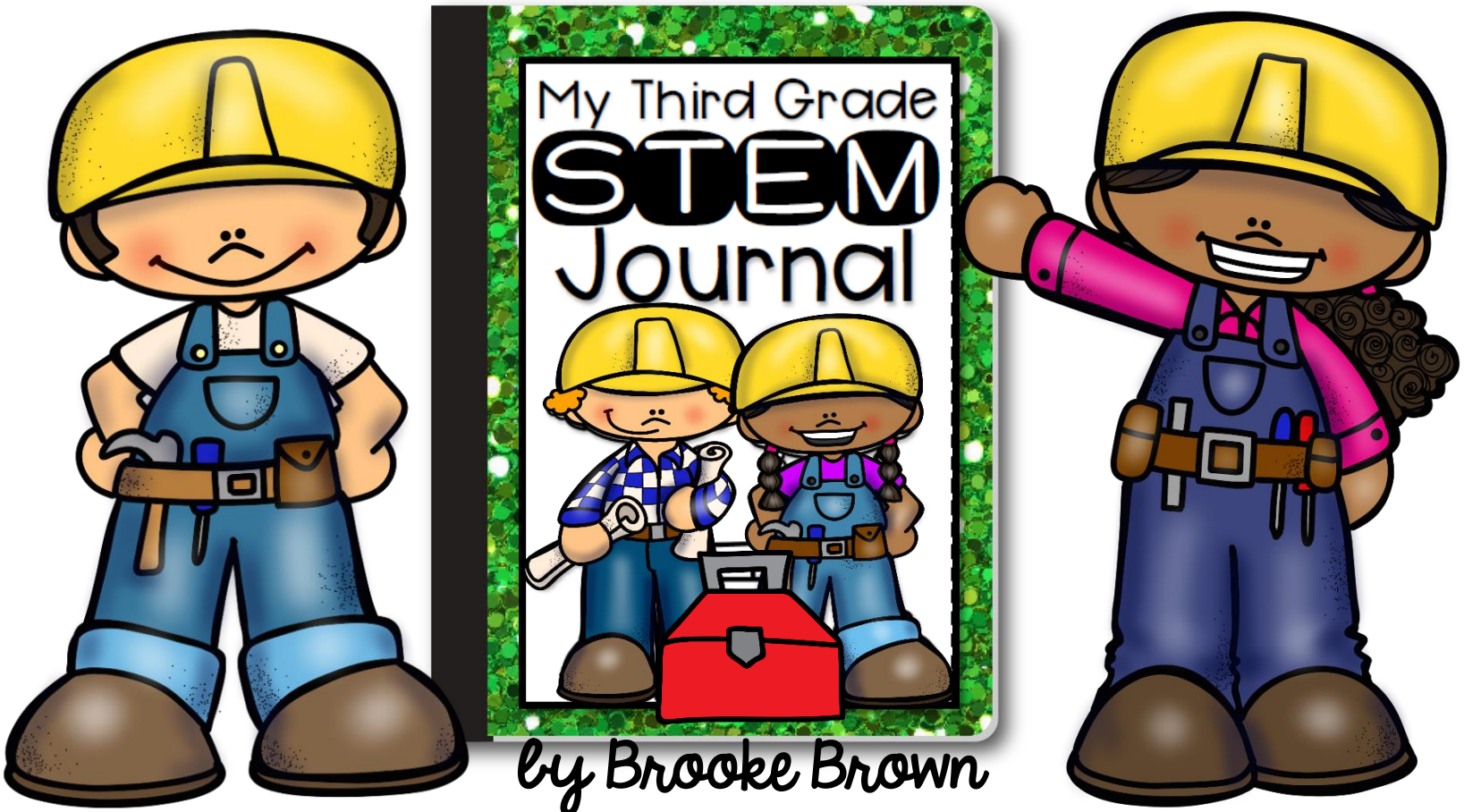
Third Grade STEM



by Brooke Brown

HOW TO USE

The following materials are designed specifically for third grade students and align with crosscutting NGSS science, engineering and math standards. Six challenges are provided to align with major NGSS content areas. Student booklets can be cut and glued into composition notebooks (main cover provided on Page 4) or can be used as stand alone booklets by copying front to back and folding in half. Suggested materials for each challenge are inexpensive and/or found in most early childhood classrooms. Parents can also be asked to donate needed supplies. Students are encouraged to work in partners or small groups. Each challenge should be allotted 45-60 minutes from start to finish, including a whole class discussion both before and after the challenge.

<u>Each challenge in this package contains the following items:</u>

*Challenge Description, Aligned NGSS Standards, Suggested Materials, and Detailed Lesson Plans

*Photos of possible student products

*Teacher Chart to guide whole class discussion for use on a document camera or interactive whiteboard

*Student booklet to record prior knowledge, ideas, observations, questions, materials, blueprints, and reflections

CONTENTS

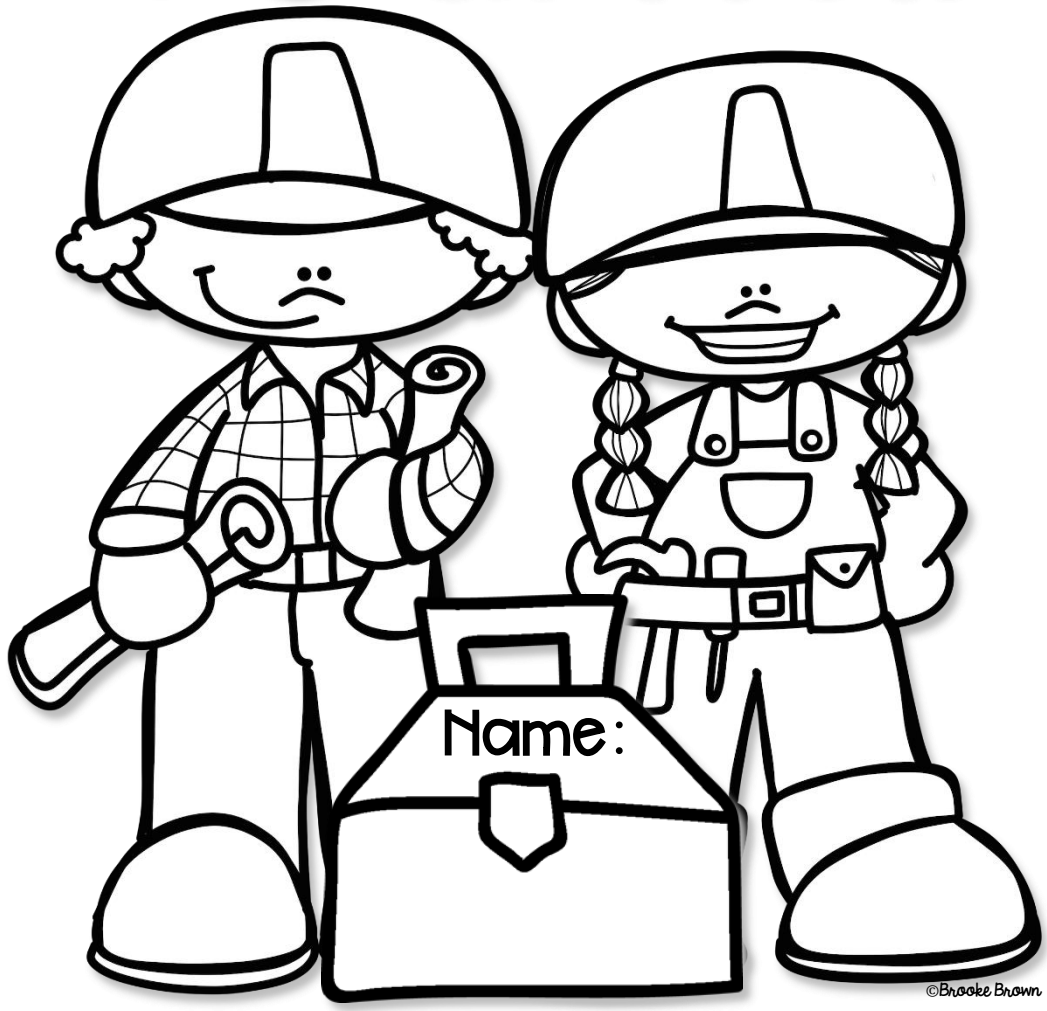
Page 4: Student Journal Cover

Motion and Stability: Forces and Interactions
Pages 5-10: Magnetic Maze
Pages 11-15: Marshmallow Catapult
Heredity: Inheritance and Variation of Traits
Pages 16-22: Genetic Links
Biological Evolution: Unity and Diversity
Pages 23-27: Super Animal
Earth's Systems
Pages 28-33: Close Up Climate
Earth and Human Activity
Pages 34-38: Flood-proof House

Page 39: Credits

My Third Grade STEM Journal

My Third Grade STEM Journal



Magnetic Maze

NGSS Standard Alignment: 3-PS2-3:Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other., 3-PS2-4: Define a simple design problem that can be solved by applying scientific ideas about magnets. 3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Challenge Description: Students will construct a maze out of popsicle sticks on a poster board and may tape the sticks down to the poster if they choose Then, they will navigate a magnetic "mouse" through the maze to get to the cheese at the end. They will experiment with basic principles for how magnets attract and repel with north/south poles, and learn about magnetic fields as they travel through mediums such as the poster board. Some students may choose to "push" the mouse through the maze with like poles repelling, while others may choose to place the magnet on the other side of the poster board to attract and pull the mouse from the other side.

Suggested Materials: informational books about magnets, poster board, popsicle sticks, scotch tape, strong magnets such as buttons or bars, copies of the mouse (with magnet on the back) and cheese templates on page 8.

LESSON PLAN

1. Prime students' background knowledge about magnets by reading aloud an informational book of your choice.
2. Hold a class discussion, allowing students to brainstorm examples of different magnetic materials around the classroom. Have student volunteers test each material with a magnet. Ask students how they think magnets work and discuss examples of how magnets are useful in our world. Record their ideas on the provided teacher chart and have them add ideas to their individual booklets.
3. Introduce permitted materials and share the two part challenge: the first part being for students to construct the maze and the second part for students to use magnets to "move" the mouse through the maze to the cheese at the end. Discuss possible ways that students might get their mouse to "move" without touching it.
4. Allow students at least 45 minutes with partners or small groups to construct and test their mazes, as well as record in their individual student journals. If time permits, they can trade mazes with another group and attempt to move their mouse through it.
5. Hold a whole class closing discussion and reflection, allowing students to share what they created and what they learned about magnets. Record their ideas on the provided teacher chart.

Magnetic Maze

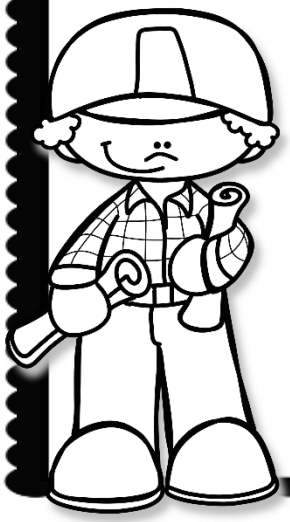
Possible Product

Magnetic Maze

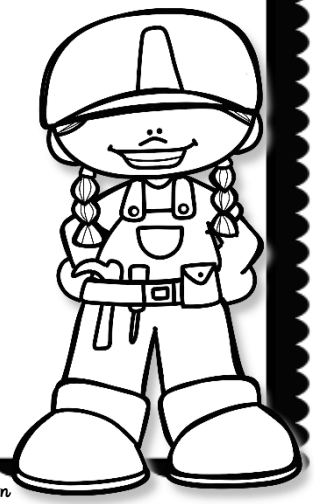
Properties of Magnets

Things That Are Magnetic

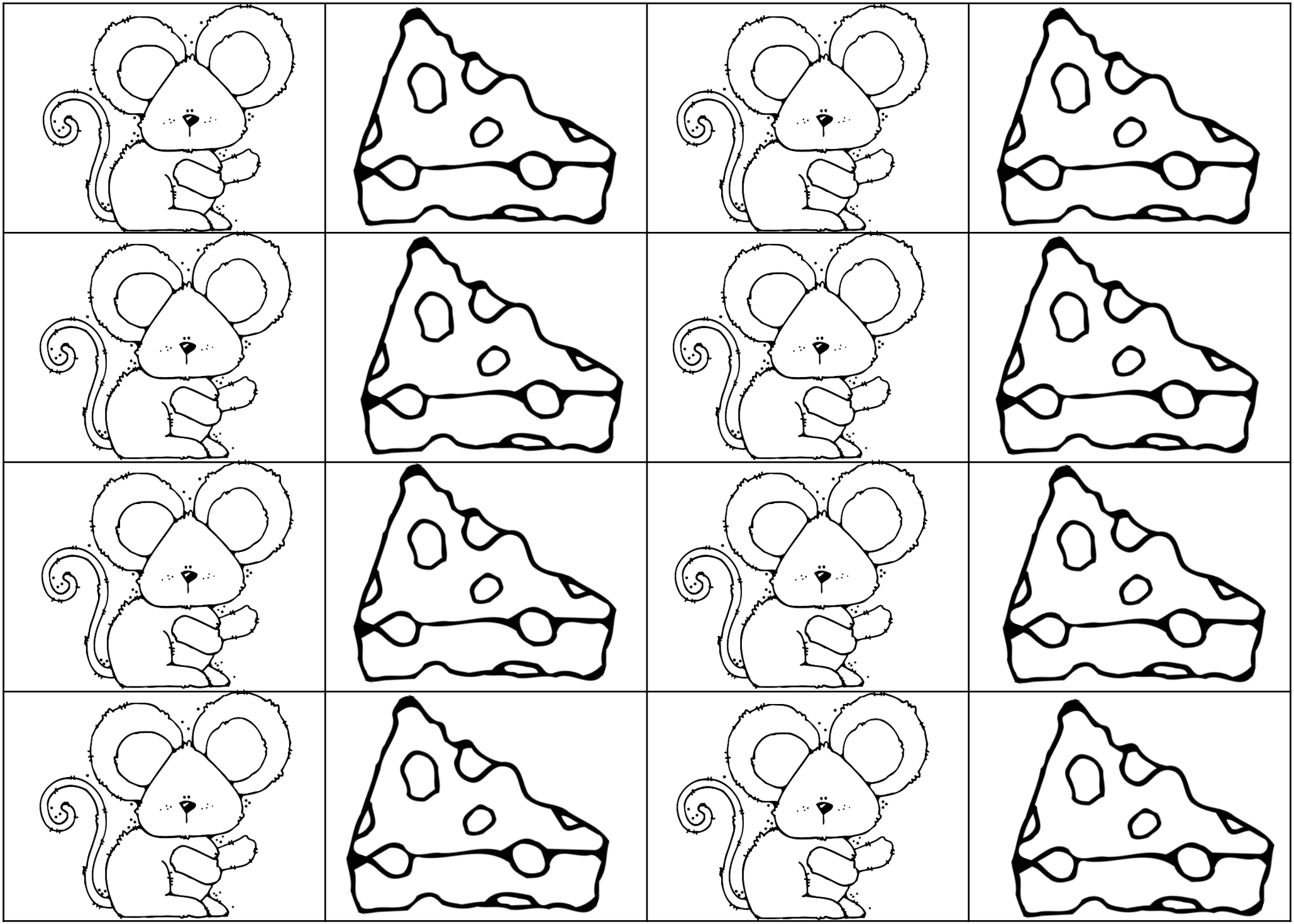
How Magnets Are Useful



What We Learned About Magnets



Mouse & Cheese Templates



Magnetic Maze

Name:_____

THE CHALLENGE

Can you construct a maze and use magnets to move a mouse through the maze from start to finish?

What are some properties of Magnets?

One thing That was EASY:

One thing That was CHALLENGING:

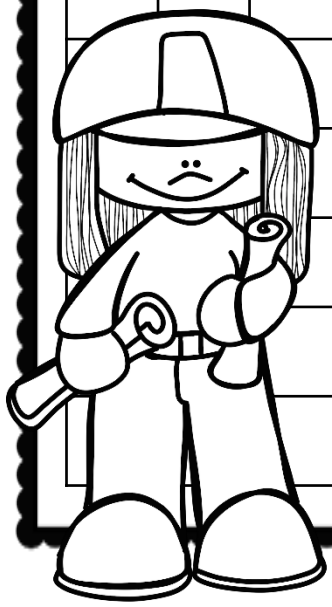
One thing That I IMPROVED:

What I Learned About Magnets

Things That Are Magnetic

How Magnets Are Useful

My Magnetic Maze



MARSHMALLOW CATAPULT

NGSS Standard Alignment: 3-PS2-1: Plan and conduct and investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. 3-PS2-2: Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. 3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. CCSS.MATH.CONTENT.3.MD.B.4: Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch.

Challenge Description: Students will create a simple model of a catapult using rubber bands, popsicle sticks, and a plastic spoon. While this is a more challenging activity, a wide variety of working catapults are possible. Encourage students to intersect sticks in different directions and use the spoon as the "arm" to throw the marshmallow. Students will also measure the approximate distances for each launch to the nearest centimeter.

Suggested Materials: informational books about force and motion, popsicle sticks, rubber bands, plastic spoons, large marshmallows, meter sticks or tape measures

LESSON PLAN

1. Prime students' background knowledge about force and motion by reading aloud an informational book of your choice. I would highly suggest that you project a variety Google images of catapults on an interactive whiteboard and discuss the similarities, differences, and parts of a catapult that might be important such as the "arm," "base," and angle/space that elevates the arm.
2. Hold a class discussion, allowing students to share what they already know about methods of balanced and balanced forces and what questions they have. Have students press their palms together and discuss what happens. (balanced force = no motion), then gently push a pencil across their desk (unbalanced force = motion) Essentially, students should grasp that a balanced force causes no motion at all, while an unbalanced force causes motion. Record their ideas and examples on the provided teacher chart and have them add ideas to their individual booklets.
3. Introduce permitted materials and share the challenge. Allow students to share ideas for how the materials work and might fit together in different ways to make working catapults. Model how to measure longer distances to the nearest centimeter using meter sticks or tape measures.
4. Allow students at least 45 minutes with partners or small groups to create and test a variety of designs, measure the distance of launches, and record in their STEM journals.
5. Hold a whole class closing discussion and reflection, allowing students to share what they created and what they learned about force and motion. Students likely discovered that an unbalanced force must be used for a catapult to function properly. Record their ideas on the provided teacher chart and have them finish their individual booklets.

MARSHMALLOW CATAPULT

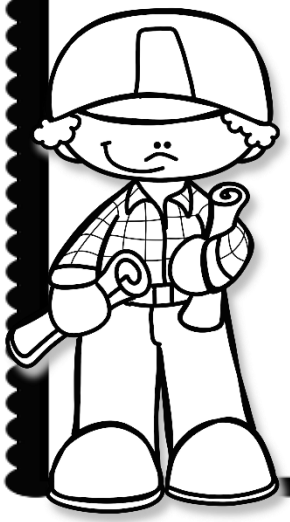
Possible Product

Marshmallow Catapult

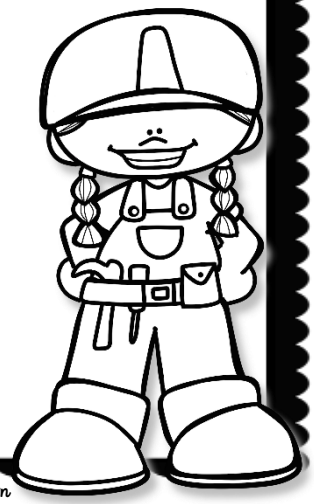
What is Balanced Force?

What is Unbalanced Force?

Questions We Have About Force



What We Learned About Force



Tests

Test	Distance to nearest centimeter
1	
2	
3	
4	

One thing That was EASY:

One thing That was CHALLENGING:

One thing That I IMPROVED:

Marshmallow Catapult

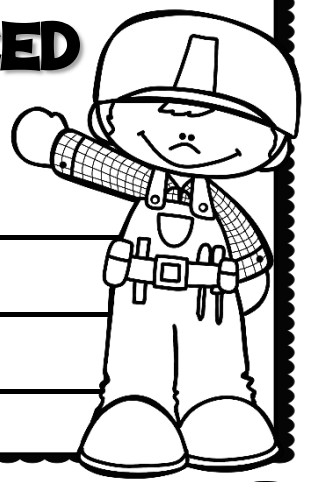
Name:_____

THE CHALLENGE

Can you create a catapult that will launch a marshmallow the farthest distance?

What is BALANCED Force?

What is UNBALANCED Force?

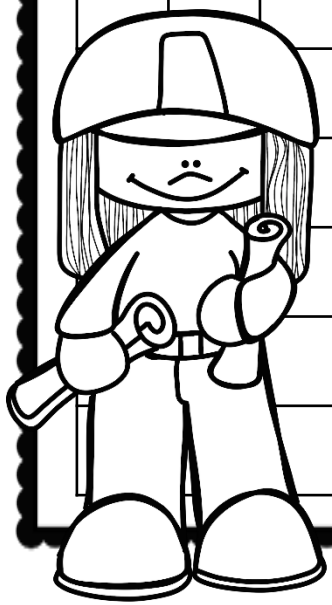


Examples of BALANCED Forces

Examples of UNBALANCED Forces

My catapult

Don't forget to label the parts!



Genetic Links

NGSS Standard Alignment: 3-LS3-1: Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. 3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Challenge Description: Students will survey five different classmates to discover different dominant and recessive genetic traits and analyze their data on a tally chart. They will also create a color-coded paper chain and chart that represents their own traits.

Suggested Materials: informational books about genetics/inheritance of traits, copies of pages 20-22 for each student, crayons

Lesson Plan

1. Prime students' background knowledge about inheritance and traits by reading aloud an informational book of your choice.
2. Hold a class discussion, explaining and discussing the difference between observable traits (traits that we can actually see) and unobservable traits (traits that we cannot actually see, such as personalities, interests, likes, and dislikes). On the first page of their booklets, have students record in their booklets that we get our traits from (1) family and (2) the environment. Also, discuss the difference between dominant (more common) and recessive (less common) traits. Record their ideas on the provided teacher chart and have them add ideas to their individual booklets.
3. Go over survey instructions and allow students to survey five different classmates using the chart inside their booklets. Bring students back together as a whole class to discuss and compare results, using the teacher chart to guide their responses. After students make predictions for which traits are dominant and recessive, share and discuss the chart on page 19.
4. Allow students at least 30 minutes to create their paper chains for "Genetic Links" on page 20 and complete the corresponding chart in the back of their booklets. Students may also bring home their booklets to compare traits with parents or family members.

Genetic Links

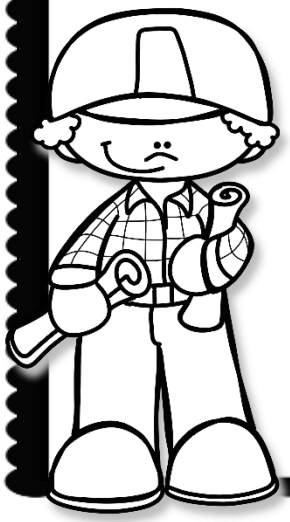
Possible Product

Genetic Links

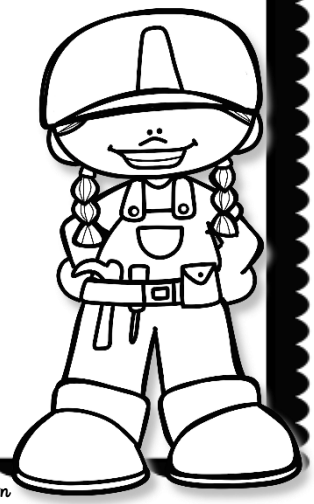
What are OBSERVABLE Traits?

What are UNOBSERVABLE Traits?

What are DOMINANT Traits?

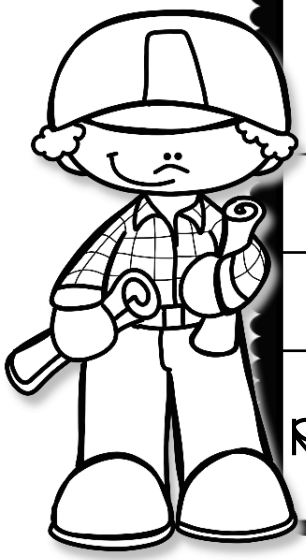


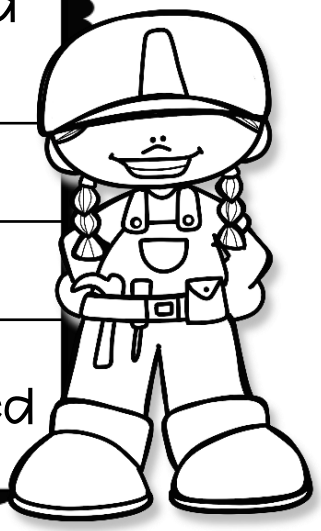
What are RECESSIVE Traits?



Dominant and Recessive Traits

DOMINANT (more common)	RECESSIVE (less common)
Dimples	No Dimples
Freckles	No Freckles
Free Earlobes	Attached Earlobes
Rolling Tongue	Nonrolling Tongue
Second Toe Longer Than Big Toe	Big Toe Longer Than Second Toe
Brown Eyes	Blue, Green, or Hazel Eyes
Dark Colored Hair	Light Colored Hair
Right Arm on Top When Folded	Left Arm on Top When Folded





Genetic Links

Follow the color code to color each link of your chain. Cut the links apart and glue together on the gray boxes to create a "paper chain."

	My Genetic Links NAME:_____
	Dimples = DARK PINK No Dimples = LIGHT PINK
	Freckles = ORANGE No Freckles = YELLOW
	Free Earlobes = LIGHT BLUE Attached Earlobes = DARK BLUE
	Rolling Tongue = PURPLE Nonrolling Tongue = RED
	Second Toe Longer = LIGHT GREEN Big Toe Longer = DARK GREEN
	Brown Eyes = BROWN Blue, Green, or Hazel Eyes = BLUE
	Dark Hair = BLACK Light Hair = WHITE
	Right Arm on Top When Folded = TAN Left Arm on Top When Folded = GRAY

Genetic Links

Name: _____

THE CHALLENGE

Can you identify and analyze observable traits for yourself and your classmates?

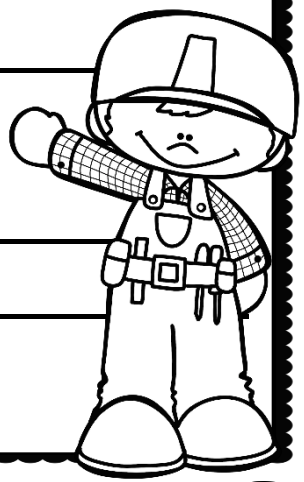
Where Do Our Traits Come From?

1. _____

_____

2. _____

_____



My Observable Traits

Use your "Genetic Links" chain to complete the following chart.

Color	Meaning	D (Dominant) or R (Recessive)

What are OBSERVABLE Traits?

What are NONOBSERVABLE Traits?

What are DOMINANT Traits?

What are RECESSIVE Traits?

My Classmates' Observable Traits

Survey 5 classmates and make a tally mark in the box for each observable trait that they have. When you are finished, circle the traits that were most common.

Dimples		No Dimples	
Freckles		No Freckles	
Free Earlobes		Attached Earlobes	
Rolling Tongue		Nonrolling Tongue	
Second Toe Longer Than Big Toe		Big Toe Longer Than Second Toe	
Brown Eyes		Blue, Green, or Hazel Eyes	
Dark Colored Hair		Light Colored Hair	
Right Arm on Top When Folded		Left Arm on Top When Folded	

SUPER ANIMAL

NGSS Standard Alignment: 3-LS4-2: Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing, 3-LS4-3: Construct an argument with evidence that in a particular habitat some organisms survive well, some survive less well, and some cannot survive at all. 3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Challenge Description: Students will design a body covering for an animal that will protect it as much as possible and allow for optimal potential for survival. Students will use a paper plate to create a "shield" for a stuffed animal that turns it into a "super animal," offering protection from predators and weather. Students can use harder objects to mimic protective shells, toothpicks for "spikes," waterproof materials to keep their animal dry or insulating materials to keep it warm. They may also color camouflaged patterns or warning colors on their plates.

Suggested Materials: informational books about animal survival, small stuffed animals, paper plates, toothpicks, crayons, egg cartons cut into pieces, plastic baggies, scraps of warm fabric such as wool or flannel, scotch tape or liquid glue, rubber bands to attach shields around stuffed animals

LESSON PLAN

1. Prime students' background knowledge about animal survival by reading aloud an informational book of your choice. You may also choose to project a variety Google images of animals on an interactive whiteboard so that students can discuss survival mechanisms for each one.
2. Hold a class discussion, allowing students to share what they already know about animal survival and what questions they have about how animals use their body coverings to survive and protect themselves. Record their ideas on the provided teacher chart and have them add ideas to their individual booklets.
3. Introduce permitted materials and share the challenge. Allow students to share ideas for how the materials work and might fit together in different ways to create a protective animal shield.
4. Allow students at least 45 minutes with partners or small groups to create and test a variety of designs, as well as record in their STEM journals. Students will also design an ideal habitat for their Super Animal on the last page of their booklet.
5. Hold a whole class closing discussion and reflection, allowing students to share what they created and what they learned about animal survival. Record their ideas on the provided teacher chart.

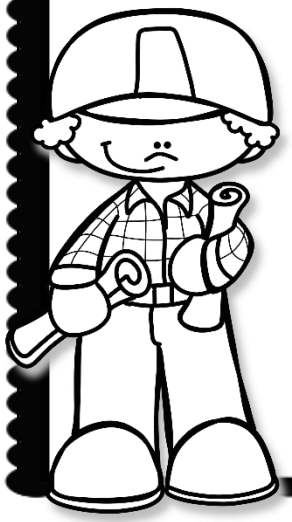
SUPER ANIMAL
Possible Products

SUPER ANIMAL

What Animals Need to Survive

Dangers to Animals

How Animals Protect Themselves



My Super Animal

Material	How it Protects my Animal

If you could design a HABITAT for your Super Animal, what would it look like?

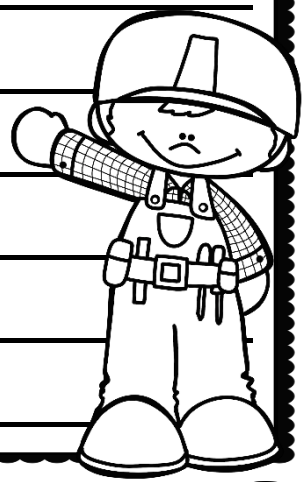
SUPER ANIMAL

Name:_____

THE CHALLENGE

Can you create a shield for an animal that protects it and helps it to survive?

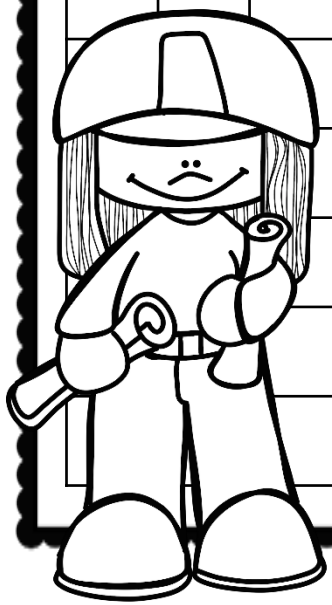
What Animals Need to Survive



Dangers to Animals

How Animals protect Themselves

My Super Animal



CLOSE UP CLIMATE

NGSS Standard Alignment: 3-ESS2-2: Obtain and combine information to describe climates in different regions of the world. 3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Challenge Description: Students will research a variety of climates, then create a diorama that represents a climate region of the world. You may choose to assign specific climate regions to students or allow them to choose their own. After constructing the inside of the diorama, they will complete three informational labels about their climate to attach to the outside of the box.

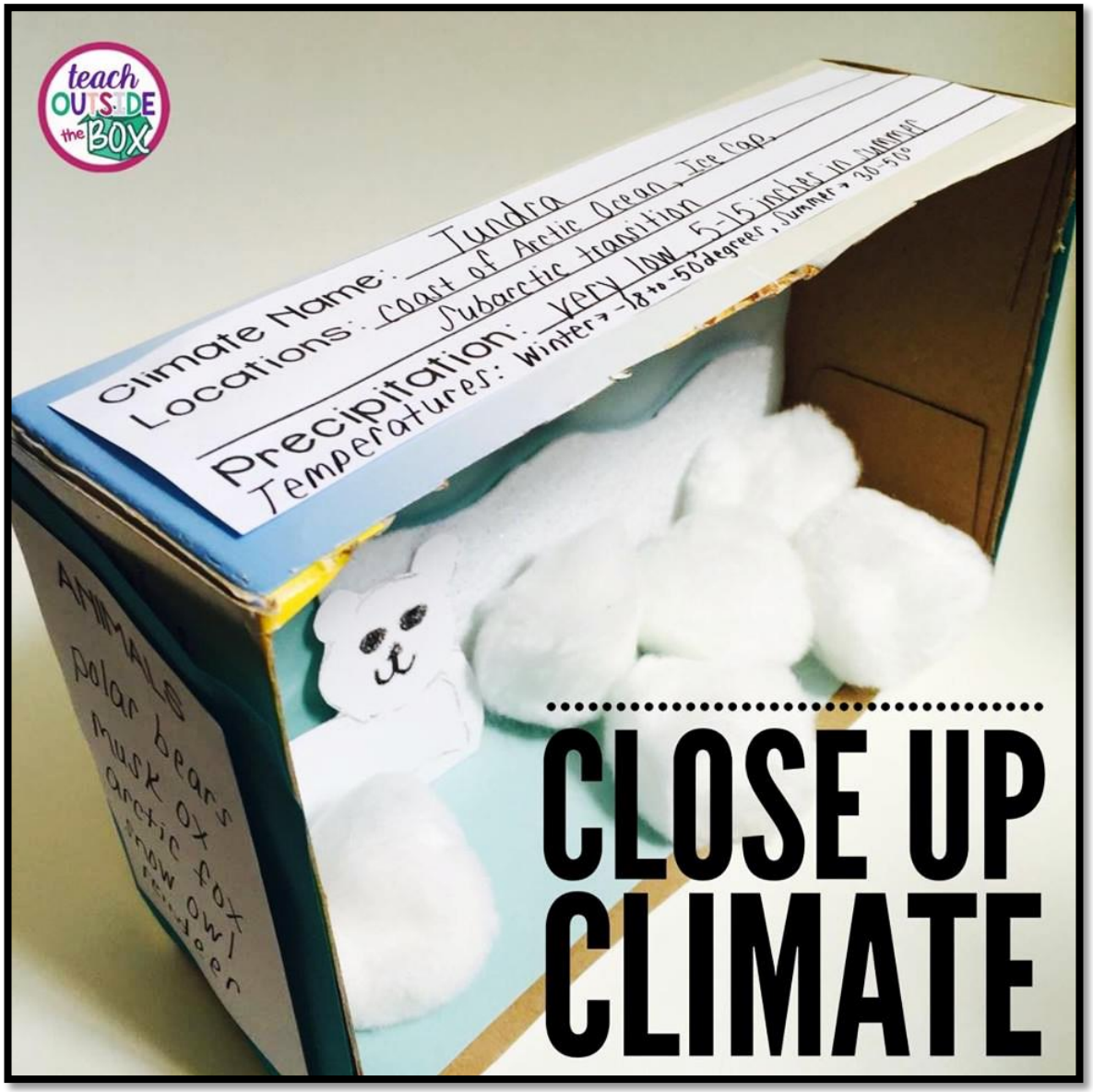
Suggested Materials: empty cardboard boxes such as shoe boxes or Kleenex boxes, construction paper, fabric and felt scraps, crafting materials of your choice, scotch tape or liquid glue, copies of labels on page 32, access to https://sites.google.com/site/climatetypes/home and/or printouts of the home page, 5 causes of climate, and climate information from each page.

LESSON PLAN

1. Hold a class discussion about climate by allowing them to explore the https://sites.google.com/site/climatetypes/home website. Record found information on the provided teacher chart and allow students to use it to complete their individual booklets. You may choose to project the site on an interactive whiteboard, allow students to research with partners on computers or devices, or print the informational sheets directly from the website. Allow them to use photographs from the website for inspiration as they construct their dioramas.
2. Introduce permitted materials and share the challenge instructions. You may choose to assign specific climates to each group or allow them to choose their own.
3. Allow students at least 45 minutes with partners or small groups to use the website information to create their dioramas and complete the corresponding labels for the boxes.
4. Hold a whole class closing discussion and reflection, allowing students to share what they learned about different climate types and present their dioramas to the class.

CLOSE UP CLIMATE

Possible Products



Close Up Climate

What Does Climate Mean?

The 5 Causes of Climate

1
2
3
4
5

12 Climate Types

1
2
3
4
5
6
7
8
9
10
11
12

Fascinating Facts About My Climate

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

6. _____

_____

Close Up Climate

Name: _____

THE CHALLENGE

Can you create an informational diorama that represents a type of climate?

What does CLIMATE mean?

_____

_____

_____

What are some climate types that are found in our country?

_____

_____

_____

_____

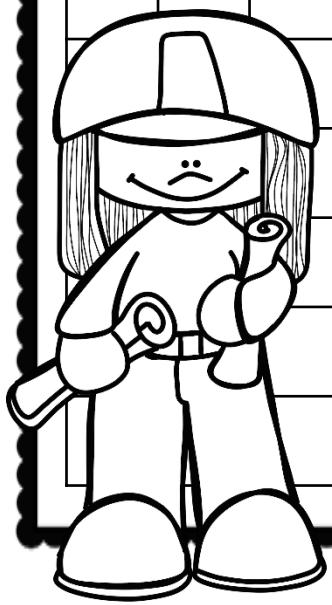
_____

_____

12 Climate Types

1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

My Climate



CLOSE UP CLIMATE

TOP LABEL

Climate Name: _____

Locations: _____

_____

Temperature: _____

Precipitation: _____

SIDE LABELS

VEGETATION	ANIMALS

FLOOD-PROOF HOUSE

NGSS Standard Alignment: 3-ESS3-1: Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard, 3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Challenge Description: Students will design a small model of a house and a protective barrier around the house to prevent it from flooding. They will test a variety of materials to determine which are effective and which are not for sealing out water and protecting a structure.

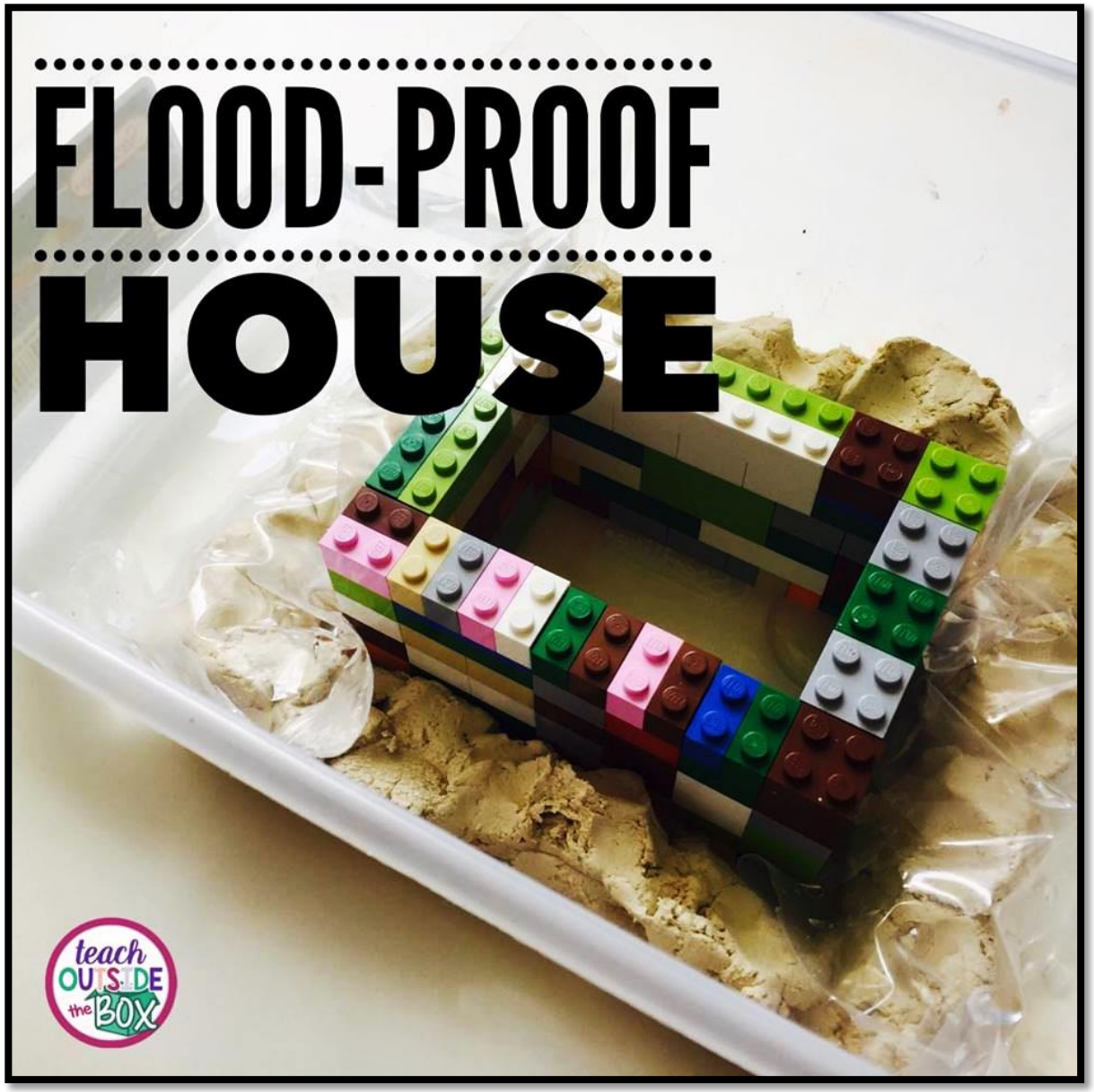
Suggested Materials: informational books about flooding and severe weather, plastic containers, building blocks such as Legos or unifix/linking cubes (for the house structure), air dry clay, plastic tablecloths or gallon-sized plastic baggies, Styrofoam plates

LESSON PLAN

1. Prime students' background knowledge about severe weather by reading aloud an informational book of your choice. If possible, project real images of floods and discuss methods of barriers that could protect structures from water damage.
2. Hold a class discussion about how to prepare for different types of severe weather. Record their ideas on the provided teacher chart and have them add ideas to their individual booklets.
3. Introduce permitted materials and share the challenge instructions. Allow students time to test the effectiveness of different materials with water, construct a variety of designs, and record in their STEM journals.
4. Hold a whole class closing discussion and reflection, allowing students to share what they learned about flood barriers. Record their ideas on the provided teacher chart and have them finish their individual booklets.

FLOOD-PROOF HOUSE

Possible Product

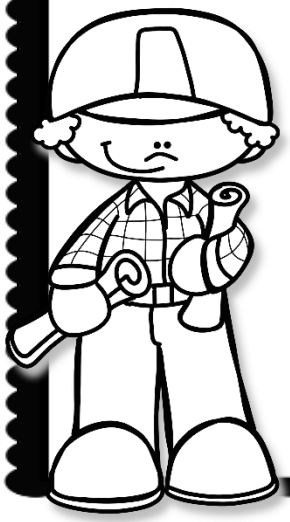


Flood-Proof House

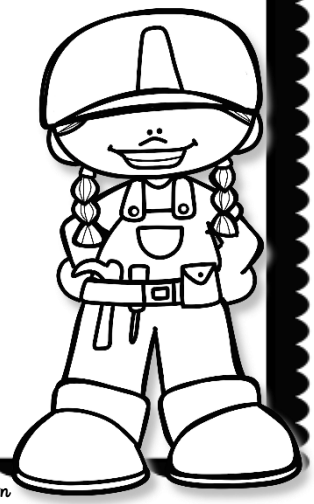
Types of Severe Weather

How we can prepare for severe weather

Ideas for Flood-proof Materials



What we LEARNED



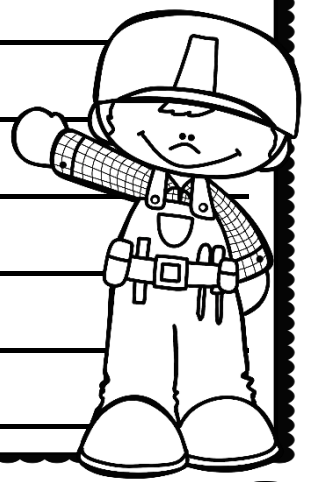
FLOOD-PROOF HOUSE

Name: _____

THE CHALLENGE

Can you construct a house with barriers to prevent flooding?

Types of severe weather



One thing That was EASY:

One thing That was CHALLENGING:

One thing That I IMPROVED:

What I Learned

1. _____

2. _____

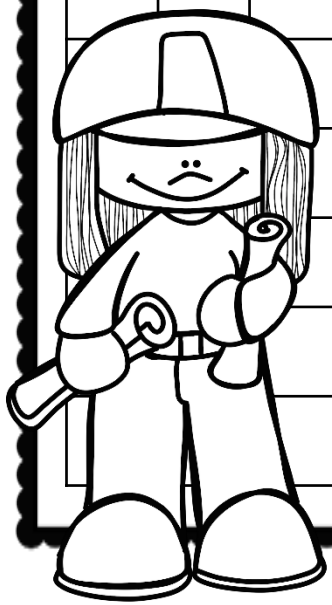
3. _____

How we can prepare for severe weather

MATERIAL TESTS

Material	What Happened

My Flood-proof House



credits

Thank you for your purchase!

Created by Brooke Brown

https://sites.google.com/site/climatetypes