

A black binder with a colorful collage of science and craft supplies on the cover. The supplies include wooden sticks, a red calculator, a pair of scissors, a light bulb, colorful pipe cleaners, a small egg, and various colored pom-poms. A large black circle in the center contains the text 'STEM ALL YEAR 9 MONTHS OF LOW PREP SEASONAL CHALLENGES' and 'CREATED BY BROOKE BROWN'.

**STEM**

**ALL YEAR**

**9 MONTHS OF LOW PREP  
SEASONAL CHALLENGES**

CREATED BY BROOKE BROWN

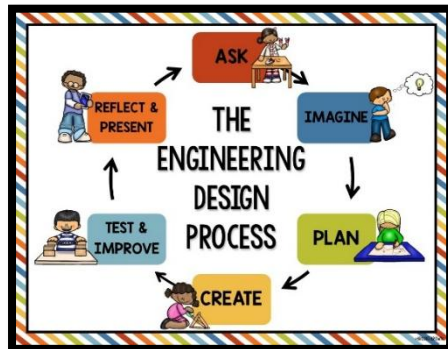
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# 36 SEASONAL STEM CHALLENGES





- ✓ SIMPLE SUPPLIES
- ✓ INTERACTIVE ANCHOR CHARTS
- ✓ VISUAL VOCABULARY
- ✓ QR CODE RESEARCH



## Roller coaster

You have been asked to design a new roller coaster for an amusement park!

Construct a roller coaster that will carry a marble from the top to the bottom without falling off.

**MATERIALS:**

- Coated paper plates with "tips" around the edges.
- Mini or medium-sized cups
- Tape
- Scissors
- Marbles (one per group)

## Straw Rocket

Your friends have challenged you to a contest! Construct a straw rocket that will travel the farthest distance.

**MATERIALS:**

- Straws (One per student)
- Paper strips (One per student)
- Paper rockets (One per student)
- Scotch tape
- Yardsticks

## Waterproof critter House

You've caught some insects in your backyard and need to be kept dry during a rainstorm. Construct a waterproof shelter for your insects that contains materials for survival.

**MATERIALS:**

- Empty tissue boxes
- Paper plates
- OPTIONS FOR WATERPROOF MATERIALS: large Ziplock bags, trash bags, plastic wrap, plastic table cloths
- Outdoor materials such as rocks, leaves, dirt and sticks
- Paper critters (2-3 per group)
- Spray bottle with water

## BRAINBUILDER

### POOL NOODLE party

Can you use only pool noodle pieces and toothpicks to build a variety of structures?

**TRY CREATING:**

- tower
- house
- bridge
- vehicle
- boat
- airplane

## WORDS TO KNOW

<b>gravity</b> force of attraction of objects to the center of the Earth 	<b>friction</b> surface resistance to motion 
<b>acceleration</b> an object's change in velocity 	<b>momentum</b> the amount of motion an object has 

## WORDS TO KNOW

<b>thrust</b> the force of flight that pushes an object forward or upward 	<b>drag</b> force on an object in the air that reduces forward motion 
<b>propel</b> to push or drive forward 	<b>gravity</b> force of attraction of objects to the center of the Earth 

## WORDS TO KNOW

<b>shelter</b> a dwelling or home designed for protection 	<b>terrarium</b> a clear container that houses plants, insects, reptiles, or amphibians 
<b>waterproof</b> not allowing water to pass through 	<b>habitat</b> the natural environment of an animal 

## Roller coaster

**REAL WORLD EXAMPLES**

What is similar? What is different?

**Important Features of Roller Coasters**

Forces at Work in Roller Coasters

Our Design Ideas

## Straw Rocket

**REAL WORLD EXAMPLES**

What is similar? What is different?

**Basic Parts of a Rocket**

How Rockets Work

Forces of Flight

## Waterproof critter House

**REAL WORLD EXAMPLES**

What is similar? What is different?

Where Insects Live

Types of Insects

## EXPLORE ROLLER COASTERS

<b>ROLLER COASTERS</b> 	<b>ROLLER COASTER PHYSICS</b> 
<b>ROLLER COASTER FORCES</b> 	<b>WORLD'S TALLEST ROLLER COASTERS</b> 

## EXPLORE ROCKETS

<b>ESCAPE TO THE MOON</b> 	<b>HOW ROCKETS WORK</b> 
<b>BUILDING ROCKETS</b> 	<b>FORCES OF FLIGHT</b> 

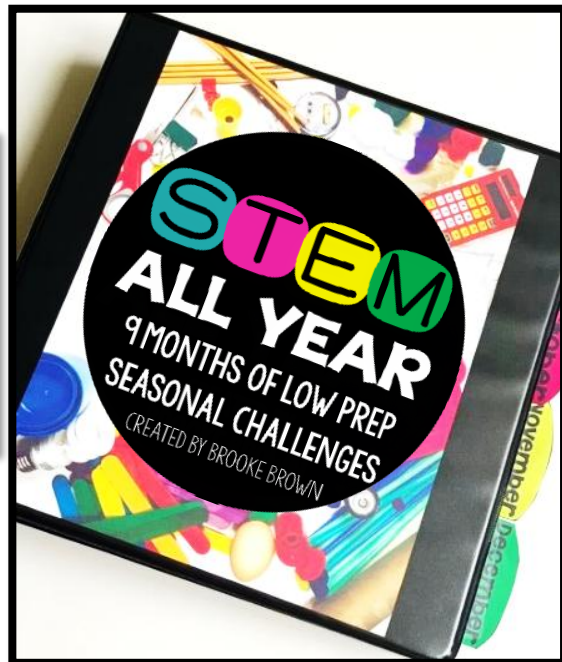
## EXPLORE INSECTS

<b>INSPECT AN INSECT</b> 	<b>UNDER A ROCK</b> 
<b>BUG HUNTING GAME</b> 	<b>10 INTERESTING INSECTS</b> 

# DIFFERENTIATED RECORDING SHEETS

## LOWER GRADES

## UPPER GRADES



# 9 STEM BrainBuilders



## CLOSING REFLECTION QUESTIONS

### LET'S REFLECT!

- What was most difficult about this challenge?
- What features in your design were necessary for the marble to roll all the way to the end?
- What improvements were necessary as you constructed your roller coaster?
- What force pulled your marble to the end of the track?
- How are potential and kinetic energy used in a roller coaster?
- How did friction affect your marble?
- How is your roller coaster design similar to and different from a real roller coaster?
- If we completed this challenge again, what would you do differently next time?



# SAY Hello TO STRESS-FREE STEM!

## SUPPLIES CHECKLIST

STEM CHALLENGE	ITEM	NUMBER PER GROUP	I HAVE IT
Roller Coaster	cups (mini or medium-sized work best)	12	
	coated paper plates with "lips" around the edges	6	
	tape	1 roll	
	scissors	2	
	marble	1	
Straw Rocket	9" x 12" sheet of construction paper	1-2	
	straws	1 per student	
	blank paper rectangle	1 per student	
	paper rocket	1 per student	
	scissors and tape	1 per pair of students	
Waterproof Critter House	yardstick	1	
	empty tissue box	1	
	OPTIONS for water proof materials: gallon ziplock bags, trash bags, plastic tablecloths, plastic wrap	variety	
	paper plates	1	
	scissors	1	
BONUS BRAINBUILDER: Pool Noodle Party	tape	3 feet	
	mini cups with paper critters taped to the front	1 set	
	spray bottle with water	1	
	pool noodles sliced into a variety of shapes and sizes	1 large tub per class	
	toothpicks	30 per group	

## STANDARDS ALIGNMENT

MAY STANDARDS ALIGNMENT			
CHALLENGE	ENGINEERING	SCIENCE	MATH
Roller Coaster	K-2-ETS1 Engineering Design: K-2-ETS1-A, 3-5-ETS1-2, 3-5-ETS1-3 3-5-ETS1 Engineering Design: 3-5-ETS1-A, 3-5-ETS1-2, 3-5-ETS1-3	K-PS2 Motion and Stability: Forces and Interactions 3-PS2 Motion and Stability: Forces and Interactions 4-PS3 Energy 5-PS2 Motion and Stability: Forces and Interactions	OPS: Make sense of problems and persevere in solving them. DPS: Develop abstract and quantitative reasoning. DPS: Reason with numbers and quantities. DPS: Use appropriate tools strategically.
Straw Rocket	K-2-ETS1 Engineering Design: K-2-ETS1-A, 3-5-ETS1-2, 3-5-ETS1-3 3-5-ETS1 Engineering Design: 3-5-ETS1-A, 3-5-ETS1-2, 3-5-ETS1-3	K-PS2 Motion and Stability: Forces and Interactions 3-PS2 Motion and Stability: Forces and Interactions 4-PS3 Energy 5-PS2 Motion and Stability: Forces and Interactions	OPS: Make sense of problems and persevere in solving them. DPS: Develop abstract and quantitative reasoning. DPS: Reason with numbers and quantities. DPS: Use appropriate tools strategically.
Waterproof Critter House	K-2-ETS1 Engineering Design: K-2-ETS1-A, 3-5-ETS1-2, 3-5-ETS1-3 3-5-ETS1 Engineering Design: 3-5-ETS1-A, 3-5-ETS1-2, 3-5-ETS1-3	K-LJ From Molecules to Organisms: Structures and Processes K-ESS2 Earth's Systems Structure, Function, and Information Processing 3-LJ Biological Evolution: Unity and Diversity 3-ESS2 Earth and Human Activity	OPS: Make sense of problems and persevere in solving them. DPS: Develop abstract and quantitative reasoning. DPS: Reason with numbers and quantities. DPS: Use appropriate tools strategically.
BONUS BRAINBUILDER: Pool Noodle Party	K-2-ETS1 Engineering Design: K-2-ETS1-A, 3-5-ETS1-2, 3-5-ETS1-3 3-5-ETS1 Engineering Design: 3-5-ETS1-A, 3-5-ETS1-2, 3-5-ETS1-3	2-Structure and Properties of Matter 4-Balance, Stability	OPS: Make sense of problems and persevere in solving them. DPS: Develop abstract and quantitative reasoning. DPS: Use appropriate tools strategically.

## CHALLENGE OVERVIEW



## STEM CHALLENGE: Roller coaster

**OVERVIEW:** This challenge is perfect for the end of the year. It requires perseverance as well as constant testing and improvements, and is sure to bring cheers of success at the end. For best results, purchase coated paper plates with prominent "lips" around the outer edges that are not too thick for students to cut (not Styrofoam). Students will cut off the outer lips of the plates and crease them along the middle to make "tracks" for the marbles. They may also cut the tracks into different sizes so that they can turn their track different directions. The tracks should be taped to the top of mini or medium-sized plastic (cocktail) cups. The cups can be taped together in towers so that students can gradually reduce the height of the tracks from beginning to end.

### HELPFUL TIPS:

- 1) Test each piece of the track before extending it to add another piece.
- 2) Tape the cup towers down to the construction paper to stabilize the roller coaster.
- 3) If any drops in the roller coaster are too steep, the marble may fall out. Tape small pieces of paper plate to the tracks to act as "bumpers" to block the marble from falling out.

After students achieve a successful roller coaster design, encourage them to give it an exciting name and decorate their poster with signs and details.

**KEY SKILLS:** Engineering roller coasters, Potential and Kinetic Energy, Acceleration and Momentum, Gravity

**SUGGESTED READ ALOUDS:** *Roller Coaster* by Maria Frazee, *Roller Coasters (How it Works)* by Precious McKenzie, *Building a Roller Coaster* by Karen Latchana Kenney

**MATERIALS PER GROUP:** marble, 12 mini or medium-sized cups, 6 coated paper plates with "lips" around the edges, 1-2 sheets of 9" x 12" construction paper, scissors, 1 roll of tape

## LESSON PLAN

1. Activate students' prior knowledge by asking them to share what they already know about roller coasters and the forces at work during a roller coaster ride.
2. Share and discuss the videos on "Explore Roller Coasters."
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 60-90 minutes to construct their roller coasters and test them with marbles.
8. Hold a whole class closing discussion and reflection, allowing students to share, compare, and contrast their roller coaster designs. Use the "Let's Reflect" poster to guide the discussion.

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## KEY SKILLS

## SUGGESTED READ ALOUDS

## MATERIALS

## STEP BY STEP INSTRUCTIONS

# EXTENSIVE SUPPLEMENTS



## 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.

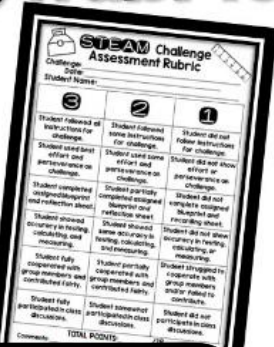

Sincerely, \_\_\_\_\_

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

Parent Name(s): \_\_\_\_\_  
Child's Name: \_\_\_\_\_  
I am able to donate: \_\_\_\_\_

HS0018709

## STEM Grading Rubric



GOOGLE SLIDES  
NOTEBOOKS FOR  
PAPERLESS RECORDING  
& TEACHING AIDS

