May

STEM

summer challenges

CREATED BY
BROOKE BROWN

contents

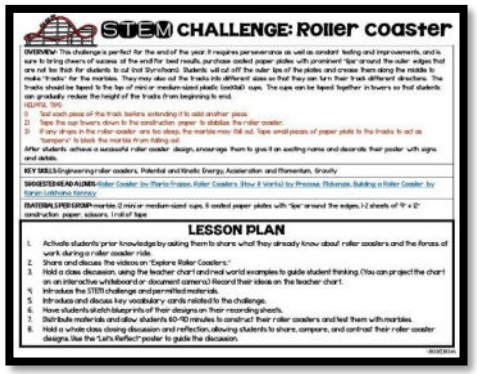
How to use

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.

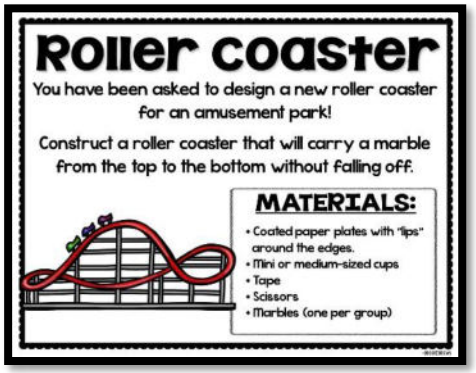
components

LESSON PLAN

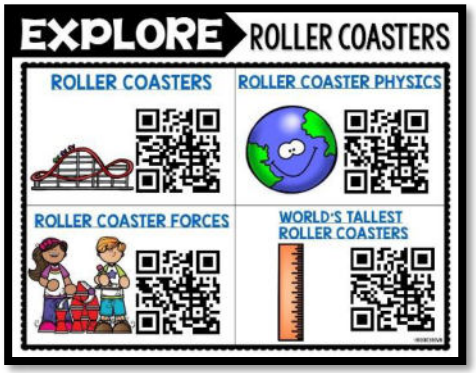
- Overview
- Skills
- Read Aloud Ideas
- Supplies



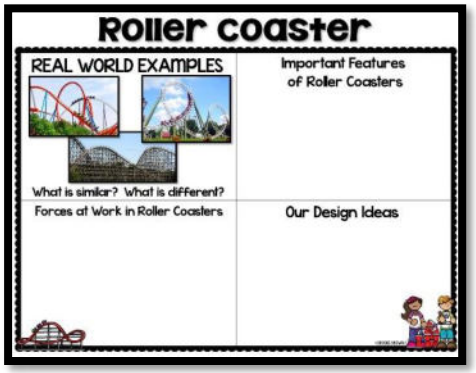
STUDENT INSTRUCTIONS



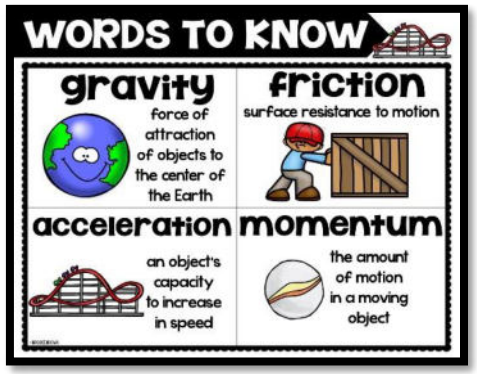
QR CODE WEBSITES & VIDEOS



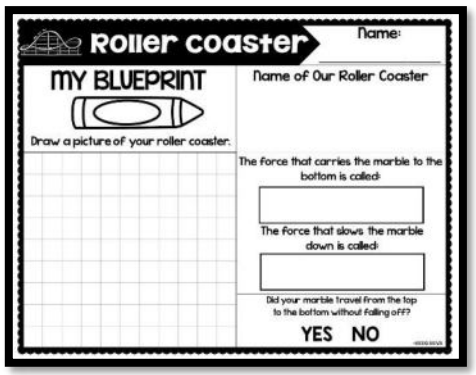
TEACHER ANCHOR CHART



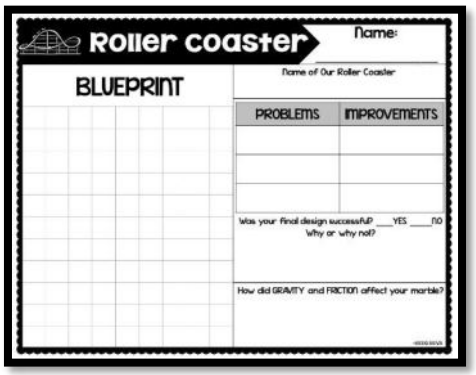
KEY VOCABULARY



K-2nd RECORDING SHEET



3rd-5th RECORDING SHEET

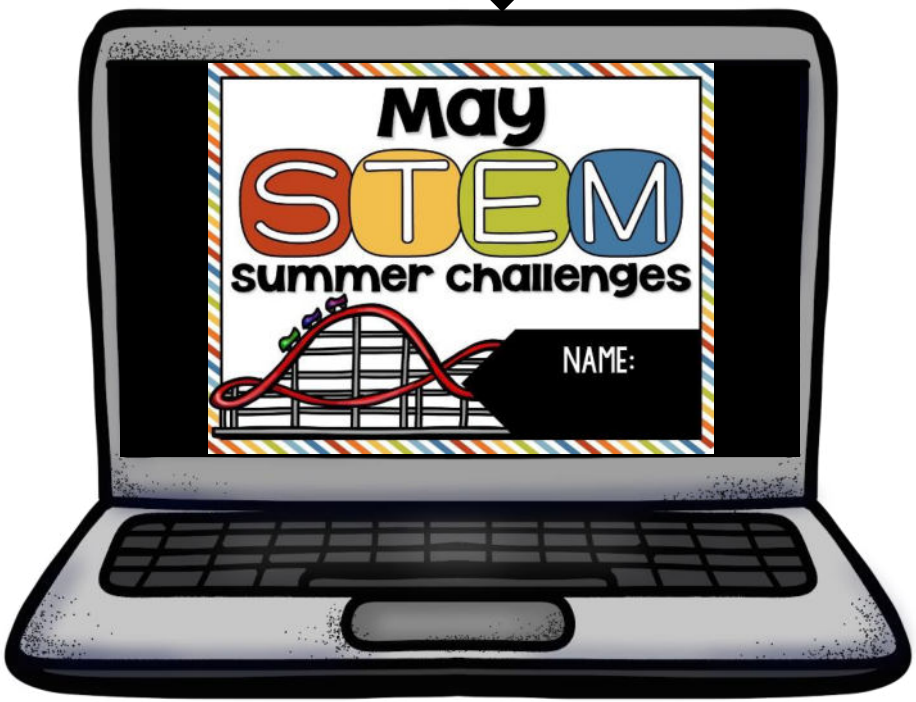


REFLECTION DISCUSSION QUESTIONS

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

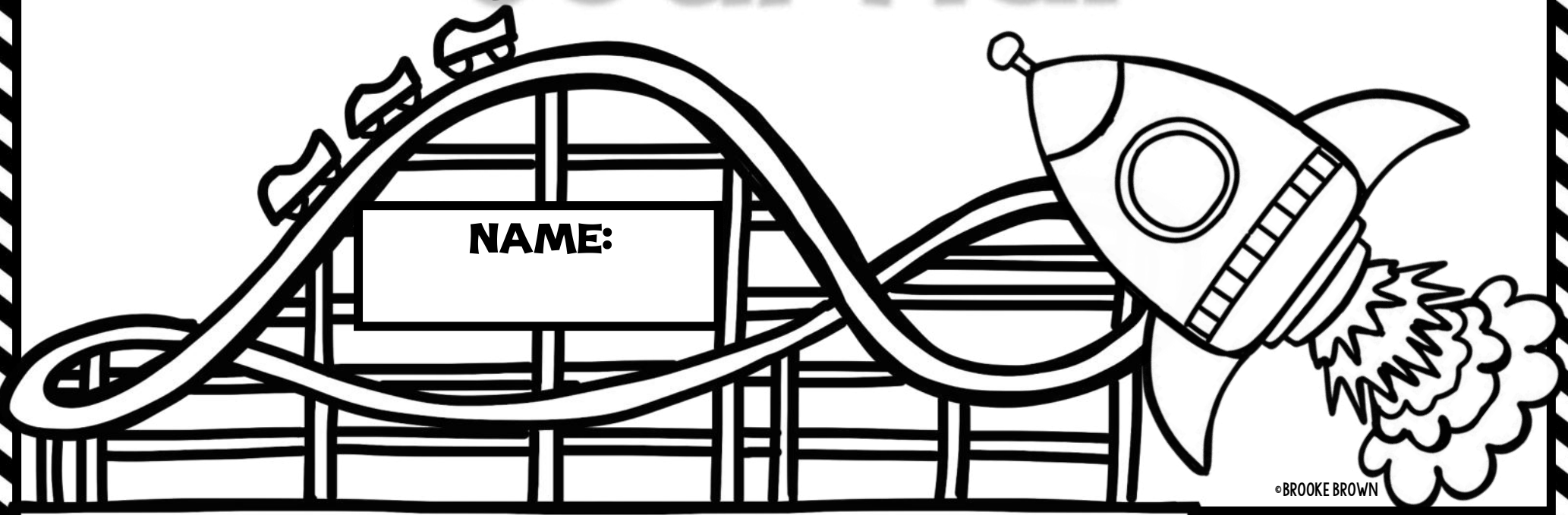
MAY SUPPLIES CHECKLIST

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	
	9" x 12" sheet of construction paper	1-2	
Straw Rocket	straws	1 per student	
	blank paper rectangle	1 per student	
	paper rocket	1 per student	
	scissors and tape	1 per pair of students	
	yardstick	1	
Waterproof Critter House	empty tissue box	1	
	OPTIONS for waterproof materials: gallon ziplock bags, trash bags, plastic tablecloths, plastic wrap	variety	
	paper plates	1	
	scissors	1	
	tape	3 feet	
	mini cups with paper critters taped to the front	1 set	
	spray bottle with water	1	
BONUS BRAINBUILDER: Pool Noodle Party	pool noodles sliced into a variety of shapes and sizes	1 large tub per class	
	toothpicks	30 per group	

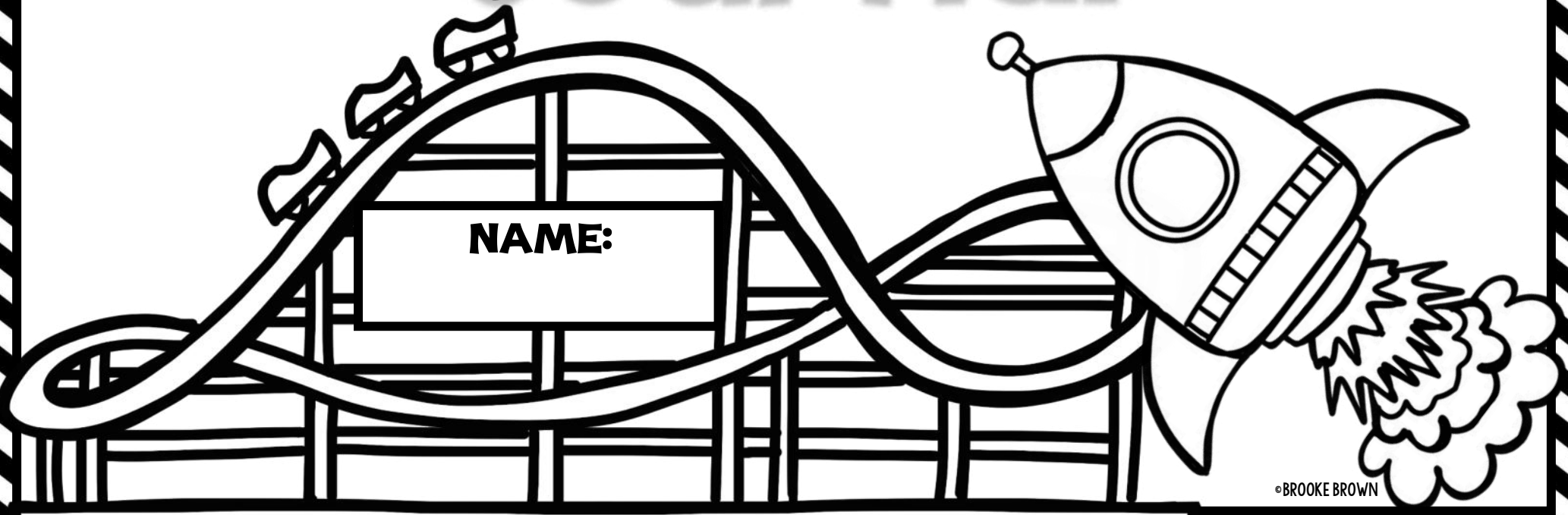
MAY STANDARDS ALIGNMENT

CHALLENGE	ENGINEERING	SCIENCE	MATH
Roller Coaster	K-2-ETSI Engineering Design: K-2-ETSI-1, 3-5 ETSI-2, 3-5 ETSI-3 3-5-ETSI Engineering Design: 3-5-ETSI-1, 3-5 ETSI-2, 3-5 ETSI-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	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
Straw Rocket	K-2-ETSI Engineering Design: K-2-ETSI-1, 3-5 ETSI-2, 3-5 ETSI-3 3-5-ETSI Engineering Design: 3-5-ETSI-1, 3-5 ETSI-2, 3-5 ETSI-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	MP1: Make sense of problems and persevere in solving them MP.2: Reason abstractly and quantitatively MP.4: Model with mathematics MP.6: Attend to precision MP.5: Use appropriate tools strategically
Waterproof Critter House	K-2-ETSI Engineering Design: K-2-ETSI-1, 3-5 ETSI-2, 3-5 ETSI-3 3-5-ETSI Engineering Design: 3-5-ETSI-1, 3-5 ETSI-2, 3-5 ETSI-3	K-LS1 From Molecules to Organisms: Structures and Processes K-ESS2 Earth's Systems I.Structure, Function, and Information Processing 3-LS4 Biological Evolution: Unity and Diversity 3-ESS3 Earth and Human Activity	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
BONUS BRAINBUILDER: Pool Noodle Party	K-2-ETSI Engineering Design: K-2-ETSI-1, 3-5 ETSI-2, 3-5 ETSI-3 3-5-ETSI Engineering Design: 3-5-ETSI-1, 3-5 ETSI-2, 3-5 ETSI-3	2.Structure and Properties of Matter •Balance, stability	MP1: Make sense of problems and persevere in solving them MP.4: Model with mathematics MP.7: Look for and make use of structure.

My May STEM Journal



My May STEAM Journal



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 Marla 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

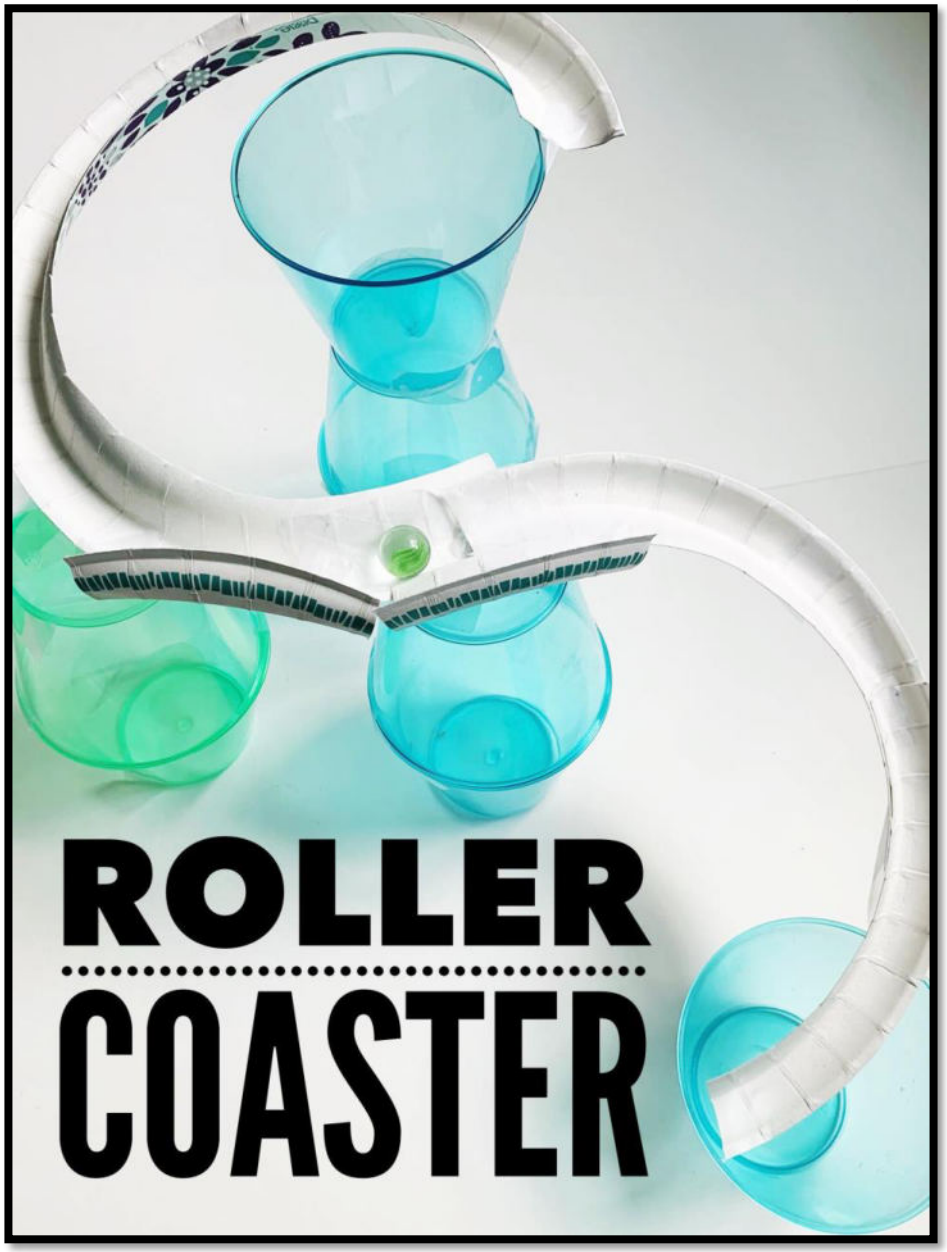
LESSON PLAN

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.

Roller coaster

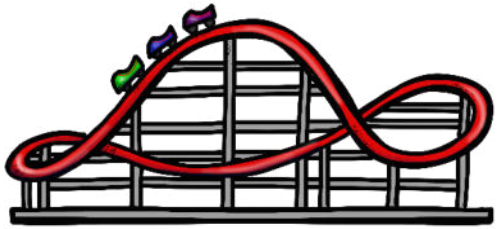
POSSIBLE PRODUCT

(for teacher reference only)



EXPLORE ROLLER COASTERS

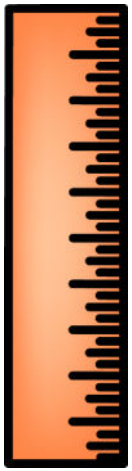
ROLLER COASTERS



ROLLER COASTER PHYSICS

ROLLER COASTER FORCES

WORLD'S TALLEST ROLLER COASTERS



Roller coaster

REAL WORLD EXAMPLES

What is similar? What is different?

Important Features of Roller Coasters

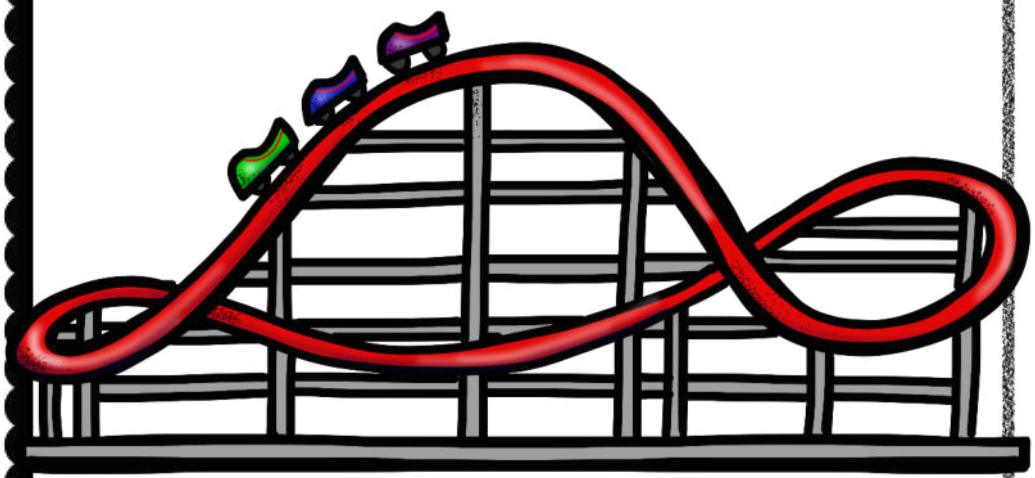
Forces at Work in Roller Coasters

Our Design Ideas

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 "lips" around the edges.
- Mini or medium-sized cups
- Tape
- Scissors
- Marbles (one per group)

WORDS TO KNOW

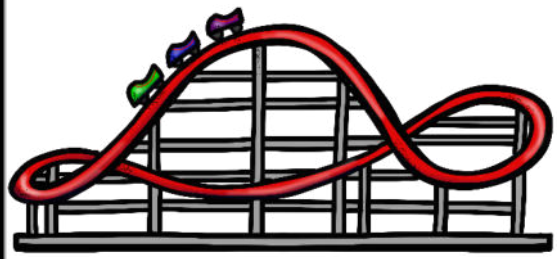
gravity

force of attraction of objects to the center of the Earth

friction

surface resistance to motion

acceleration



an object's capacity to increase in speed

momentum

the amount of motion in a moving object

Roller coaster

Name: _____

MY BLUEPRINT

Draw a picture of your roller coaster.

Name of Our Roller Coaster

The force that carries the marble to the bottom is called:

The force that slows the marble down is called:

Did your marble travel from the top to the bottom without falling off?

YES NO

Roller coaster

Name: _____

BLUEPRINT

Name of Our Roller Coaster

PROBLEMS	IMPROVEMENTS

Was your final design successful? ____YES _____NO

Why or why not?

How did GRAVITY and FRICTION affect your marble?

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?

STEM CHALLENGE: Straw Rocket

OVERVIEW: This quick and simple challenge allows students to experiment with basic forces of flight. Students wrap paper strips around the end of a straw and seal it shut with tape. They may color and tape a paper rocket on top, if they choose. Students will blow on the end of the straw to launch the rocket and measure how far it travels. For best results, make sure the end and sides of the pocket are completely sealed. Have them pull the straw a little bit out, and leave an air pocket at the end before blowing.

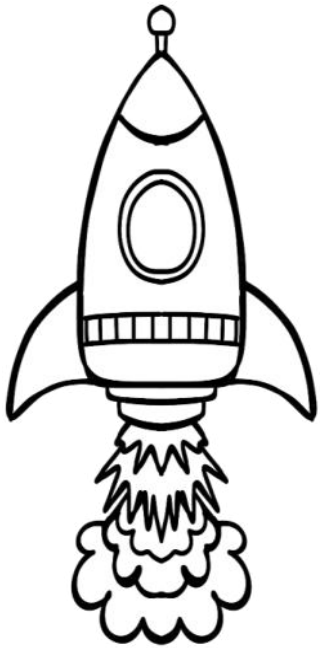
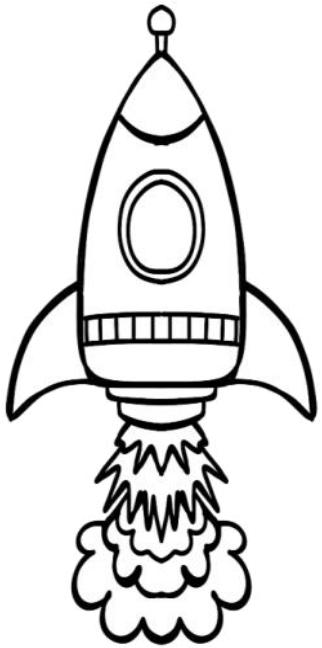
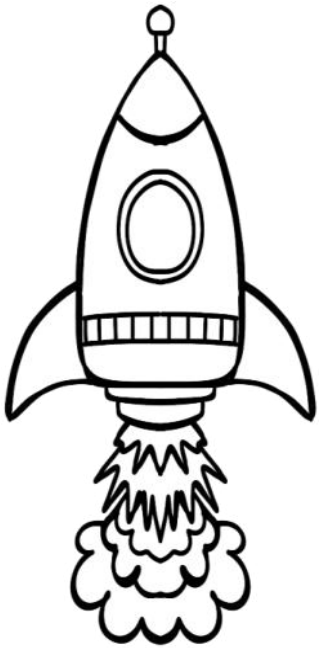
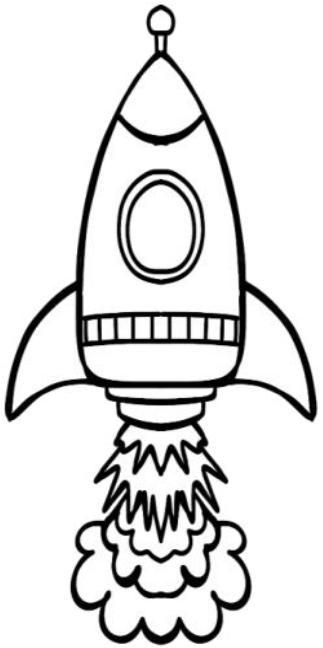
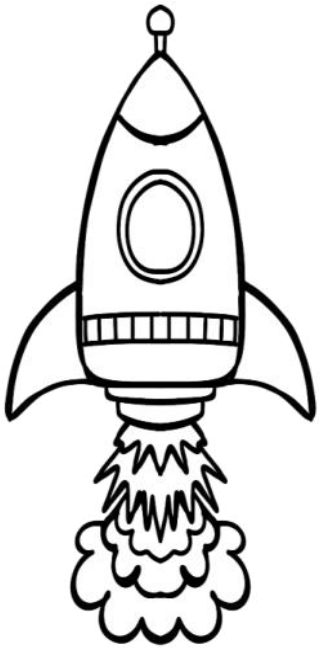
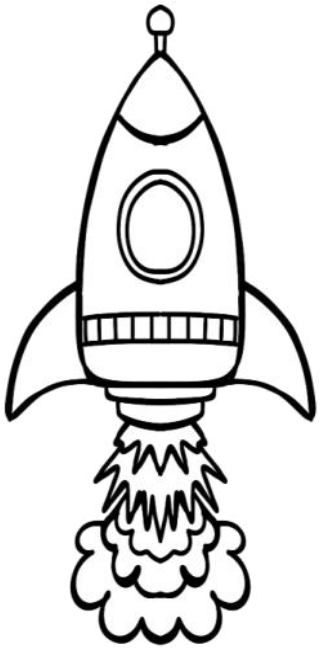
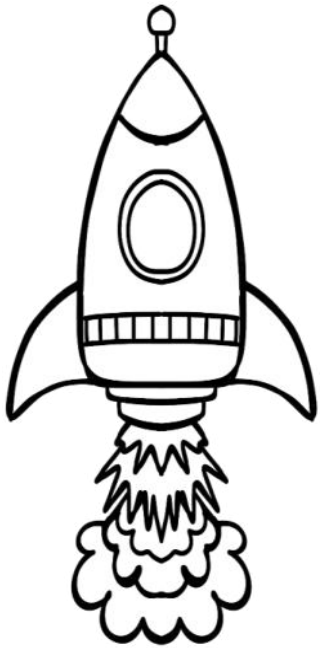
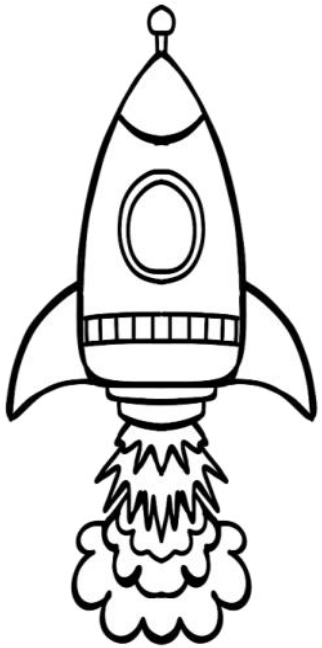
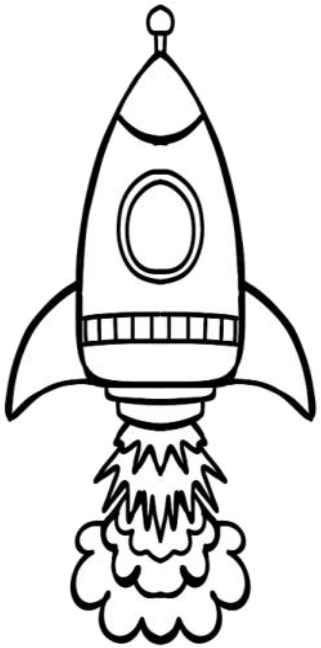
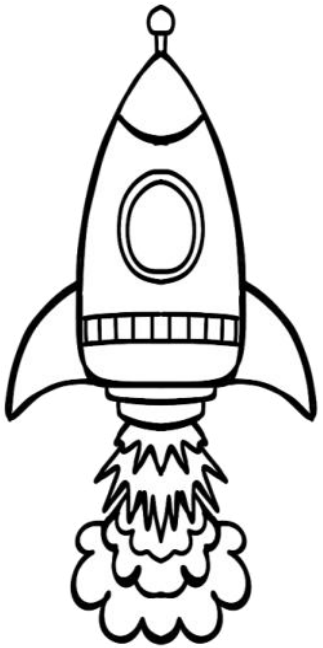
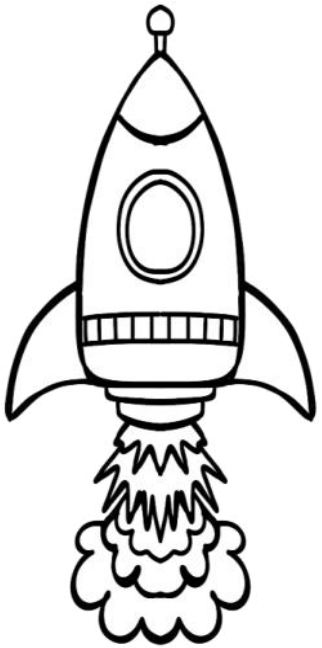
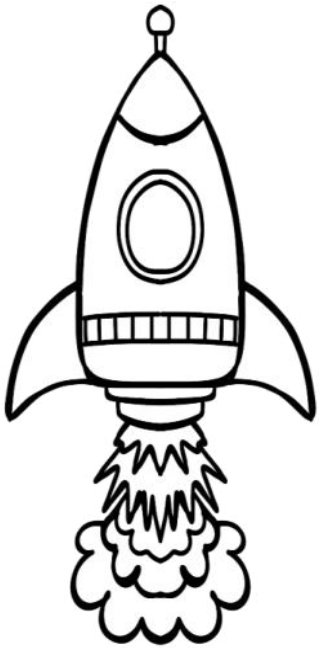
KEY SKILLS: Forces of Flight (gravity, thrust, drag), Measurement

SUGGESTED READ ALOUDS: Mousetronaut by Mark Kelly, If You Decide to Go to the Moon by Faith McNulty, Spaceships and Rockets by DK

MATERIALS PER GROUP: 1 straw per student, 1 paper strip and paper rocket per student, tape, yardstick

LESSON PLAN

1. Activate students' prior knowledge by asking them to share what they already know about the forces of flight and how rockets work.
2. Share and discuss the videos on "Explore Rockets."
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 20-30 minutes to construct and test their straw rockets, measuring the distances they travel.
8. Hold a whole class closing discussion and reflection, allowing students to share their straw rocket designs. Use the Let's Reflect" poster to guide the discussion.

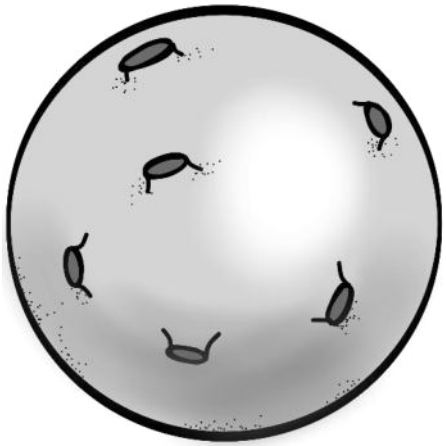













Straw Rocket

POSSIBLE PRODUCT
(for teacher reference only)

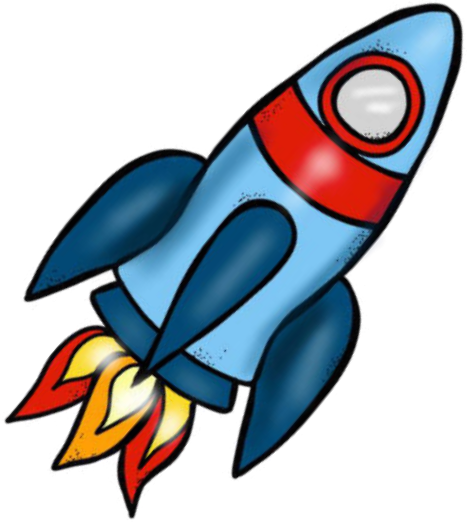
EXPLORE ROCKETS

ESCAPE TO THE MOON



HOW ROCKETS WORK

BUILDING ROCKETS



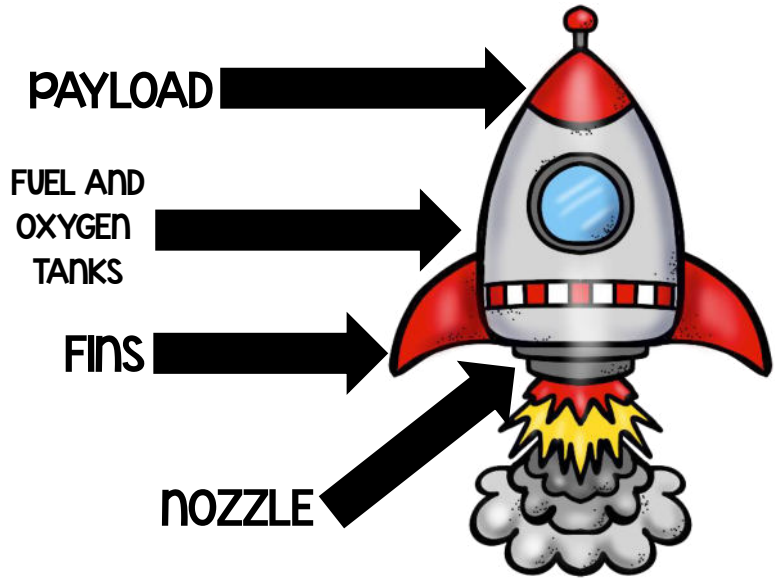
FORCES OF FLIGHT

Straw Rocket

REAL WORLD EXAMPLES

What is similar? What is different?

Basic Parts of a Rocket



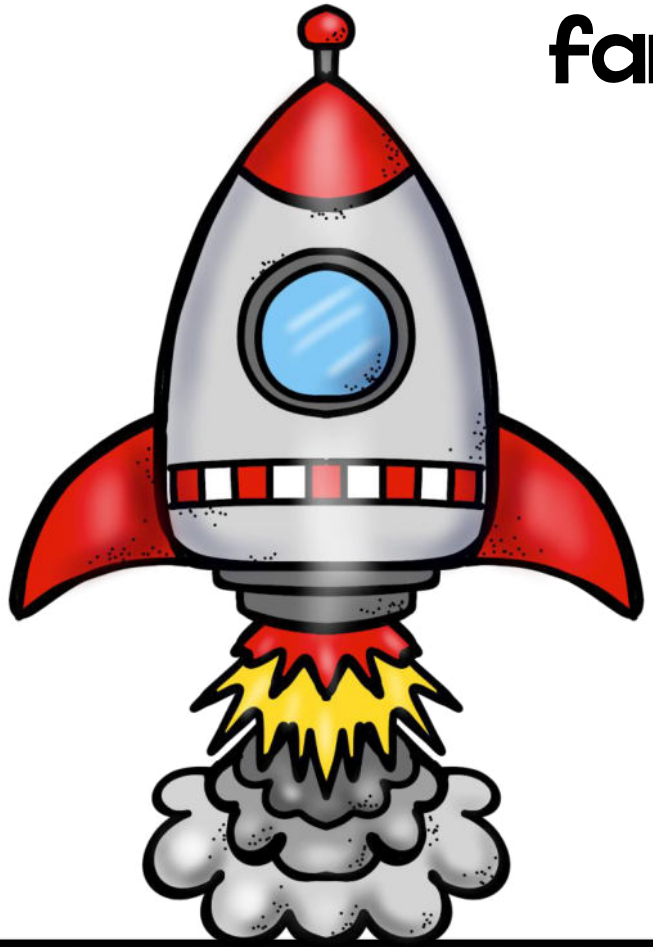
How Rockets Work

Forces of Flight

Straw Rocket

Your friends have challenged you to a contest!

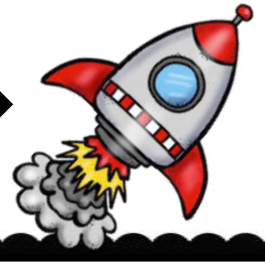
Construct a straw rocket that will travel the farthest distance.



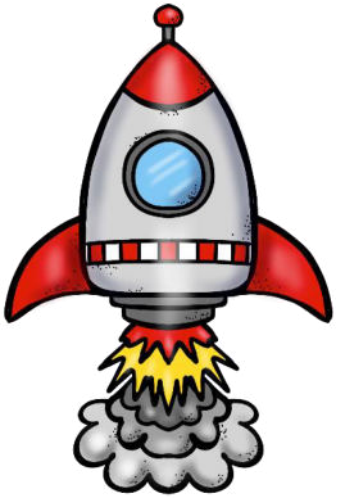
MATERIALS:

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

WORDS TO KNOW



thrust

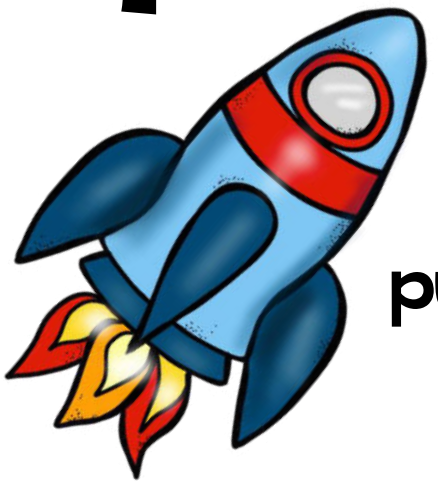


the force of flight that pushes an object forward or upward

drag

force on an object in the air that reduces forward motion

propel



to drive or push forward

gravity

force of attraction of objects to the center of the Earth

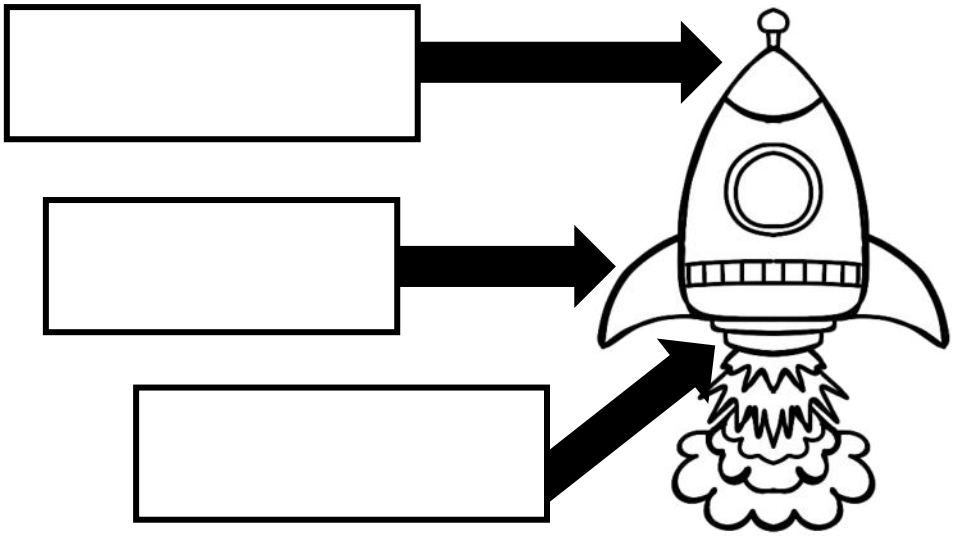
Straw Rocket

Name: _____

MY BLUEPRINT

Draw a picture of your straw rocket.

Label the PAYLOAD, FINS, and NOZZLE.



How far did your rocket travel?

TEST 1	
TEST 2	
TEST 3	

Straw Rocket

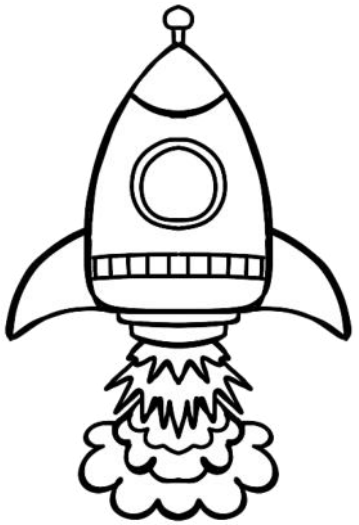
Name: _____

BLUEPRINT

How far did your rocket travel?

TEST 1	
TEST 2	
TEST 3	

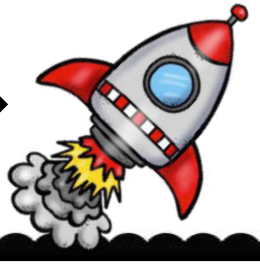
Label the PAYLOAD, FUEL AND OXYGEN TANKS, FINS, and NOZZLE.



Which forces of flight were at work when you launched your rocket?

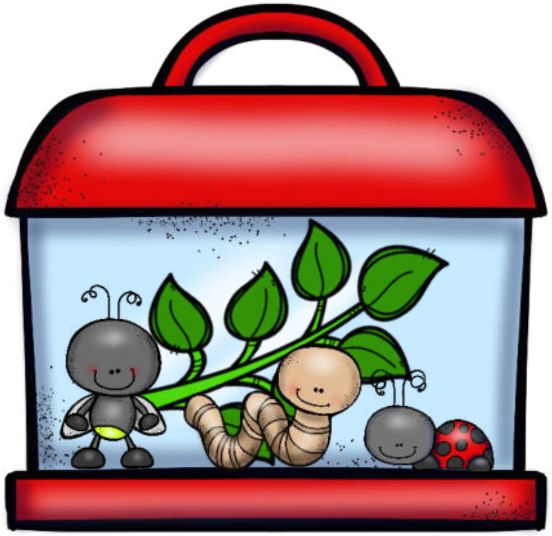
What improvements did you make to your rocket design or launch strategy?

LET'S REFLECT!



- What was most difficult about this challenge?
- What types of pushes and pulls were used in this challenge?
- Which forces of flight were at work when you launched your straw rocket?
- How did you improve the distance of each test? How is wind power involved with the same principles you used today?
- How is your rocket design similar to and different from a real rocket?
- If we completed this challenge again, what would you do differently next time?

STEM CHALLENGE: waterproof critter House



OVERVIEW: For this challenge, students will create a simple habitat for a small insect or "critter" such as a ladybug, ant, or worm. They will cover a tissue box with a variety of waterproof materials such as thick Ziplock baggies, plastic wrap, trash bags, or plastic table cloths, ensuring that air holes are left for their critter to breathe. They will gather a variety of outdoor materials, place a paper critter inside, and test the shelter by spraying it with water to see if it keeps their critter dry.

KEY SKILLS: Engineering Shelters, Insect habitats and needs, Waterproof devices

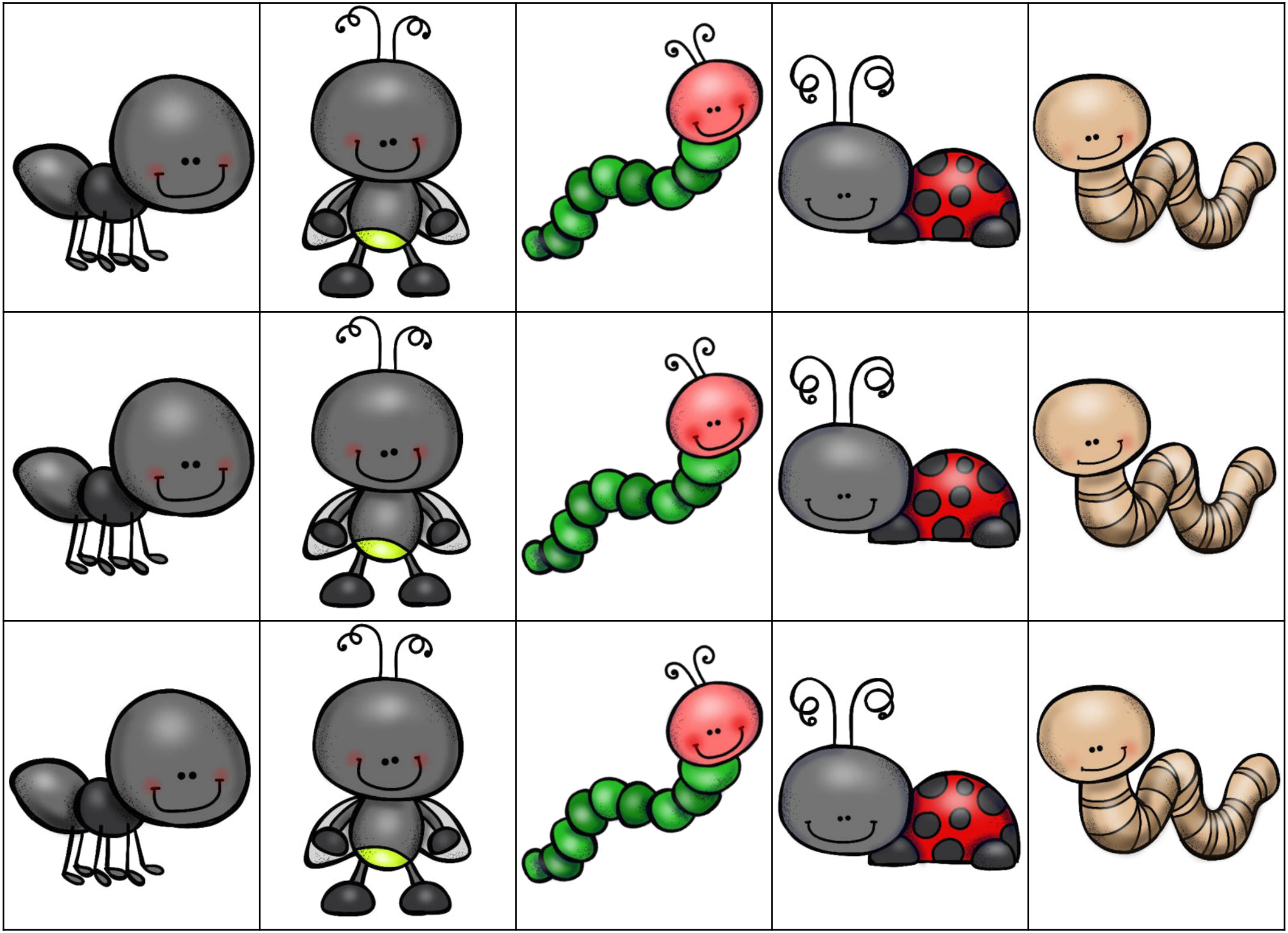
SUGGESTED READ ALOUDS: Bugs A to Z by Caroline Lawton, The Bug Book by Sue Fliess, On Beyond Bugs by Tish Rabe

MATERIALS PER GROUP: empty tissue box, paper plate, tape, scissors, paper critters taped to mini cups, spray bottle with water, outdoor materials such as rocks, dirt, leaves, and sticks, OPTIONS for waterproof materials: gallon ziplock bags, trash bags, plastic tablecloths, plastic wrap

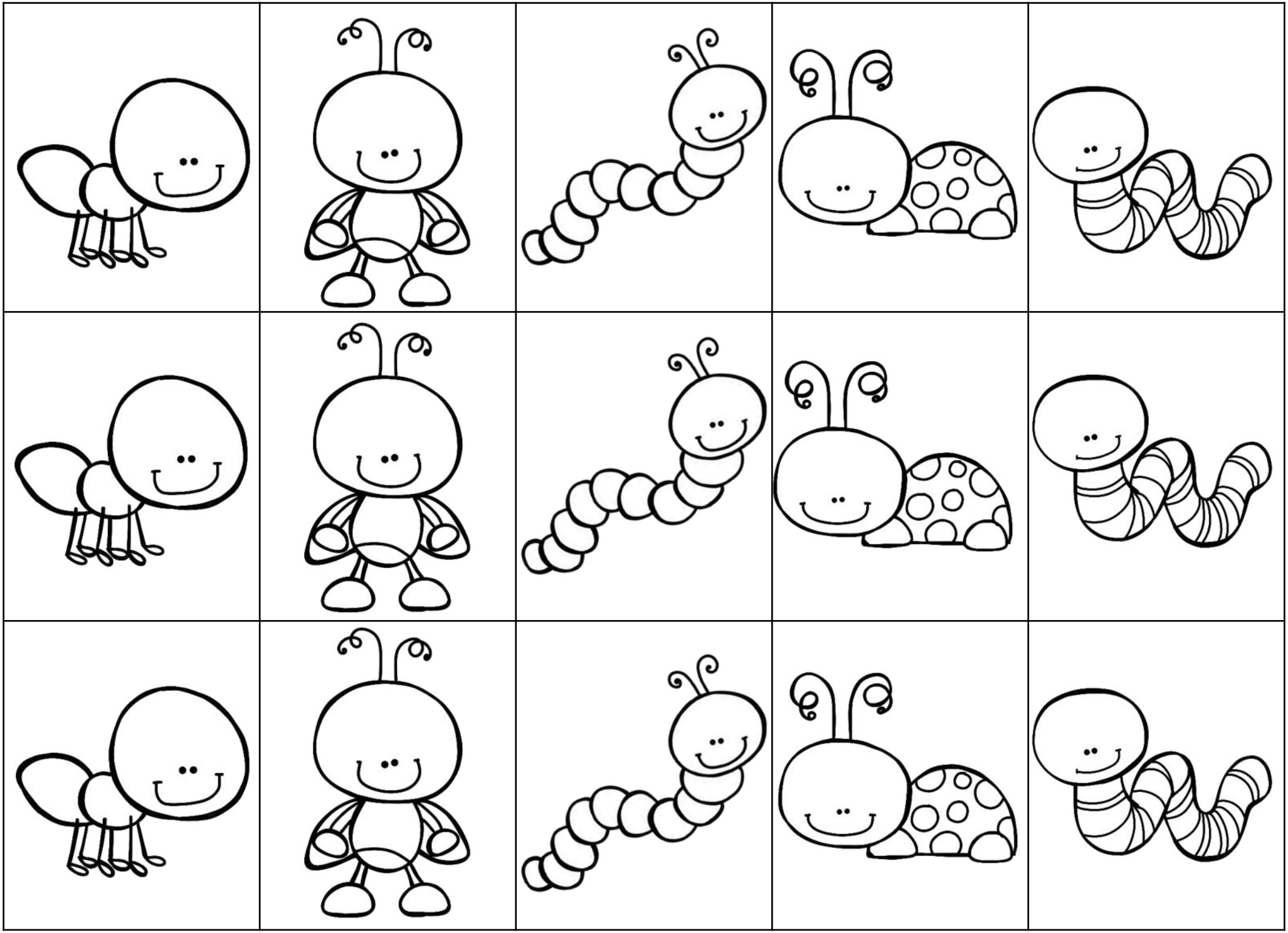
LESSON PLAN

1. Activate students' prior knowledge by asking them to share what they already know about manmade insect homes. Ask them to share examples of small animals and insects that can be survive in artificial habitats and what those habitats need.
2. Share and discuss the videos on "Explore Insects."
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. Allow students 10-15 minutes to gather outdoor materials for their critter house in a baggie.
7. 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 critter houses, place paper critters inside, and test them to ensure they are waterproof.
8. Hold a whole class closing discussion and reflection, allowing students to share their critter houses. Use the "Let's Reflect" poster to guide the discussion.

critters



critters



Waterproof Critter House

POSSIBLE PRODUCT

(for teacher reference only)

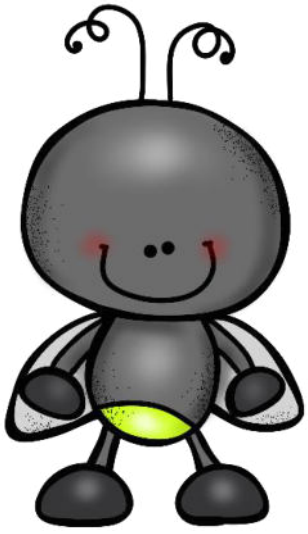
EXPLORE INSECTS

INSPECT AN INSECT

UNDER A ROCK

BUG HUNTING GAME

10 INTERESTING INSECTS



Waterproof Critter House

REAL WORLD EXAMPLES

What is similar? What is different?

Types of Insects

Where Insects Live

What Insect Homes Need

Waterproof Critter House

You've caught some insects in your backyard and they 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

WORDS TO KNOW

shelter

a dwelling
or home
designed
for protection

terrarium

a clear
container that
houses plants,
insects, reptiles,
or amphibians

waterproof

unable to
be penetrated
by water

habitat

the natural home or environment
of a plant or animal

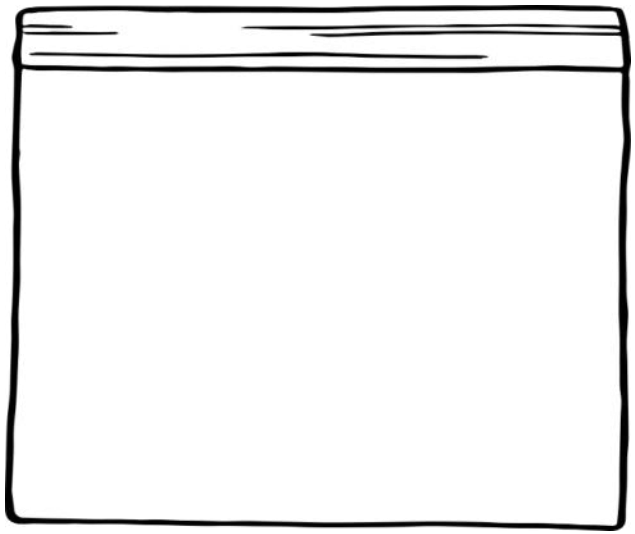
Waterproof Critter House

Name: _____

MY BLUEPRINT

Draw a picture of your critter house.

Draw the objects that you found outside for your habitat.



Draw the insects that you put inside your critter house.

Is your critter house WATERPROOF?

YES NO

Waterproof Critter House

Name: _____

BLUEPRINT

What objects did you gather outside for your insect habitat?

Which materials did you use to make your critter house waterproof?

Did your shelter stay dry when you sprayed it with water?

YES NO

How could you improve your shelter to make it an ideal habitat for insects?

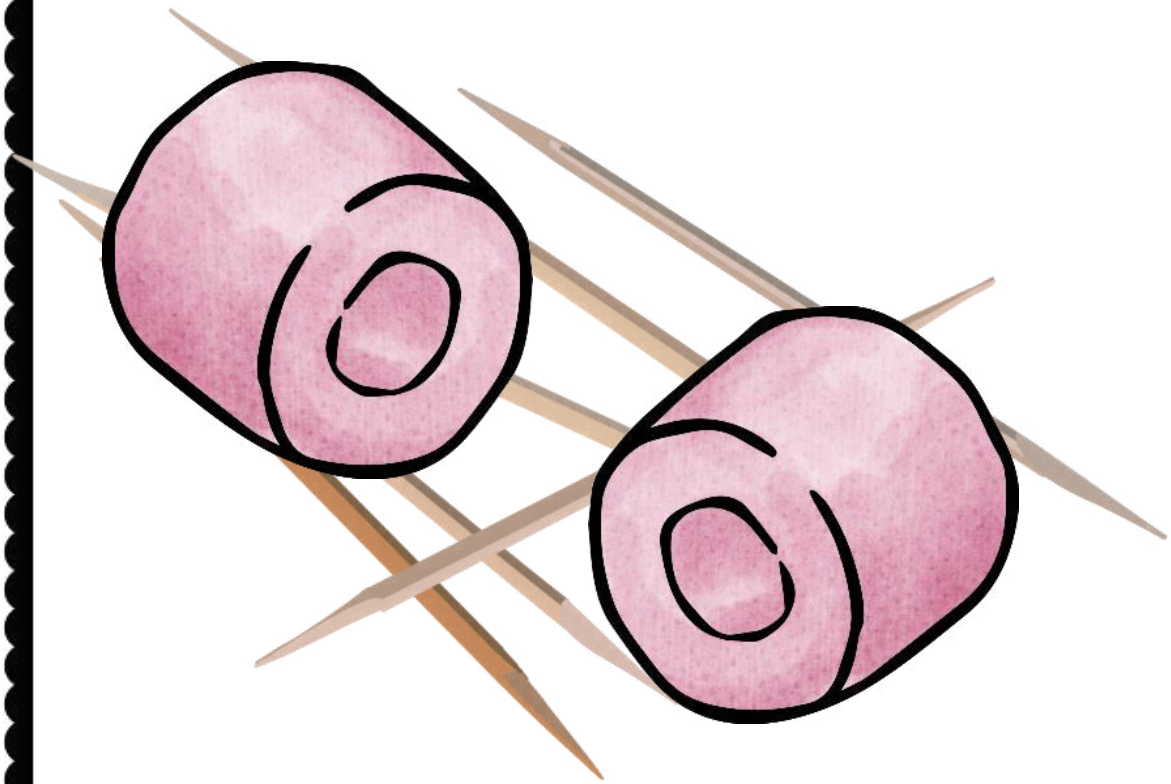
LET'S REFLECT!

- What was most difficult about this challenge?
- How did you design your critter house to be a good habitat for your insects?
- What types of items did you include in your critter house to help your insects survive?
- Which waterproof material was most effective and why do you think so?
- What types of waterproof materials do you find on real shelters?
- What are some waterproof materials that are found in nature or animal coverings?
- If we completed this challenge again, what would you do differently next time?

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

Pool Noodle Party

POSSIBLE PRODUCT

(for teacher reference only)

Pool Noodle Party

Name: _____

Draw and describe your creations.

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: _____

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STEAM Challenge Assessment Rubric

Challenge: _____

Date: _____

Student Name: _____

3	2	1
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STEAM Challenge Assessment Rubric

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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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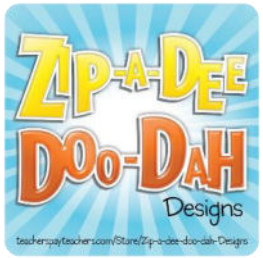
Credits

Created by Brooke Brown

Thank you for your purchase!



http://www.teacherspayteachers.com/Store/Zip-a-dee-doo-dah-Designs