December STEM christmas challenges

CREATED BY BROOKE BROWN

contents

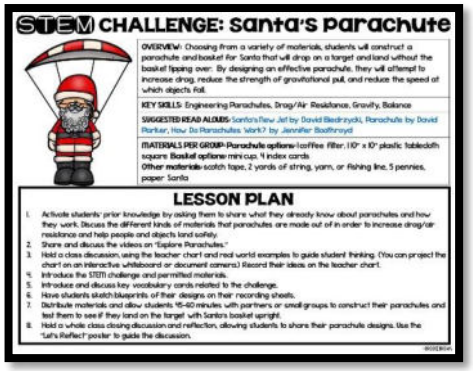
How to use

The following STEM/STEAM challenges are designed to be completed with partners or in small groups. You might choose to do activities on separate days or in the form of STEM/STEAM stations that rotate, however, you will need to allow 45-60 minutes for each activity to be completed. Needed supplies are inexpensive and can be found in your classroom or at most craft stores.

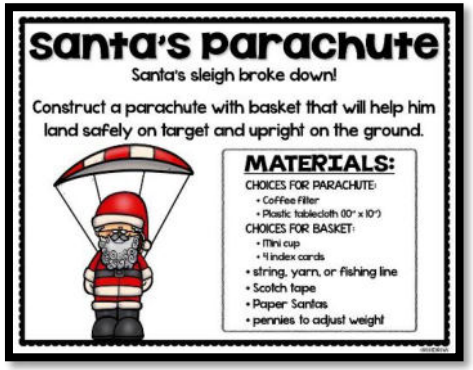
components

LESSON PLAN

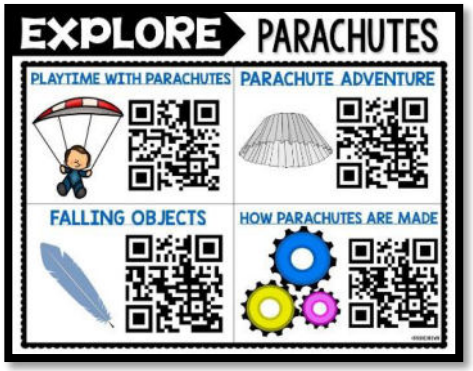
- Overview
- Skills
- Read Aloud Ideas
- Supplies



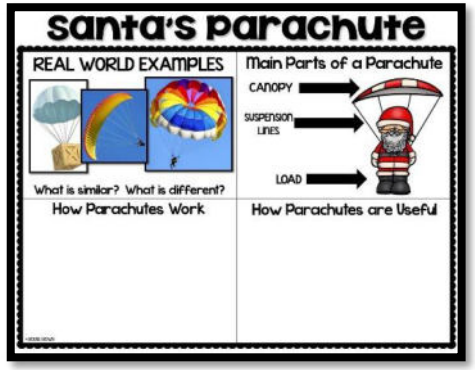
STUDENT INSTRUCTIONS



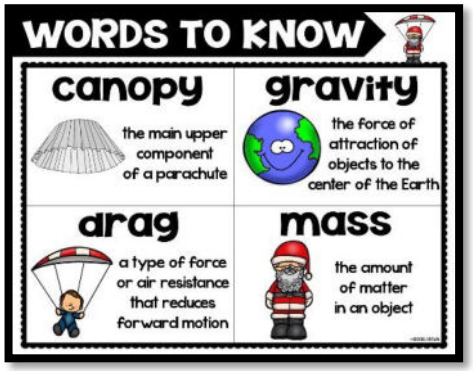
QR CODE WEBSITES & VIDEOS



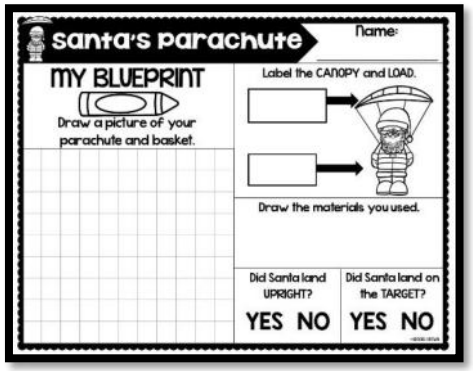
TEACHER ANCHOR CHART



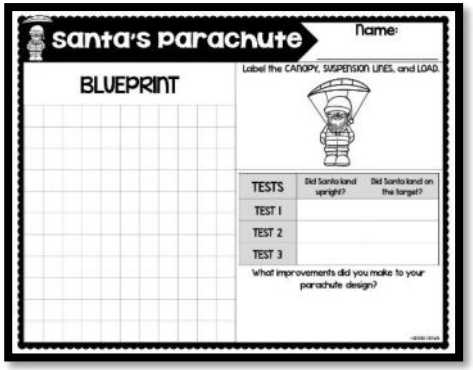
KEY VOCABULARY



K-2nd RECORDING SHEET



3rd-5th RECORDING SHEET

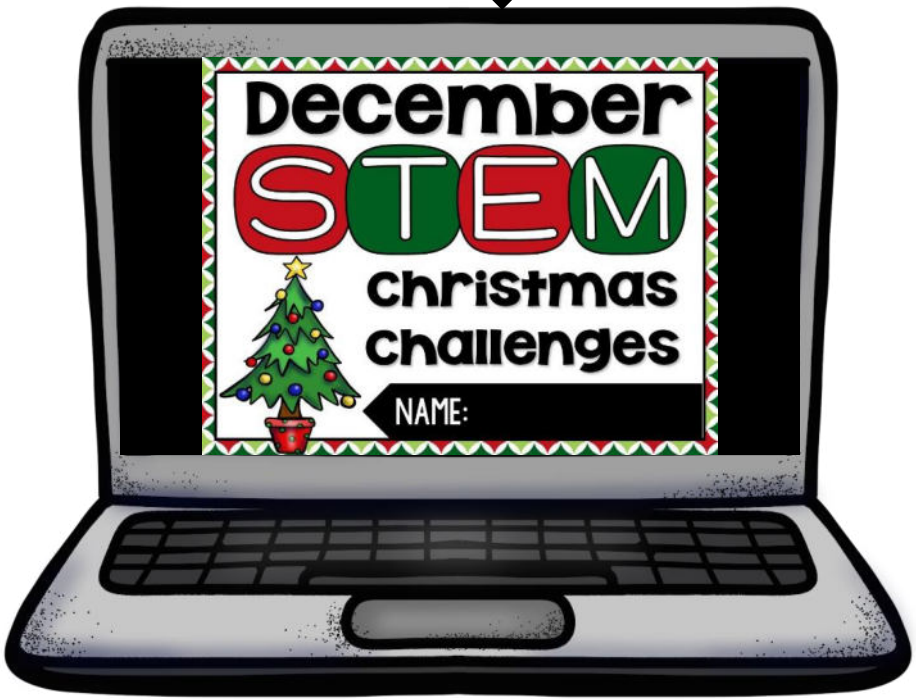


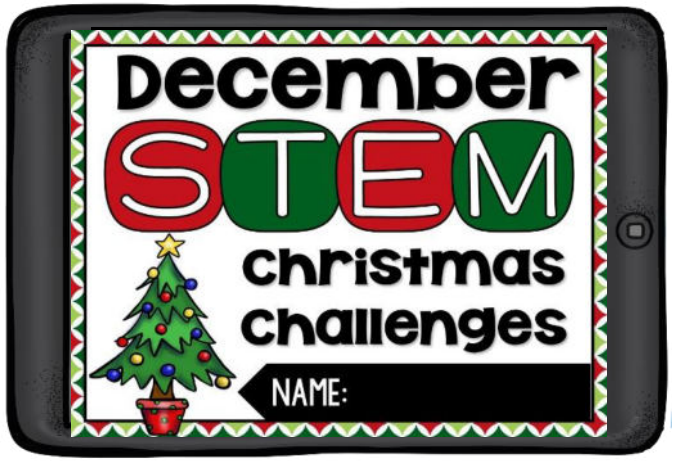
REFLECTION DISCUSSION QUESTIONS

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.

THE ENGINEERING DESIGN PROCESS

ASK

IMAGINE

PLAN

CREATE

TEST & IMPROVE

REFLECT & PRESENT

DECEMBER SUPPLIES CHECKLIST

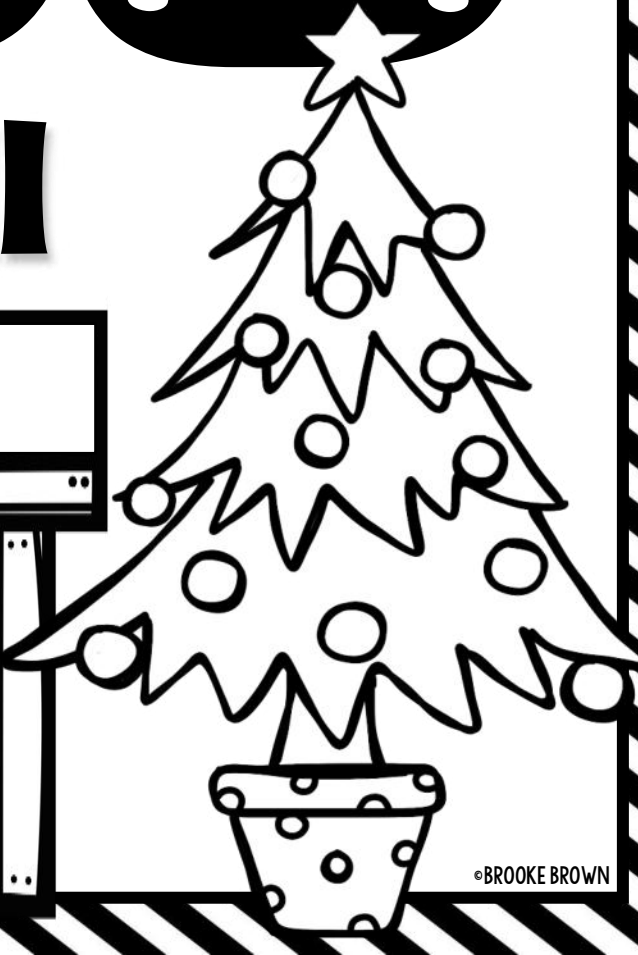
STEM CHALLENGE	ITEM	NUMBER PER GROUP	I HAVE IT
Santa's Parachute	coffee filters	1	
	thin plastic tablecloth cut into 10" x 10" squares	1	
	mini cup	1	
	index cards	4	
	Scotch tape	1 roll	
	scissors	1	
	string, yarn, or fishing line	2 yards	
	Santa cutouts	1	
	pennies	5	
Shelf for the Elf	playdough	one 4 oz. or two 3 oz.	
	popsicle sticks	20	
	elf cutout	1	
	ruler	1	
Tallest Tree	green cups (large or mini) - found at most party supply stores	24	
	ornament cutouts with tape (optional)	1 set	
	yardstick	1	
BONUS BRAINBUILDER: Gingerbread Escape	gingerbread cutout	1	
	fishing line	12 ft.	
	paperclip	1	

DECEMBER STANDARDS ALIGNMENT

CHALLENGE	ENGINEERING	SCIENCE	MATH
Santa's Parachute	K-2-ETSI Engineering Design: K-2-ETSI-I, 3-5 ETSI-2, 3-5 ETSI-3 3-5-ETSI Engineering Design: 3-5-ETSI-I, 3-5 ETSI-2, 3-5 ETSI-3	K-PS2 Motion and Stability: Forces and interactions 3-PS2 Motion and Stability: Forces and Interactions 5-PS2 Motion and Stability: Forces and Interactions	MP1: Make sense of problems and persevere in solving them MP.2: Reason abstractly and quantitatively MP.4: Model with mathematics MP.5: Use appropriate tools strategically
Tree Tower	K-2-ETSI Engineering Design: K-2-ETSI-I, 3-5 ETSI-2, 3-5 ETSI-3 3-5-ETSI Engineering Design: 3-5-ETSI-I, 3-5 ETSI-2, 3-5 ETSI-3	2.Structure and Properties of Matter •Action/Reaction forces, tension and compression forces, weight, balance, stability	MP1: Make sense of problems and persevere in solving them MP.2: Reason abstractly and quantitatively MP.4: Model with mathematics MP.5: Use appropriate tools strategically MP.6: Attend to precision MP.7: Look for and make use of structure
Shelf for the Elf	K-2-ETSI Engineering Design: K-2-ETSI-I, 3-5 ETSI-2, 3-5 ETSI-3 3-5-ETSI Engineering Design: 3-5-ETSI-I, 3-5 ETSI-2, 3-5 ETSI-3	2.Structure and Properties of Matter •Action/Reaction forces, tension and compression forces, weight, balance, stability	MP1: Make sense of problems and persevere in solving them MP.2: Reason abstractly and quantitatively MP.4: Model with mathematics MP.5: Use appropriate tools strategically MP.6: Attend to precision MP.7: Look for and make use of structure
BONUS BRAINBUILDER: Gingerbread Escape	K-2-ETSI Engineering Design: K-2-ETSI-I, 3-5 ETSI-2, 3-5 ETSI-3 3-5-ETSI Engineering Design: 3-5-ETSI-I, 3-5 ETSI-2, 3-5 ETSI-3	K-PS2 Motion and Stability: Forces and interactions 3-PS2 Motion and Stability: Forces and Interactions 5-PS2 Motion and Stability: Forces and Interactions	MP1: Make sense of problems and persevere in solving them MP.4: Model with mathematics MP.5: Use appropriate tools strategically

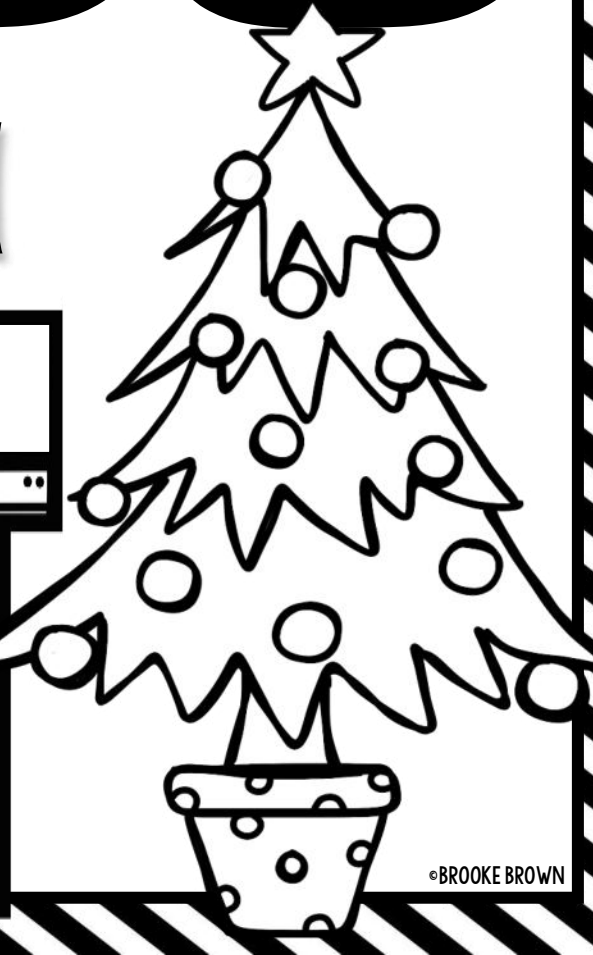
My December STEM Journal

NAME:



My December STEAM Journal

NAME:



STEM CHALLENGE: Santa's Parachute

OVERVIEW: Choosing from a variety of materials, students will construct a parachute and basket for Santa that will drop on a target and land without the basket tipping over. By designing an effective parachute, they will attempt to increase drag, reduce the strength of gravitational pull, and reduce the speed at which objects fall.

KEY SKILLS: Engineering Parachutes, Drag/Air Resistance, Gravity, Balance

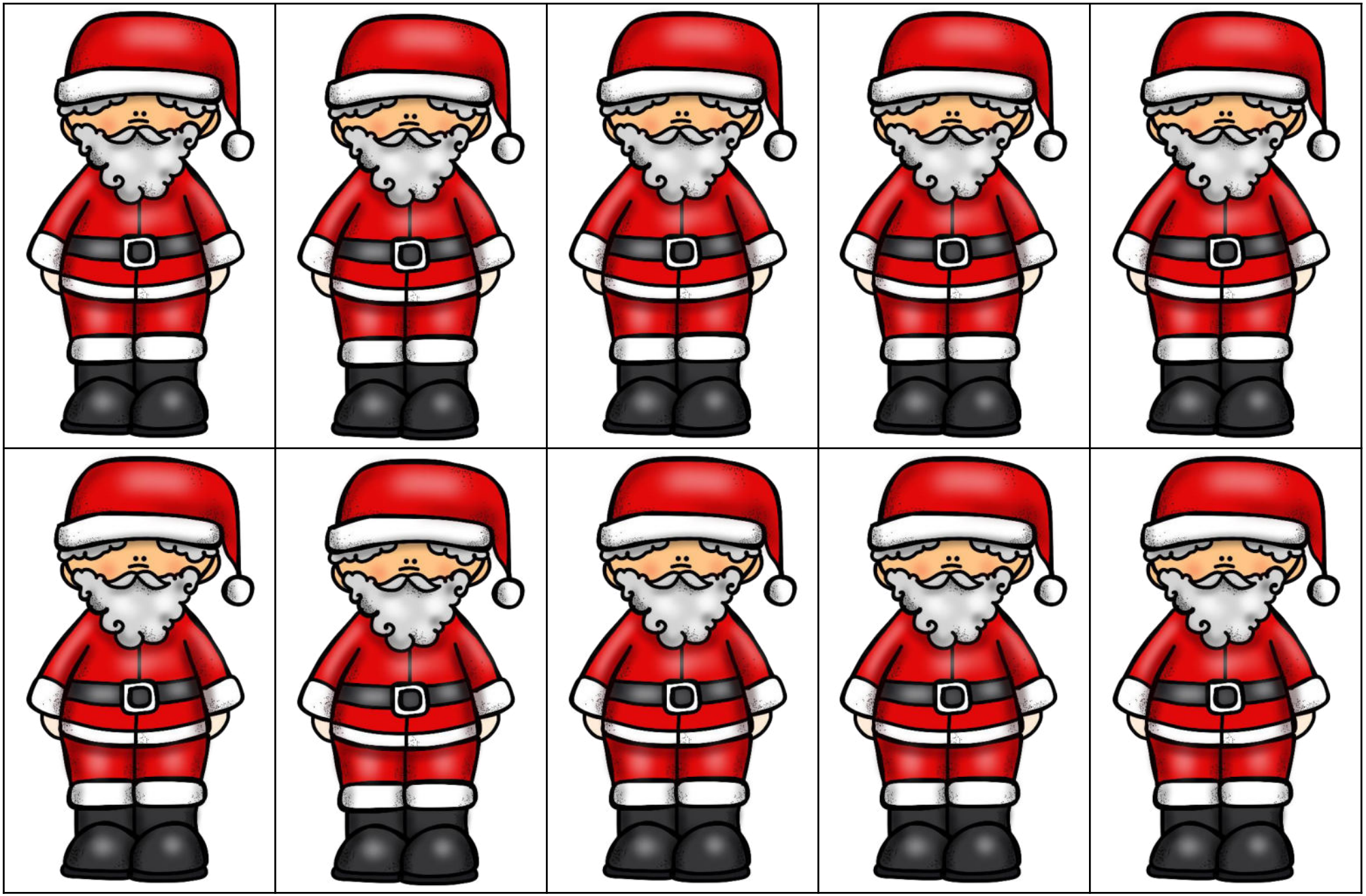
SUGGESTED READ ALOUDS: Santa's New Jet by David Biedrzycki, Parachute by David Parker, How Do Parachutes Work? by Jennifer Boothroyd

MATERIALS PER GROUP: **Parachute options:** 1 coffee filter, 1 10" x 10" plastic tablecloth square **Basket options:** mini cup, 4 index cards
Other materials: scotch tape, 2 yards of string, yarn, or fishing line, 5 pennies, paper Santa

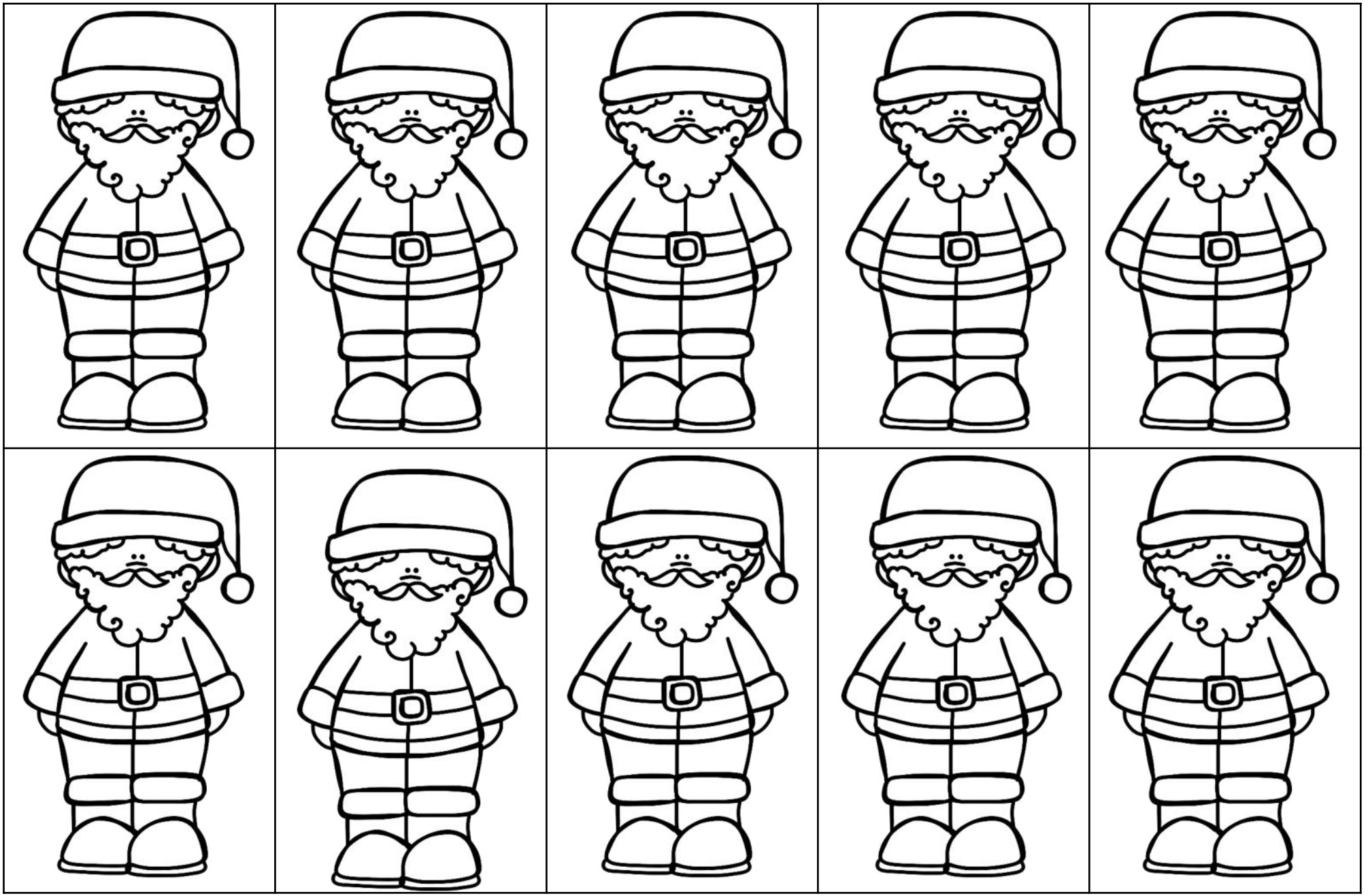
LESSON PLAN

1. Activate students' prior knowledge by asking them to share what they already know about parachutes and how they work. Discuss the different kinds of materials that parachutes are made out of in order to increase drag/air resistance and help people and objects land safely.
2. Share and discuss the videos on "Explore Parachutes."
3. 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.
4. Introduce the STEM challenge and permitted materials.
5. Introduce and discuss key vocabulary cards related to the challenge.
6. Have students sketch blueprints of their designs on their recording sheets.
7. Distribute materials and allow students 45-60 minutes with partners or small groups to construct their parachutes and test them to see if they land on the target with Santa's basket upright.
8. Hold a whole class closing discussion and reflection, allowing students to share their parachute designs. Use the "Let's Reflect" poster to guide the discussion.

Santa's Parachute Challenge



Santa's Parachute Challenge




SANTA'S
LANDING
TARGET
©BROOKE BROWN

SANTA'S LANDING TARGET

santa's parachute

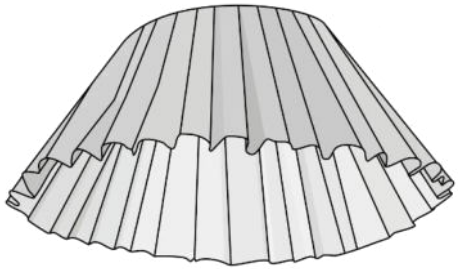
POSSIBLE PRODUCT

(for teacher reference only)

EXPLORE PARACHUTES

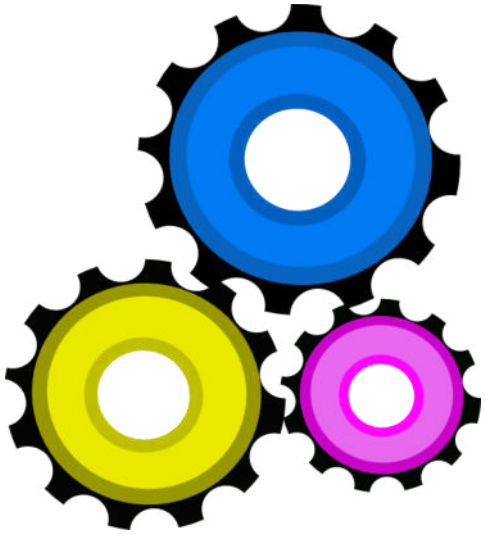
PLAYTIME WITH PARACHUTES

PARACHUTE ADVENTURE



FALLING OBJECTS

HOW PARACHUTES ARE MADE

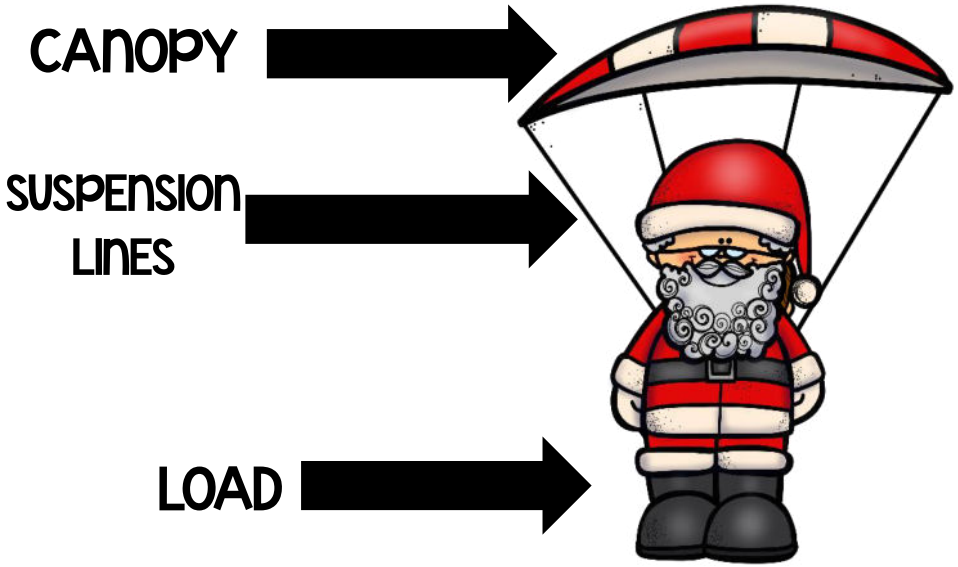


Santa's Parachute

REAL WORLD EXAMPLES

What is similar? What is different?

Main Parts of a Parachute



How Parachutes Work

How Parachutes are Useful

Santa's parachute

Santa's sleigh broke down!

Construct a parachute with basket that will help him land safely on target and upright on the ground.

MATERIALS:

CHOICES FOR PARACHUTE:

- Coffee filter
- Plastic tablecloth (10" x 10")

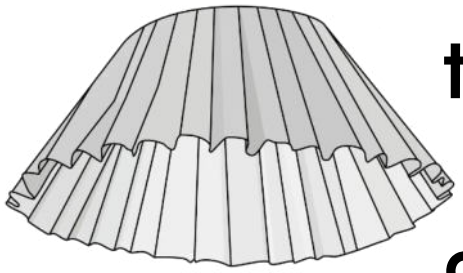
CHOICES FOR BASKET:

- Mini cup
- 4 index cards

- string, yarn, or fishing line
- Scotch tape
- Paper Santas
- pennies to adjust weight

WORDS TO KNOW

canopy



the main upper component of a parachute

gravity

the force of attraction of objects to the center of the Earth

drag

a type of force or air resistance that reduces forward motion

mass

the amount of matter in an object

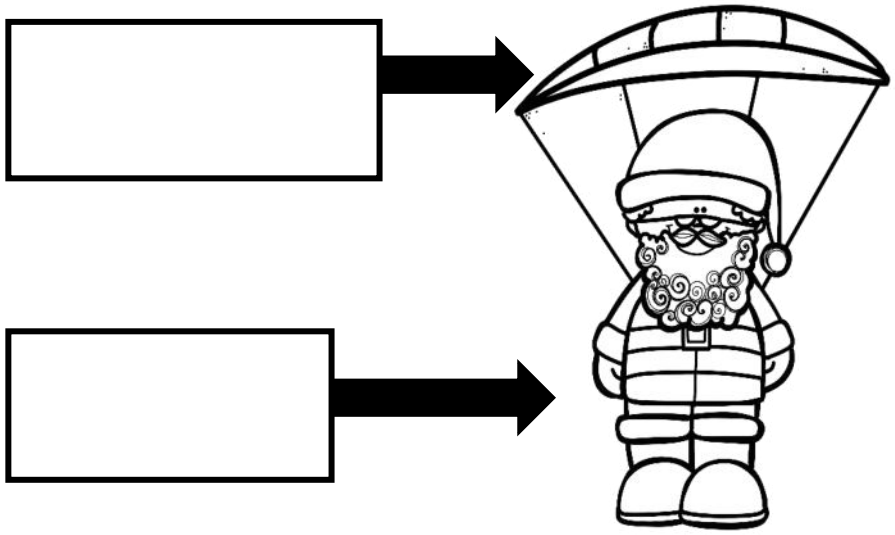
santa's parachute

Name: _____

MY BLUEPRINT

Draw a picture of your parachute and basket.

Label the CANOPY and LOAD.



Draw the materials you used.

Did Santa land UPRIGHT?	Did Santa land on the TARGET?
YES NO	YES NO

Santa's Parachute

Name: _____

BLUEPRINT

Label the CANOPY, SUSPENSION LINES, and LOAD.

TESTS	Did Santa land upright?	Did Santa land on the target?
TEST 1		
TEST 2		
TEST 3		

What improvements did you make to your parachute design?

LET'S REFLECT!

- What was most difficult about this challenge?
- How are parachutes useful?
- Which materials were most effective for your parachute and why do you think so?
- How did drag (air resistance) affect your parachute's drop?
- How did gravity affect your parachute's drop?
- How did mass and weight affect your parachute's drop?
- What are some features of real parachutes that are important for them to function effectively?
- If we completed this challenge again, what would you do differently next time?

STEM CHALLENGE: Shelf for the Elf

OVERVIEW: Students will engineer the highest shelf possible using limited materials. The popsicle sticks will serve as the shelf levels and playdough will serve as joints. The elf will fold in half to "sit" on the highest level. The shelf is best constructed in phases, with students measuring the height at each level. Students will likely build a variety of styles and shapes such as multileveled rectangular prisms, cubes, and even pyramids.

KEY SKILLS: Engineering shelves, Balance/Weight Distribution, Measurement, 3D Shapes

SUGGESTED READ ALOUDS: The Elf on the Shelf by Carol V. Aebersold, The Littlest Elf by Brandi Dougherty, Shmelf the Hanukkah Elf by Greg Wolfe

MATERIALS PER GROUP: Playdough cups (one 4 oz. or two 3 oz.), 20 popsicle sticks, one paper elf, one ruler

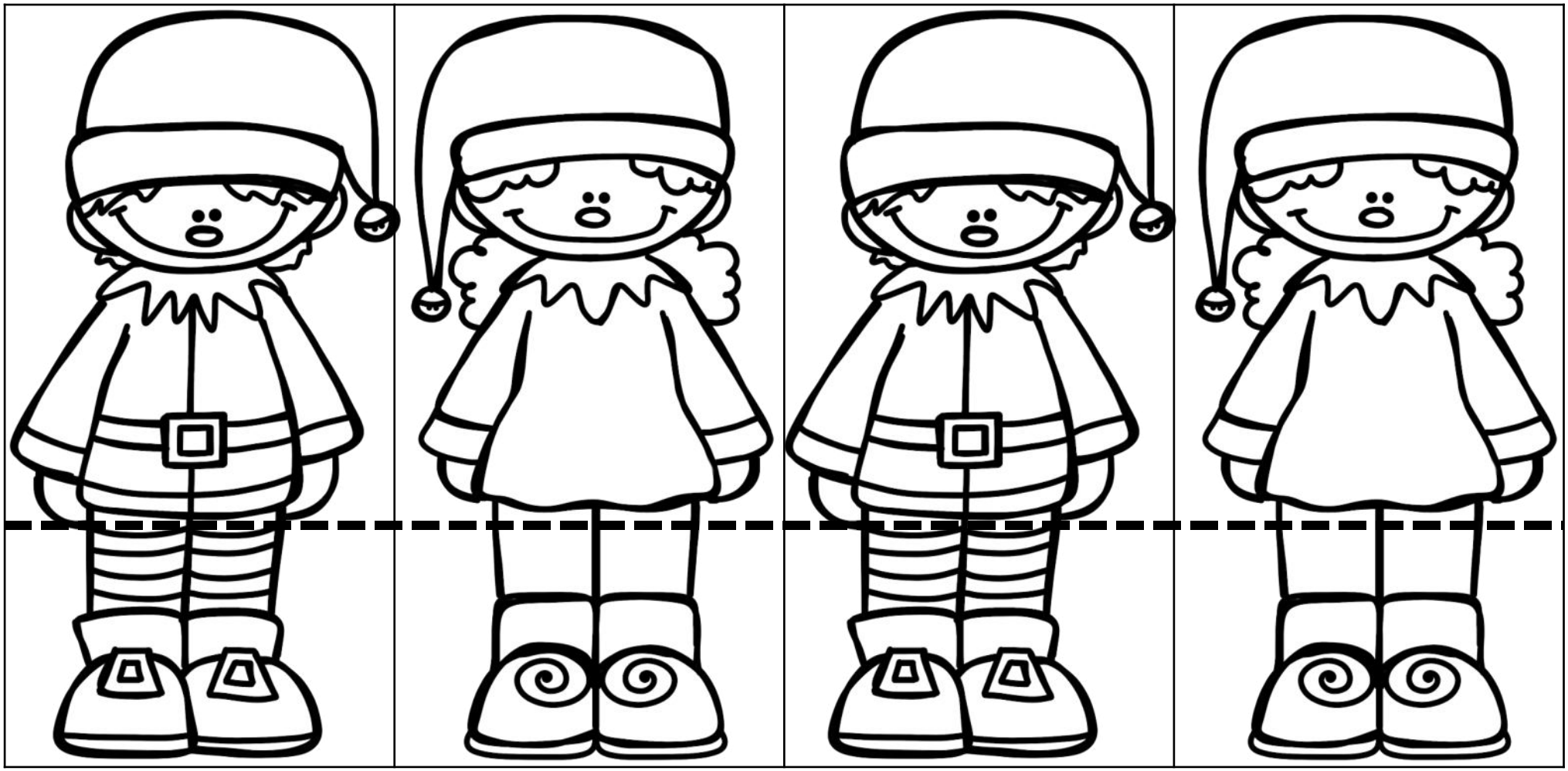
LESSON PLAN

1. Activate students' prior knowledge by asking them to share what they already know about shelf designs. Ask them to brainstorm different styles and important parts of shelves as they observe them around the classroom.
2. Share and discuss the videos on "Explore Shelves."
3. 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.
4. Introduce the STEM challenge and permitted materials.
5. Introduce and discuss key vocabulary cards related to the challenge.
6. Have students sketch blueprints of their designs on their recording sheets.
7. Distribute materials and allow students 30-45 minutes with partners or small groups to construct their shelves and measure the heights at each level.
8. Hold a whole class closing discussion and reflection, allowing students to share their shelf designs. Use the "Let's Reflect" poster to guide the discussion.

Shelf for the Elf Challenge

Cut out the elves and fold on dotted lines so that each elf is "sitting."

Shelf for the Elf Challenge



Cut out the elves and fold on dotted lines so that each elf is "sitting."

Shelf for the Elf

POSSIBLE PRODUCT

(for teacher reference only)

EXPLORE SHELVES

ENGINEERING

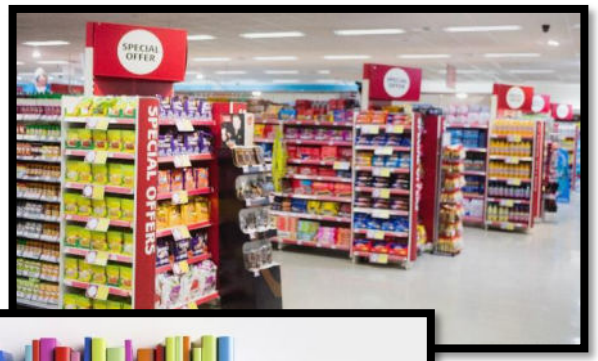
THINK LIKE AN ENGINEER

HOW SHELVES ARE MADE

FURNITURE MAKERS

Shelf for the Elf

REAL WORLD EXAMPLES

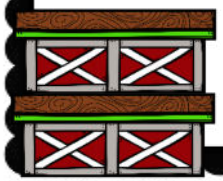


What is similar? What is different?

Where Shelves Are Found

Types of Shelves

How Shelves are Useful



Shelf for the Elf

The elf needs a safe and high place to sit that cannot be reached by children.

Construct the tallest shelf possible that will hold the elf.

MATERIALS:

- Playdough (1-2 cans per group)
- Popsicle sticks (20 per group)
- Paper elves
- Rulers

WORDS TO KNOW

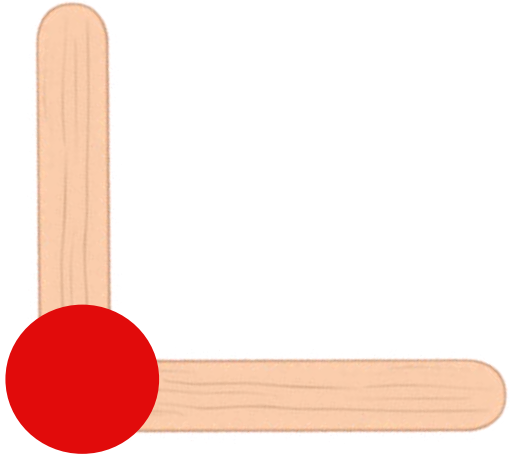
horizontal

side to side direction, parallel to the ground

vertical

up and down direction, perpendicular to the ground

joint



a point at which parts of a structure are joined

support

to bear weight or hold up

Shelf for the Elf

Name: _____

MY BLUEPRINT

Draw a picture of your shelf.

How high is your shelf?

TEST 1	
TEST 2	
TEST 3	

How many HORIZONTAL lines did you use?

_____

How many VERTICAL lines did you use?

_____

Shelf for the Elf

Name: _____

BLUEPRINT

How high is your shelf?

TEST 1	
TEST 2	
TEST 3	

How many HORIZONTAL lines did you use in your shelf?

How many VERTICAL lines did you use in your shelf?

How many JOINTS (vertices) did you use in your shelf?

Which 3D shapes did you use in your shelf design?

What improvements did you make to your shelf design?

LET'S REFLECT!

- What was most difficult about this challenge?
- How is your shelf similar to and different from the shelves in our classroom?
- How is your shelf designed to make it as sturdy and balanced as possible?
- What horizontal and vertical lines did you use in your shelf design?
- What are some different styles of shelves and how are they useful?
- What materials would you use to build real shelves?
- If we completed this challenge again, what would you do differently next time?

STEM CHALLENGE: Tallest Tree

OVERVIEW: Students will work together to stack cups and construct the tallest "tree" possible. Allow creativity and time for exploration, as some groups may choose to build more linear, pyramid-shaped trees while others might choose to build more cone-like structures with circular bases. Cups can be flipped and stacked on both ends. Optional ornament cutouts are provided for students to tape to the cups and "decorate" their trees. Students will use yardsticks to measure the heights of three different tree designs and they will compare and contrast the different styles.

KEY SKILLS: Three-dimensional shapes and structures (natural and manmade), Engineering towers/skyscrapers, Measurement

SUGGESTED READ ALOUDS: The Biggest Christmas Tree Ever by Steven Kroll, A Wish to be a Christmas Tree by Colleen Monroe, Red and Lulu by Matt Tavares

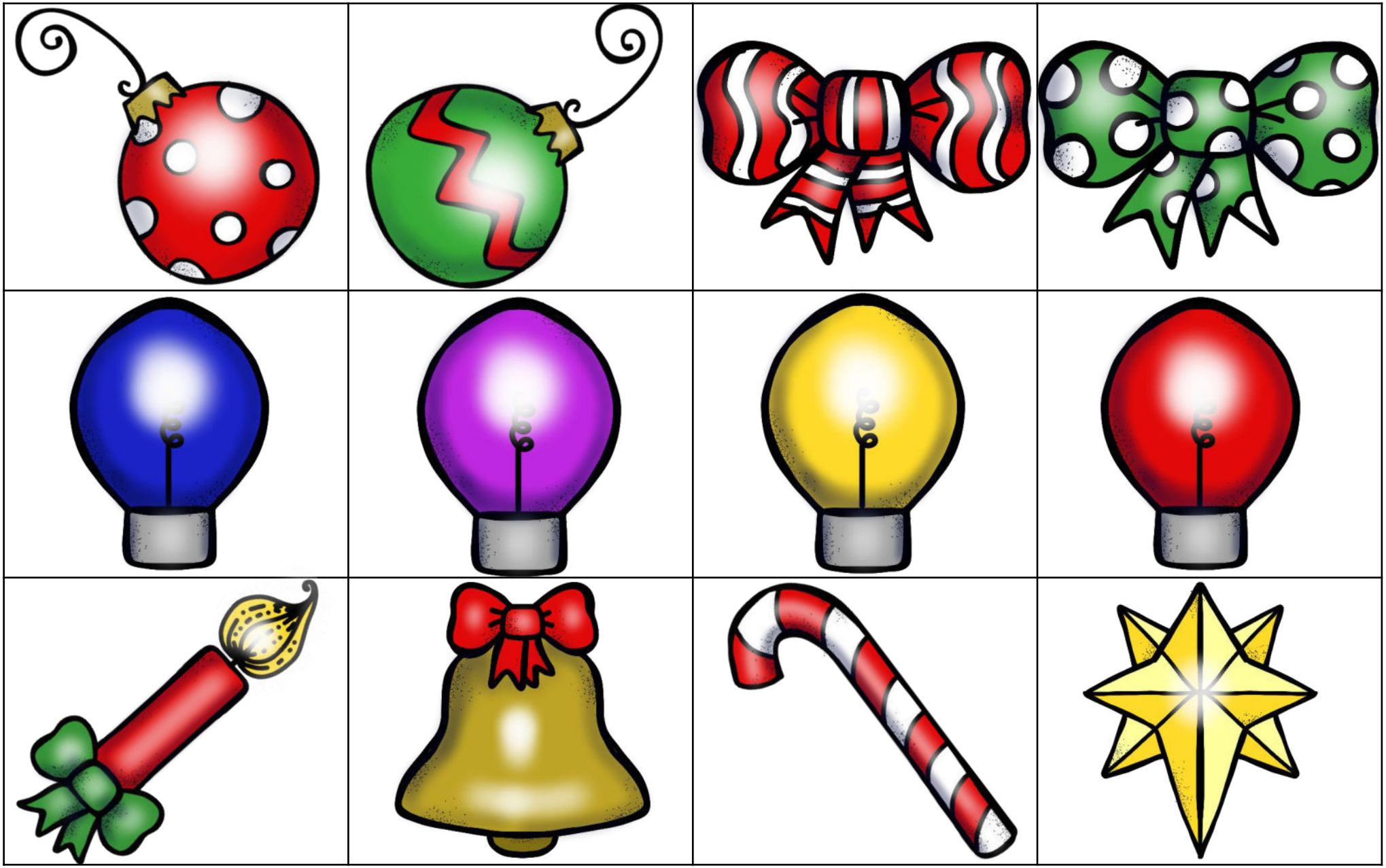
MATERIALS PER GROUP: 24 green cups, yardstick, optional paper ornaments and tape

LESSON PLAN

1. Activate students' prior knowledge by asking them to share what they already know about Christmas trees. Ask them to share what shapes and structures they see in Christmas trees (pine, fir, spruce) that are similar to manmade towers.
2. Share and discuss the videos on "Explore Trees."
3. 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.
4. Introduce the STEM challenge and permitted materials.
5. Introduce and discuss key vocabulary cards related to the challenge.
6. Have students sketch blueprints of their designs on their recording sheets.
7. Distribute materials and allow students 30-45 minutes with partners or small groups to construct three different styles of tree towers and measure the heights.
8. Hold a whole class closing discussion and reflection, allowing students to share their final tree tower designs OR create a whole class tree. Use the "Let's Reflect" poster to guide the discussion.

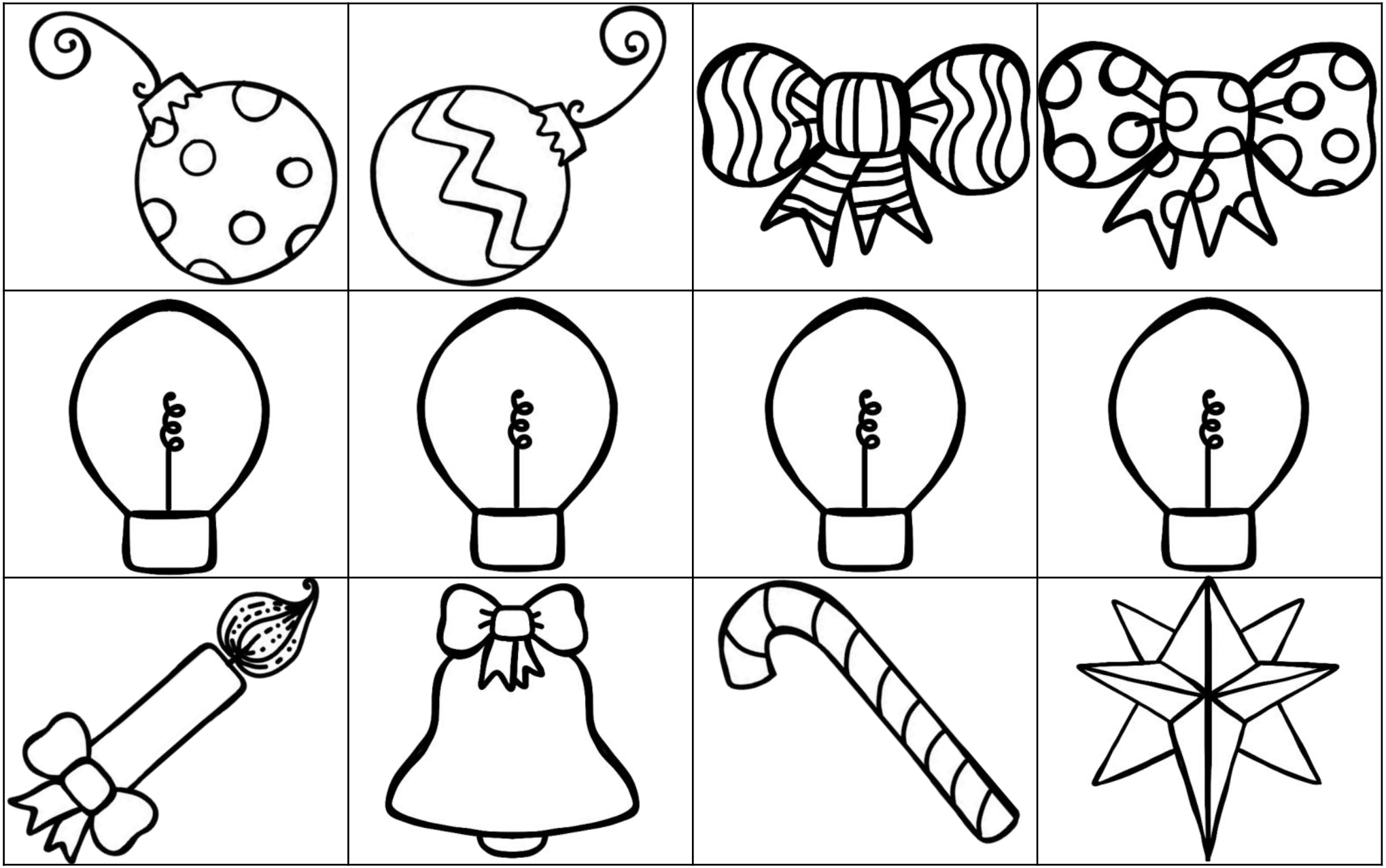
Tallest Tree Challenge

(optional ornaments to tape onto cups)



Tallest Tree Challenge

(optional ornaments to tape onto cups)



Tallest Tree

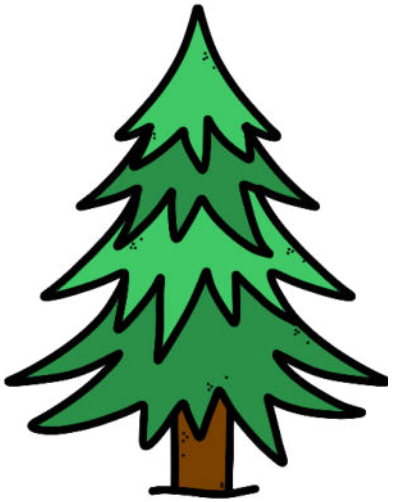
POSSIBLE PRODUCT

(for teacher reference only)

EXPLORE TREES

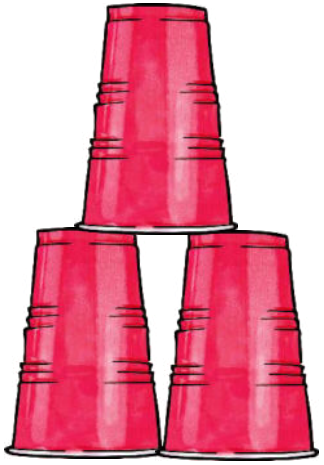
EXCELLENT EVERGREENS

WORLD'S TALLEST TREE



CHRISTMAS TREE FARMS

CUP TOWERS

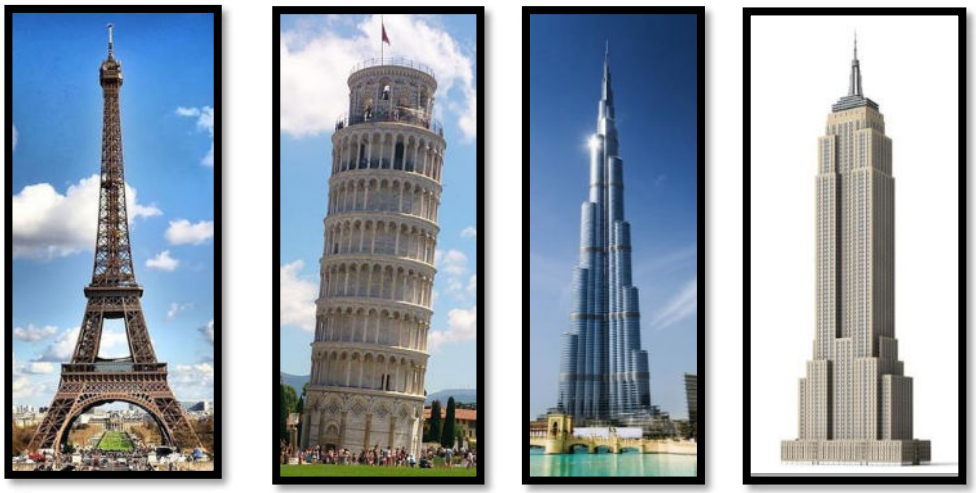


Tallest Tree

REAL WORLD EXAMPLES

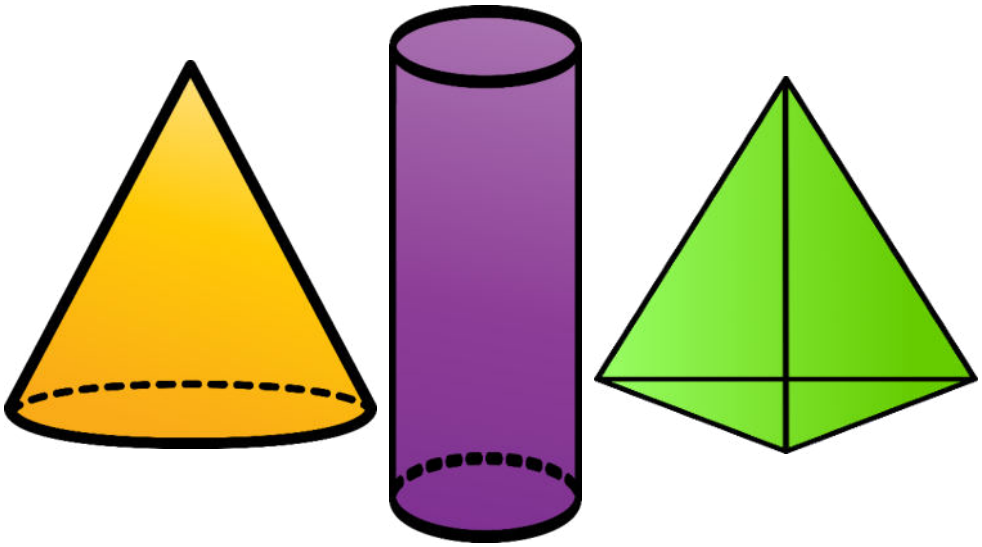
What is similar? What is different?

REAL WORLD EXAMPLES

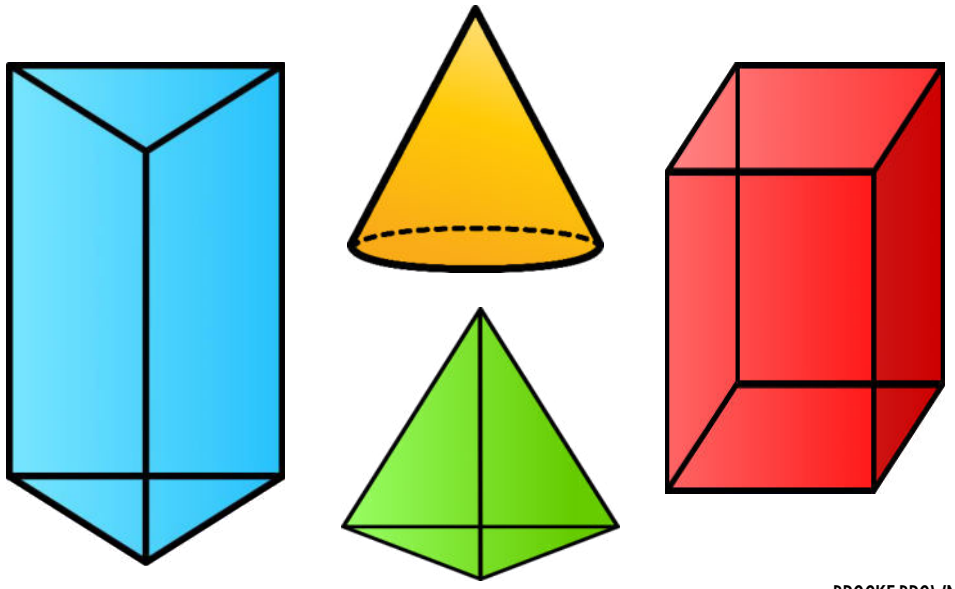


What is similar? What is different?

Common 3D Shapes found in Trees



Common 3D Shapes found in Towers



Tallest Tree

You have been asked to create a decorative tree for the holiday parade.

Use cups to construct the tallest tree possible.

MATERIALS:

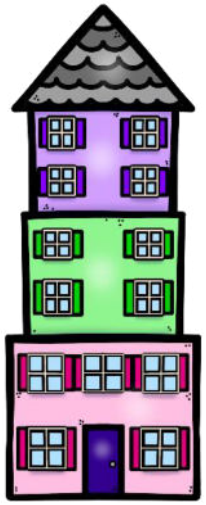
- Cups
- Paper ornaments and tape to decorate cups (OPTIONAL)
- Yardstick

WORDS TO KNOW

architect

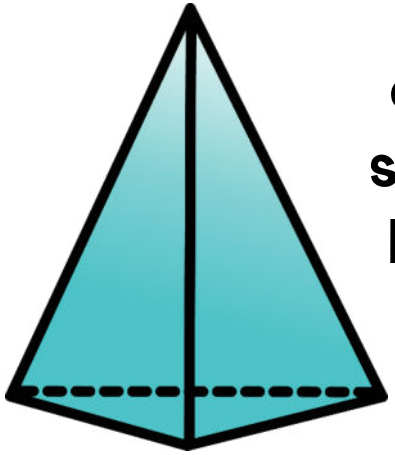
a person who designs buildings

structure



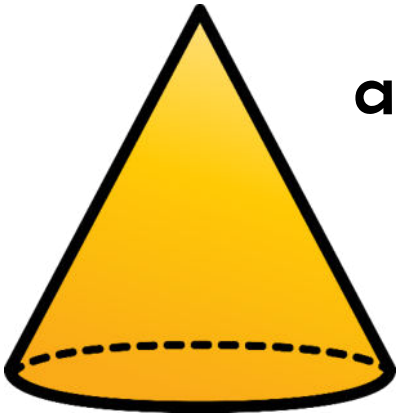
something that is built or constructed

pyramid



a three-dimensional solid with a polygonal base and triangular faces that meet at a point (apex)

cone



a three-dimensional solid that tapers from a circular base to a point

Tallest Tree

Name: _____

BLUEPRINT

1

HEIGHT: _____

BLUEPRINT

2

HEIGHT: _____

BLUEPRINT

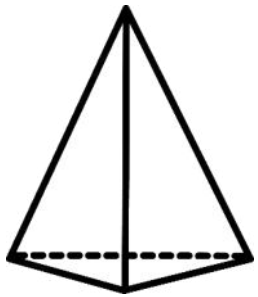
3

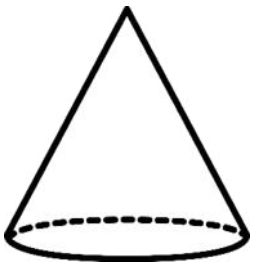
HEIGHT: _____

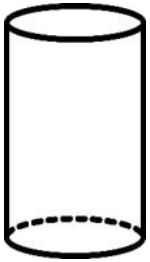
Which design worked best?

1 2 3

Color the 3D shapes that you used.



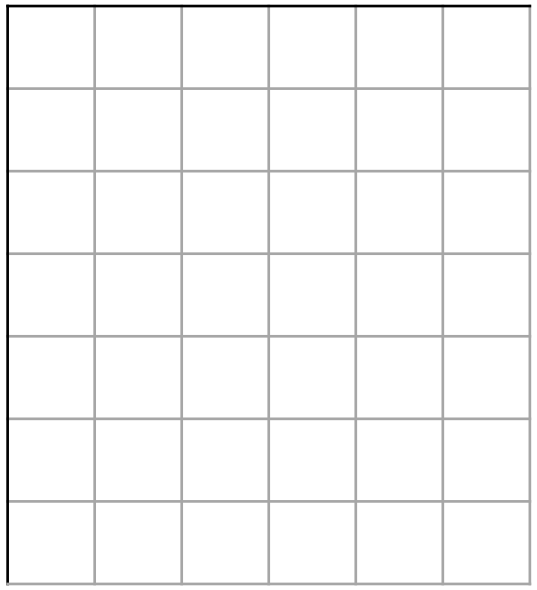




Tallest Tree

Name: _____

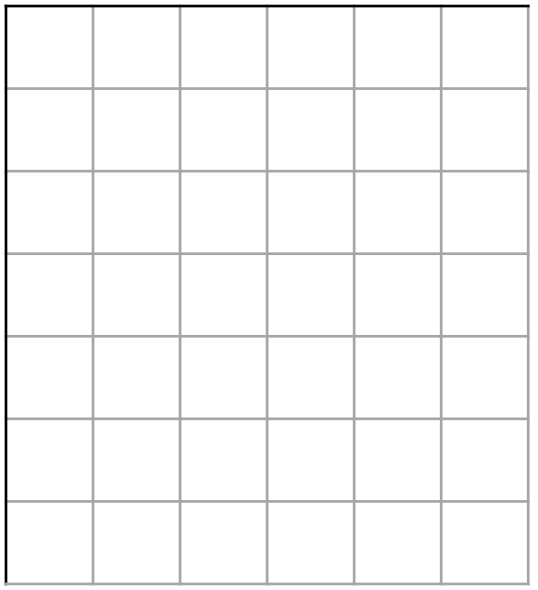
BLUEPRINT



1

HEIGHT: _____

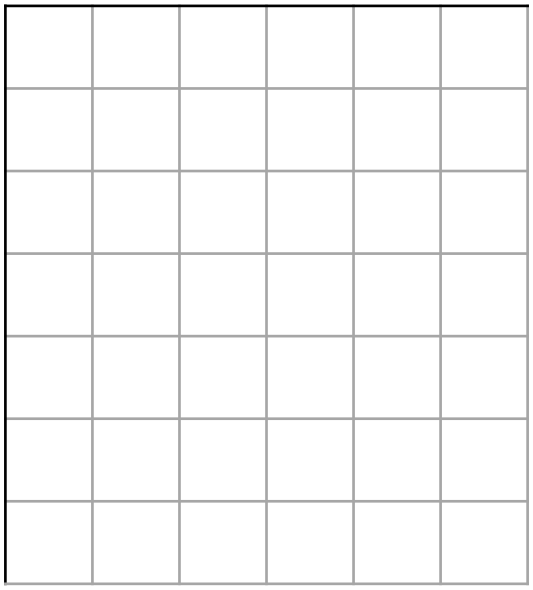
BLUEPRINT



2

HEIGHT: _____

BLUEPRINT



3

HEIGHT: _____

Which design worked best?

Why do you think it worked best?

What 3D shapes did you use in your design?

LET'S REFLECT!

- What was most difficult about this challenge?
- Which tree design was the tallest and why do you think so?
- How does the design of your tree affect its balance and stability?
- How are buildings designed using these same concepts?
- Which three-dimensional shapes are represented in your tree tower?
- If we completed this challenge again, what would you do differently next time?

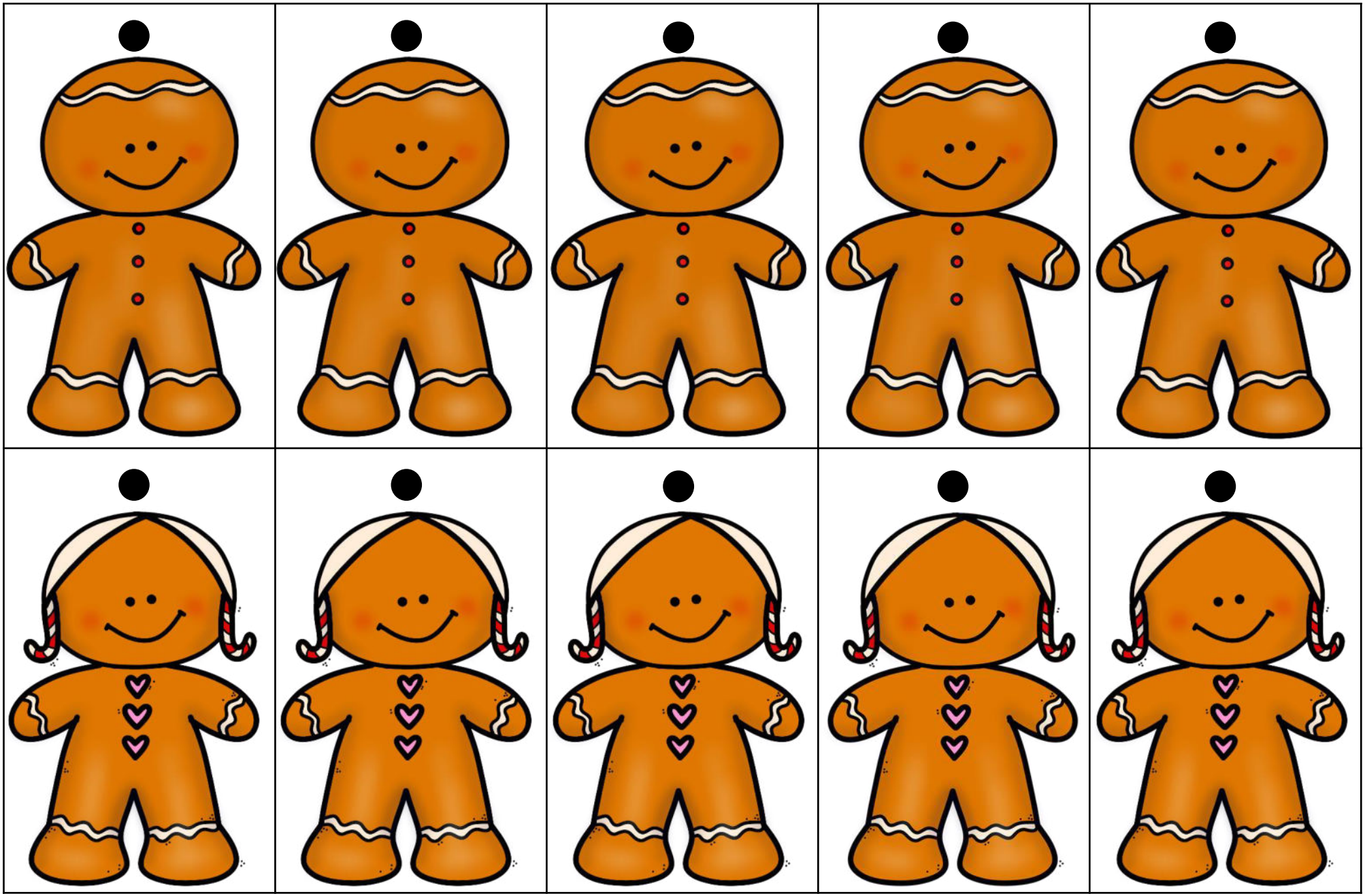
BRAINBUILDER

Gingerbread Escape

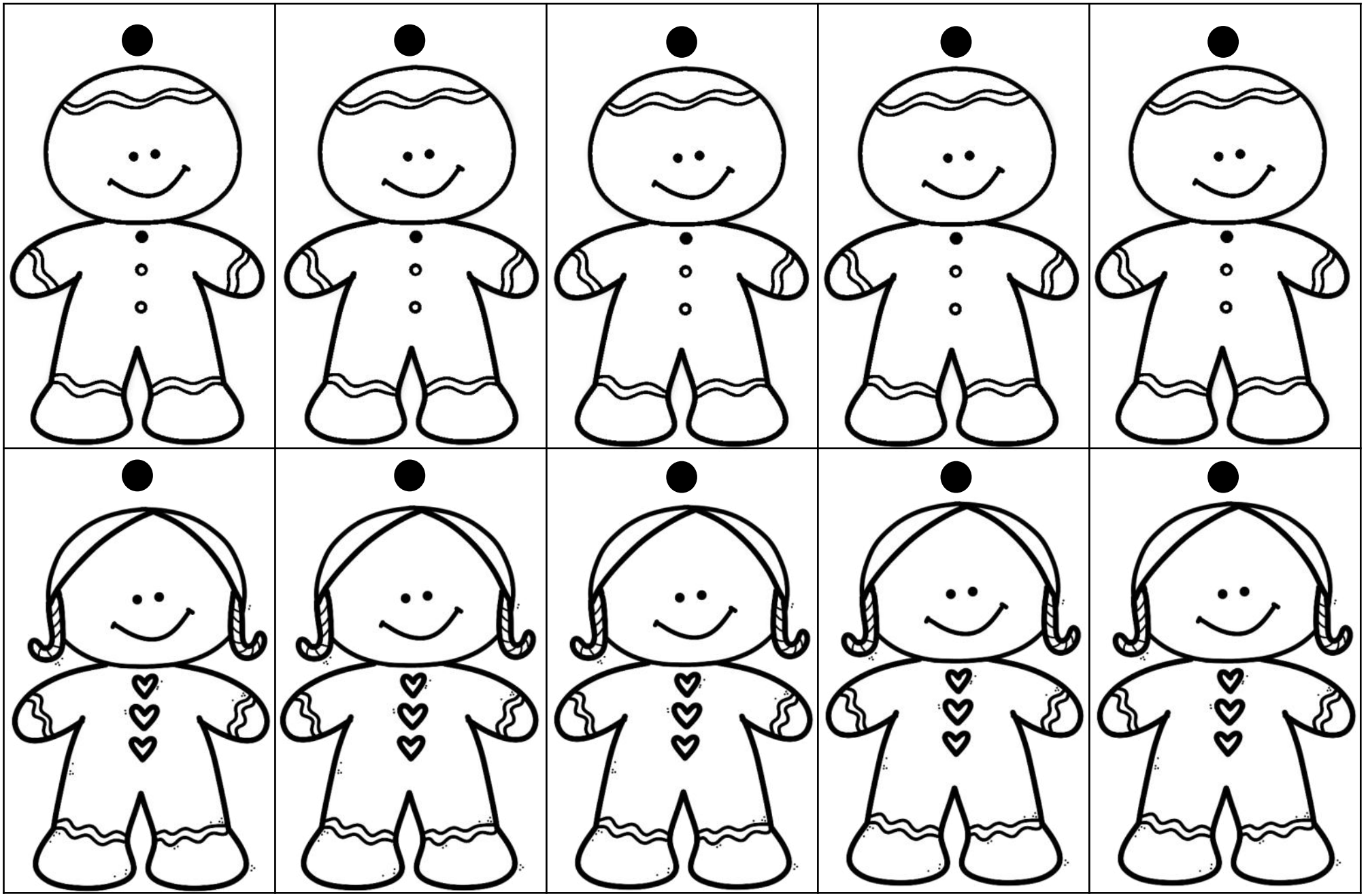
Work with your team to create a working zipline for your gingerbread man.

You will need a paper gingerbread man, paperclip, and fishing line.

Gingerbread Escape Challenge



Gingerbread Escape Challenge



Gingerbread Escape

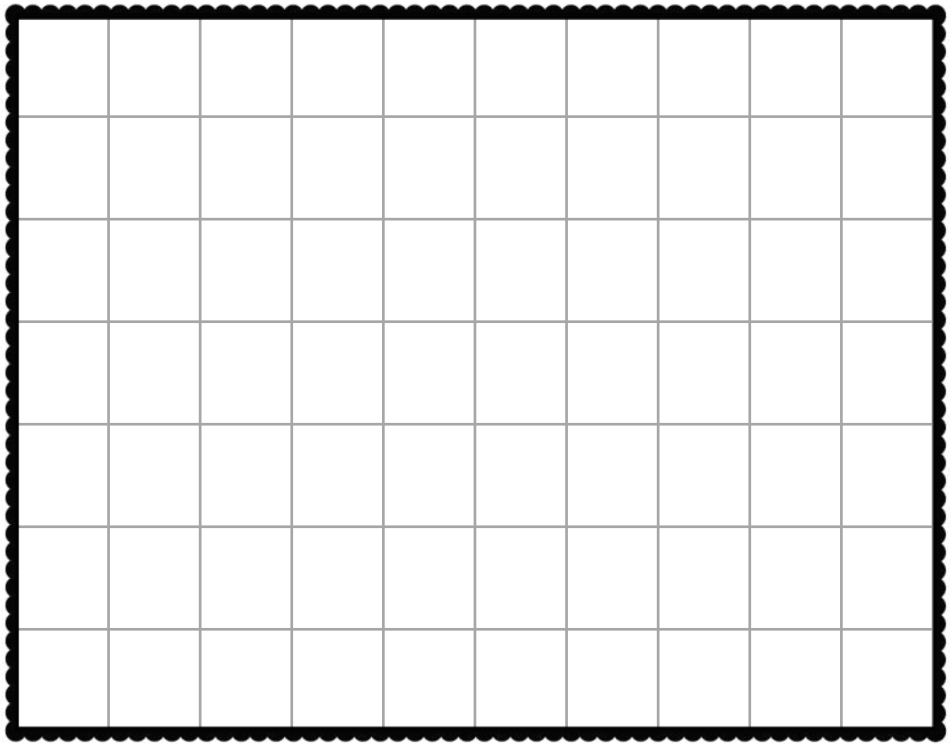
POSSIBLE PRODUCT

(for teacher reference only)

Gingerbread Escape

Name: _____

BLUEPRINT



Our zipline stretched from _____ to _____.

It measured _____ long.

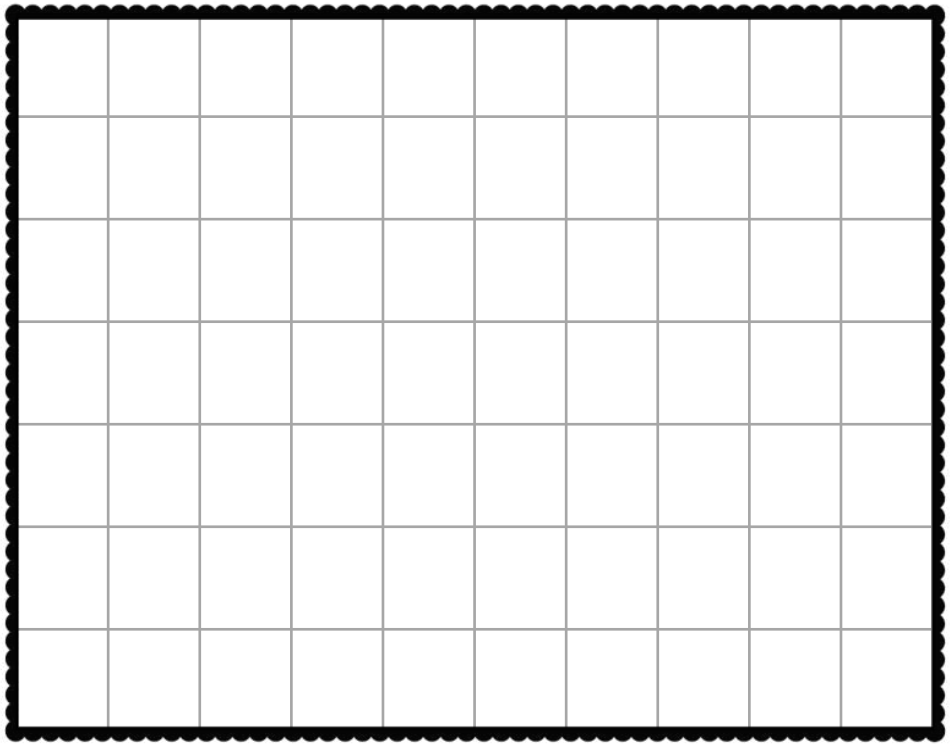
Our gingerbread man went over these objects:

1. _____
2. _____
3. _____

Gingerbread Escape

Name: _____

BLUEPRINT



Our zipline stretched from _____ to _____.

It measured _____ long.

Our gingerbread man went over these objects:

1. _____
2. _____
3. _____

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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

Challenge: _____

Date: _____

Student Name: _____

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TOTAL POINTS: _____ /18

Comments: _____

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STEAM Challenge Assessment Rubric

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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.
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TOTAL POINTS: _____ /18

Comments: _____

STEAM Challenge Assessment Rubric

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Student fully participated in class discussions.	Student somewhat participated in class discussions.	Student did not participate in class discussions.

TOTAL POINTS: _____ /18

Comments: _____

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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!

Dear Families,

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

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_____

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I am able to donate: _____

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