering arched bridges, Weight distribution, Balance, (Standard weight measurement)

SUGGESTED READ ALONGS: *Building Bridges* by Terry End, *Bridges! Amazing Structures* by Carol A. Johnson, *A Book of Bridges* by Cheryl Keely

MATERIALS PER GROUP: playdough (one 4 oz. or two 3 oz. cans), 10 pipe cleaners, mini cup, 30 pennies

LESSON PLAN

1. Activate students' prior knowledge by asking them to share what they already know about bridges. Ask them to share different styles of bridges they've seen and show the arched bridge might hold weight differently. Share and discuss the videos on "Explore Bridges."
2. Hold a class discussion, using the teacher chart and real world examples to guide student thinking. You can project the chart on an interactive whiteboard or document camera. Record their ideas on the teacher chart.
3. Introduce the STEM challenge and permitted materials.
4. Introduce and discuss key vocabulary cards related to the challenge.
5. Have students sketch blueprints of their designs on their recording sheets.
6. Distribute materials and allow students 30-45 minutes with partners or small groups to construct their arched bridges and test their balance and strength with the pot of gold/pennies on the top.
7. Hold a whole class closing discussion and reflection, allowing students to share their arched bridge designs. Use the Let's Reflect! poster to guide the discussion.

Rainbow Arch

The leprechaun wants to keep his pot of gold safe and out of reach.

Construct an arched bridge that will hold the heaviest pot of gold without falling off.

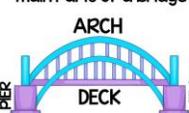
MATERIALS:

- Pipe cleaners
- Playdough
- Mini cup
- Pennies

EXPLORE BRIDGES

STRONG BRIDGES 	TYPES OF BRIDGES 
FAMOUS BRIDGES 	THE ARCH 

Rainbow Arch

REAL WORLD EXAMPLES 	Main Parts of a Bridge 
What is similar? What is different? Types of Bridges	How Bridges are Useful

KEY VOCABULARY

K-2nd RECORDING SHEET

3rd-5th RECORDING SHEET

REFLECTION DISCUSSION QUESTIONS

WORDS TO KNOW

piers  supports on the end of a bridge that withstand vertical pressure	deck  the main horizontal surface of a bridge
arch  a curved structure that goes over an opening	support  to hold weight

Rainbow Arch Name: _____

MY BLUEPRINT

Label the PIERS and ARCH.

Draw a picture of your bridge.

How many pennies does your pot of gold hold without falling off?

TEST 1
TEST 2
TEST 3

Rainbow Arch Name: _____

BLUEPRINT

How many pennies does your pot of gold hold without falling off?

TEST 1
TEST 2
TEST 3

Label the PIERS, DECK, and ARCH.

Which bridge design was strongest? Why do you think so?

LET'S REFLECT!

- What was most difficult about this challenge?
- Why are bridges important and how do they solve problems?
- Which bridge styles hold the most weight and why do you think so?
- How does the bridge that you constructed compare to a real bridge?
- What other types of structures use arches?
- If we completed this challenge again, what would you do differently next time?

Optional Google Slides Notebook

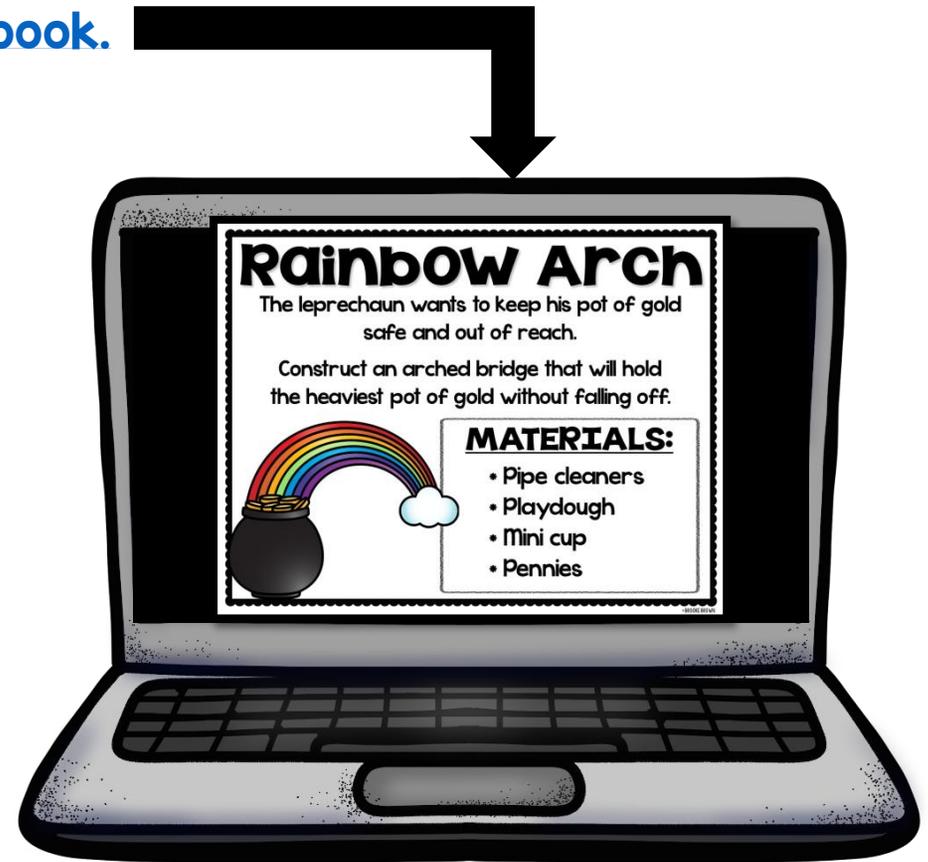
1. Download [Link for the Google Slides Notebook](#).
2. Sign into your Google Account.
3. **MAKE A COPY** of the notebook.

Each student will need their own Google account if they will be working on their own Digital Interactive notebook using Google Slides. If your students will be using iPads, they will also need to download the [Free Google Slides App](#) for the digital notebook to work properly.



Before you and your students begin editing/filling in your digital notebook, it is **VERY** important to first save a copy of the file on your own Google Drive, and then edit the copy. Your students will follow these same steps when you share the file with them.

YOU DO NOT WANT YOUR STUDENTS TO EDIT THE ORIGINAL FILE.



ASK



IMAGINE



**THE
ENGINEERING
DESIGN
PROCESS**

PLAN



CREATE



**REFLECT &
PRESENT**



**TEST &
IMPROVE**



SUPPLIES CHECKLIST

STEM CHALLENGE	ITEM	NUMBER PER GROUP	I HAVE IT
Rainbow Arch	playdough	one 4 oz. or two 3 oz.	
	pipe cleaners	10	
	mini cup	1	
	pennies	30	

STANDARDS ALIGNMENT

CHALLENGE	ENGINEERING	SCIENCE	MATH
Rainbow Arch	<p>K-2-ETSI Engineering Design: K-2-ETSI-1, 3-5 ETSI-2, 3-5 ETSI-3</p> <p>3-5-ETSI Engineering Design: 3-5-ETSI-1, 3-5 ETSI-2, 3-5 ETSI-3</p>	Tension and compression forces, measuring weight, balance and stability	<p>MP.1: Make sense of problems and persevere in solving them</p> <p>MP.2: Reason abstractly and quantitatively</p> <p>MP.4: Model with mathematics</p> <p>MP.5: Use appropriate tools strategically</p>

STEM CHALLENGE: Rainbow Arch



OVERVIEW: Students will discover the strength of arched bridges by constructing a rainbow-shaped bridge out of pipe cleaners and playdough. They will attempt to balance a “pot of gold” (mini cup) on top of the arch and add pennies to the cup to test the strength of their bridge.

KEY SKILLS: Engineering arched bridges, Weight distribution, Balance, Nonstandard weight measurement

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MATERIALS PER GROUP: playdough (one 4 oz. or two 3 oz. cans), 10 pipe cleaners, mini cup, 30 pennies

LESSON PLAN

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8. Hold a whole class closing discussion and reflection, allowing students to share their arched bridge designs. Use the “Let's Reflect” poster to guide the discussion.

Rainbow Arch

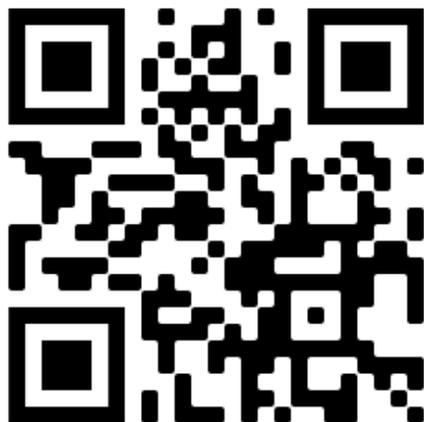
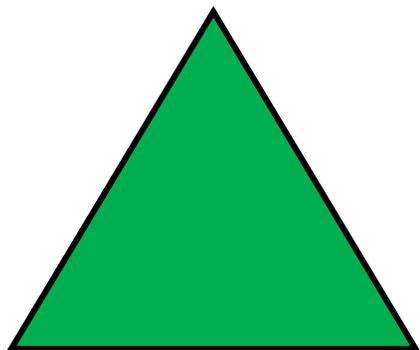
POSSIBLE PRODUCT
(for teacher reference only)



EXPLORE

BRIDGES

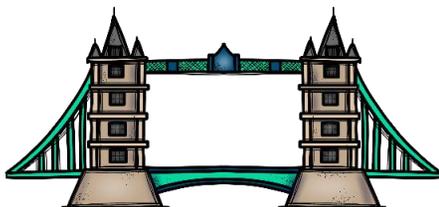
STRONG BRIDGES



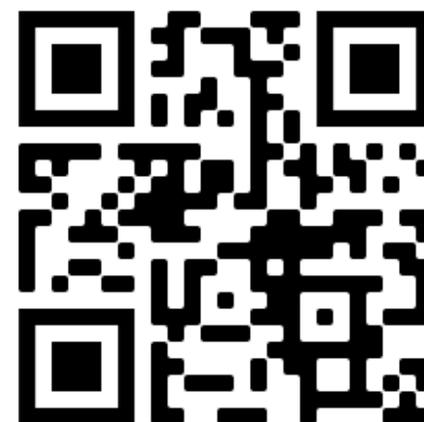
TYPES OF BRIDGES



FAMOUS BRIDGES



THE ARCH



Rainbow Arch

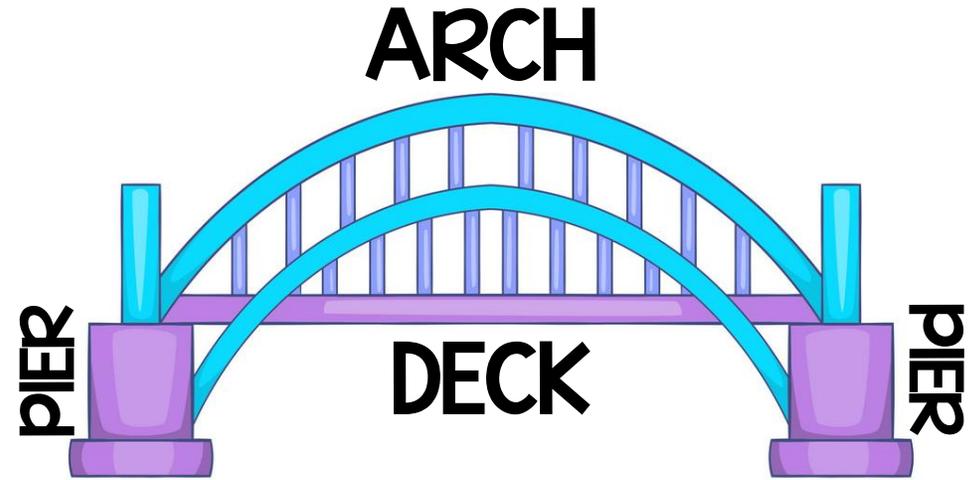
REAL WORLD EXAMPLES



What is similar? What is different?

Types of Bridges

Main Parts of a Bridge



How Bridges are Useful

Rainbow Arch

The leprechaun wants to keep his pot of gold safe and out of reach.

Construct an arched bridge that will hold the heaviest pot of gold without falling off.



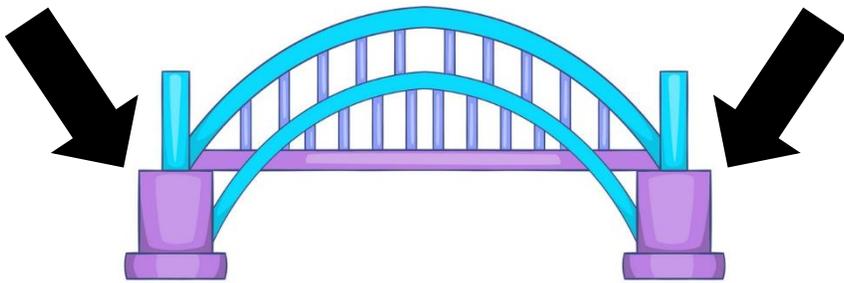
MATERIALS:

- * Pipe cleaners
- * Playdough
- * Mini cup
- * Pennies

WORDS TO KNOW

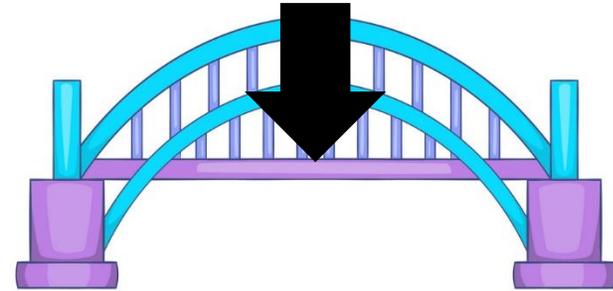


piers



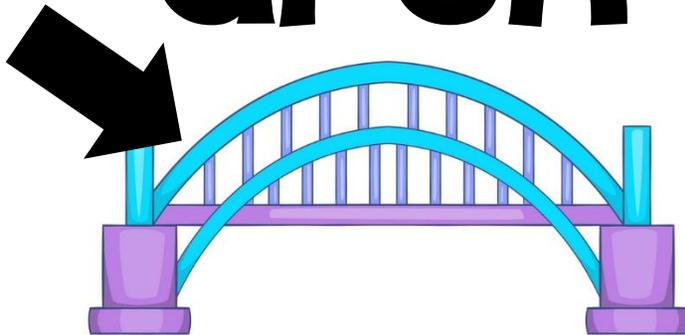
supports on the end of a bridge that withstand vertical pressure

deck



the main horizontal surface of a bridge

arch



a curved structure that goes over an opening

support



to hold weight



Rainbow Arch

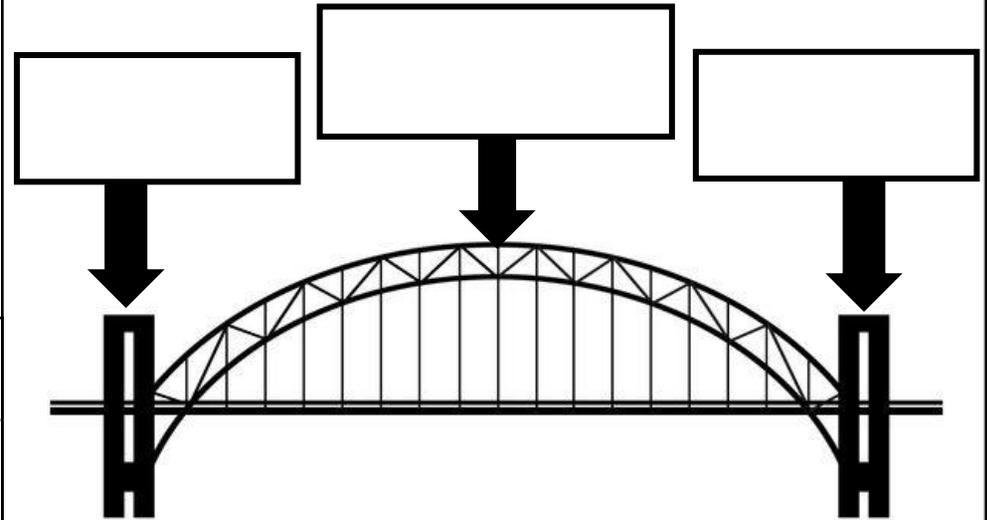
Name: _____

MY BLUEPRINT



Draw a picture of your bridge.

Label the PIERS and ARCH.



How many pennies does your pot of gold hold without falling off?

TEST 1	
TEST 2	
TEST 3	

LET'S REFLECT!



- What was most difficult about this challenge?
- Why are bridges important and how do they solve problems?
- Which bridge styles hold the most weight and why do you think so?
- How does the bridge that you constructed compare to a real bridge?
- What other types of structures use arches?
- If we completed this challenge again, what would you do differently next time?

STEM Challenge Assessment Rubric

Challenge: _____

Date: _____

Student Name: _____

3	2	1
Student followed all instructions for challenge.	Student followed some instructions for challenge.	Student did not follow instructions for challenge.
Student used best effort and perseverance on challenge.	Student used some effort and perseverance on challenge.	Student did not show effort or perseverance on challenge.
Student completed assigned blueprint and reflection sheet.	Student partially completed assigned blueprint and reflection sheet.	Student did not complete assigned blueprint and recording sheet.
Student showed accuracy in testing, calculating, and measuring.	Student showed some accuracy in testing, calculating, and measuring.	Student did not show accuracy in testing, calculating, or measuring.
Student fully cooperated with group members and contributed fairly.	Student partially cooperated with group members and contributed fairly.	Student struggled to cooperate with group members and/or failed to contribute.
Student fully participated in class discussions.	Student somewhat participated in class discussions.	Student did not participate in class discussions.

TOTAL POINTS: _____ /18

Comments: _____

STEM Challenge Assessment Rubric

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Date: _____

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TOTAL POINTS: _____ /18

Comments: _____

STEAM Challenge Assessment Rubric

Challenge: _____

Date: _____

Student Name: _____

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TOTAL POINTS: _____ /18

Comments: _____



We Need **STEM** Supplies!

Dear Families,

We are learning all about Science, Technology, Engineering, and Math through STEM lessons, and we need your help! If you are able to donate any of the following supplies for our STEM Challenges, please detach and return the form below and send back to school with your child. We greatly appreciate your support and generosity!

We are in need of the following items by _____.

Thank you so much for helping to make our STEM lessons possible!
Please contact me at _____ with any questions.

Sincerely,

If you are able to donate, please detach and return the form below:

Parent Name(s): _____

Child's Name: _____

I am able to donate: _____



We Need

STEAM Supplies!



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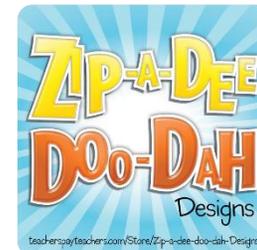
Child's Name: _____

I am able to donate: _____

credits

created by Brooke Brown

Thank you for your purchase!



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