iSTEAM After School

AMAZING EARTH

ACTIVITY BOOK

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WINGING IT: BEAK ADAPTATIONS

SUPPLIES

ITEMS NEEDED

- Bunch of grapes
- Sunflower seeds with shell
- Large pack of gummy bears
- Swedish Fish
- Chocolate Pudding
- Water
- Spoon
- Straw
- Chopsticks
- Clothespin
- Cups
- Plates

OBJECTIVES

- ☑ Understand the specific purpose of different bird beaks
- ☑ Students will learn the meaning of the term “adaptation”

HOOK

- What do we have on our bodies that help us eat? Discuss with students that our teeth, mouth, hands, fingers, tongue are all physical features that help us eat food.
- How are our teeth especially helpful? What foods can we eat because we have teeth? Give examples: crunchy foods like pretzels and carrots, or tough foods like steak or chicken.

INTRODUCTION

Close your eyes and picture a pelican plunge diving into the deep ocean to retrieve a fish as its next meal. Now picture a hummingbird stopping to sip some nectar from a flower in your neighbors yard. Lastly, picture a toucan in a tropical rainforest forest gulping down berries to stay hydrated in the tropical heat. We know these animals have a few things in common: they are all species of birds with wings, feathers and the ability to lay eggs. But how are these birds different from one another? Each species of bird has its own unique beak size and shape. Why do we think that is? Well, different species of birds have different beaks to suit their specific diets and environments. Bird beaks are adapted to help birds obtain and process food in ways that increase their chances of survival. From diet, to habitat, to feeding behavior and evolutionary adaptation, each beak is specially designed to help each bird obtain the food and resources it needs to thrive and survive. Today, we will experiment with different beak models to find the purpose of each evolutionary adaptation!

BEAK ADAPTATIONS

DISCUSSION

Look at the objects at your table. Take turns picking up each object and pretending to use them the way you normally would. Give adequate time for each student to handle each object at the table.

Now imagine each of these is the shape of a certain bird's beak. What foods do you think they could easily pick up? Discuss ideas as a table, then as a class.

WHAT IS ADAPTATION?

Adaptation is the change or the process of change in which a species becomes better suited to its environment. Therefore, the various bird beak shapes and sizes are an adaptation for the different types of foods that birds eat.

EXPERIMENTATION

Now let's envision ourselves as birds and see these "beaks" in action.
Pass out: plate of grapes, plate of sunflower seeds in the shell, cup of little water and gummy bears, cup of colored water, and cup of Swedish fish in pudding - for each table.

- Which objects work best to obtain what is on the plate or in the bowl?
- Which grabs the seeds best, the fish in the pudding, which can grab the water best?

Give plenty of time for experimentation.

TAKE AWAY

- We call these bird beaks adaptations.
- The birds' beaks have changed slightly over many years to make them the perfect shape and size for what they need to do.

BEAK ADAPTATIONS

OBSERVATION

- Show students the Bird Handout page. Looking at the 5 birds, which object do you think matches each bird beak?
- How is their beak perfect for the foods they want to eat?
- Show students the photos of the 5 birds.
- Discuss as a group, and then in their Observation box, have them match up the "beaks" (tools used) to the bird.
- What food types do you think each our experiment foods represented?
  - Cup of water - Nectar
  - Pudding - prey in mud or dirt
  - Grape - Fruit with skin
  - Sunflower Seeds- Hard shell seeds and nuts
  - Gummy in water - Fish in the Ocean or River

- Discuss the functions of each beak together.
- See next page for explanation and answers
- Now that the students can see that different birds have different uses for their beaks, ask them to think of other parts of animals bodies that would require certain “adaptations.”

EXTENSION

- Today we learned about cardinal, hummingbird, avocet, macaw, and spoonbill beaks.
- Think of another bird with a unique beak. What does it look like? What diet does that bird have?
- Draw an illustration of this bird and try to clearly show its beak helping it obtain food.

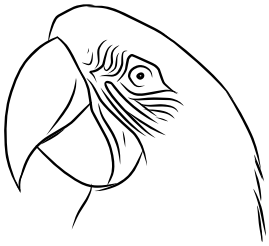
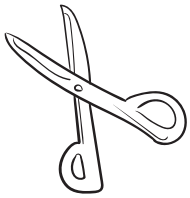
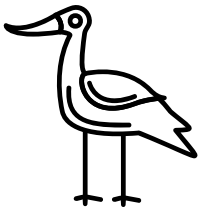
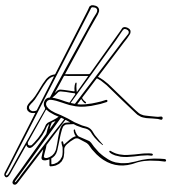
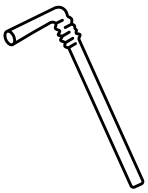
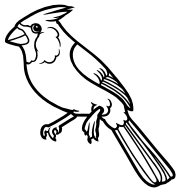
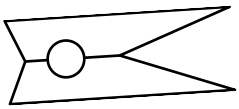
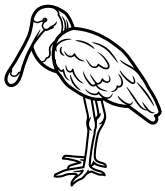
CONCLUSION

- Fill out Hypothesis, Observation and Conclusion chart together and discuss your findings!

DID YOU KNOW?

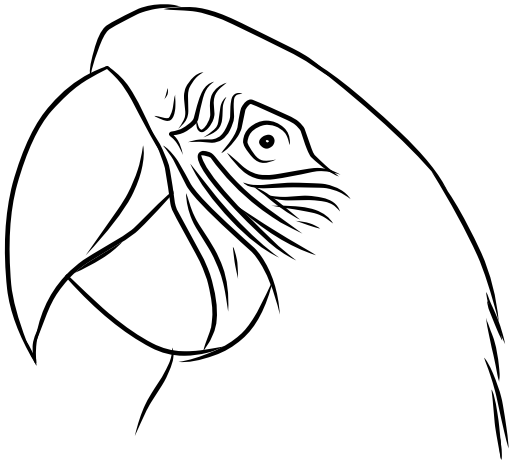
Did you know that a Macaws are playful, smarts and inquisitive parrots that are even able to mimic human vocalizations!

BEAK ADAPTATIONS

Bird	Beak Object	Food
Macaw 	Scissors – can peel/tear fruits 	Fruit like large grape 
Avocet 	Chopsticks – can pick prey up out of mud 	Fish in pudding 
Hummingbird 	Straw – suck up the nectar 	Cup of Water 
Cardinal 	Clothespin – break open the seeds 	Sunflower seeds with shell 
Spoonbill 	Spoon – can easily scoop up multiple prey 	Gummy bears in water 

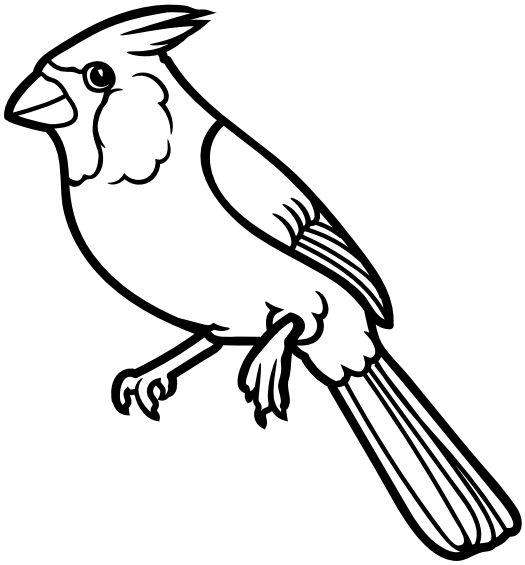
BEAK ADAPTATIONS

MACAW

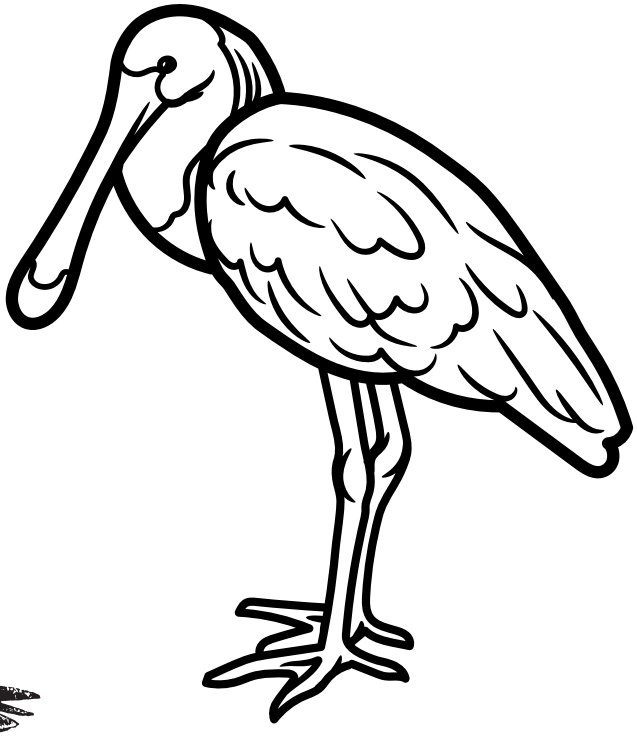


HUMMINGBIRD

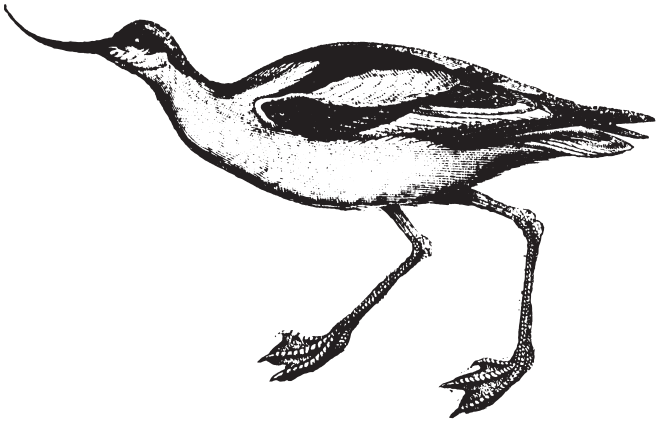
CARDINAL



SPOONBILL



AVOCET



ON TOP OF THE WORLD: MAPPING A MOUNTAIN

SUPPLIES

ITEMS NEEDED

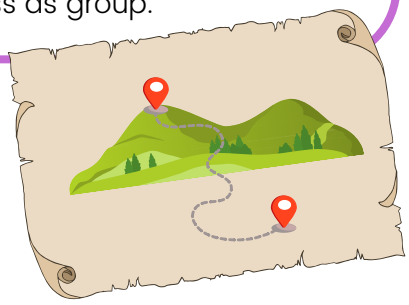
- Construction Paper (8 colors)
- Sticky foam/adhesive squares
- Pencil
- Markers
- Scissors

OBJECTIVES

- ☑ Create a representation, or model, of a mountain on a flat piece of paper.
- ☑ Understand the meaning of the term “contour map” or “topographic map.”
- ☑ Understand the meaning of “elevation.”

HOOK

- Have you ever taken a trip with family or friends and hiked up a mountain? What was that like? What types of things did you see along the way and how long did it take to summit--in other words, get to the top? Discuss as group.



INTRODUCTION

Mountain climbing, or even very large hill climbing, is not an easy task! These landforms can become steep very slowly, and you may not get too tired as you're walking, but it may take all day to get to the top and see the view. But sometimes a mountain is very steep the whole way up and it takes all day to climb because it is very physically difficult and you quickly become tiresome. Many mountain hikes take place in National Parks such as Denali National Park in Alaska or Rocky Mountain National Park in Colorado. How can National Parks such as these prepare people for steep and strenuous hikes? A map can show a hiker how to get to certain locations by utilizing cardinal directions (north, south, east, or west). But, can a piece of paper show how steep or difficult a mountain hike is?

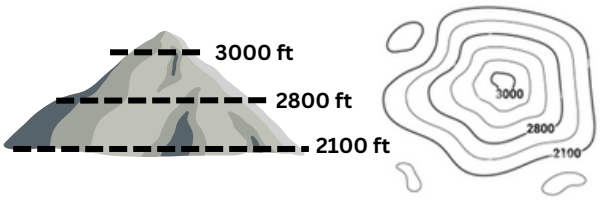
DISCUSSION

Maps of mountains are called **contour maps**. These maps include special lines to tell the hiker what to expect. Another name for a map like this is a topographic map.

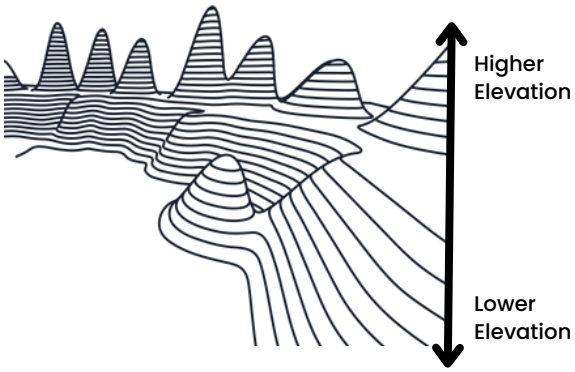
Today, we are going to make our own three-dimensional contour maps!

MAPPING A MOUNTAIN

Contour Maps



A contour map shows what each layer of a mountain would look like if you cut it into slices



Introduce the concept of elevation. Elevation is how high above sea level something is. All land has elevation– some areas are even below sea level!

DISCUSSION CONT.

Scientists and map-makers don't actually slice mountains into layers. Instead, they use special instruments to see what these layers might look like.

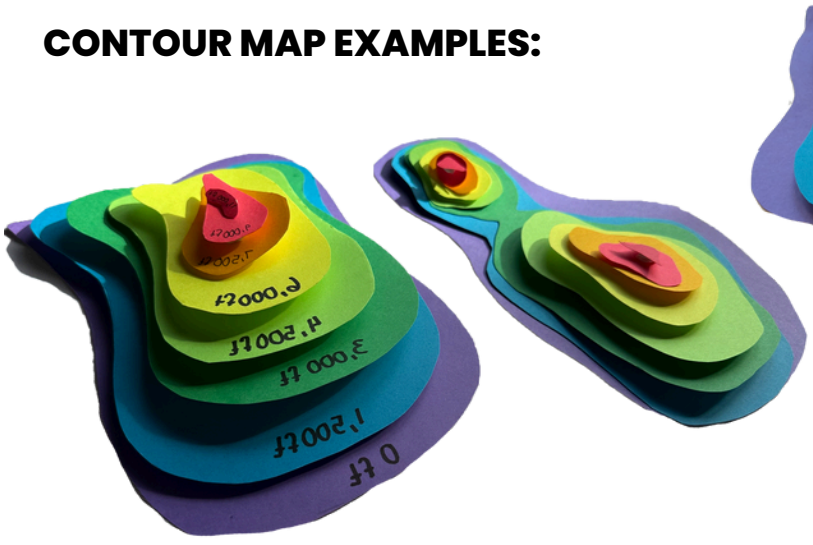
Imagine you could slice a mountain into layers and trace each layer with a giant pencil. This exactly how contour maps are made!

Many contour maps are in black and white– the outer lines represent the shortest parts of the mountain, and the inner lines represent the tallest parts of the mountain. Sometimes, each layer is a different color to help us see the height more clearly. Red is the tallest part of the mountain, and purple is the lowest.

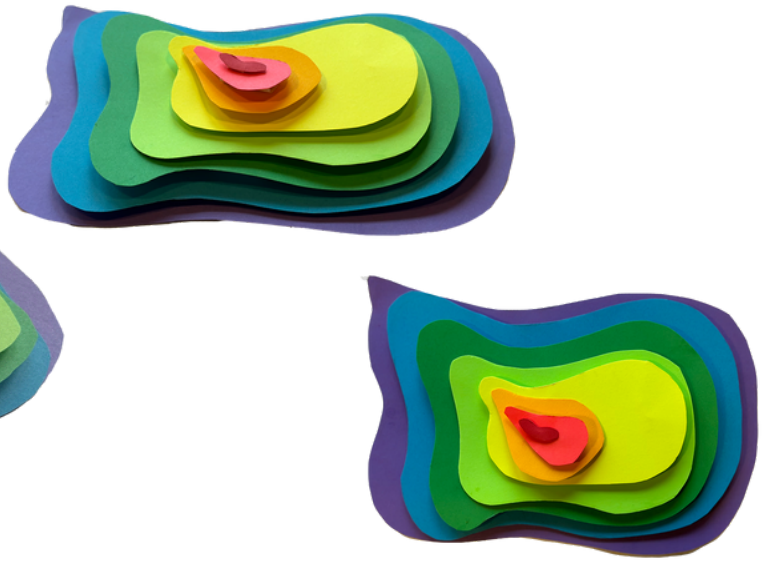
Before making contour maps, hand out pieces of blank paper to students and have them try to draw a map of a mountain however they want.

Later, you can compare and contrast these ideas to an actual topographical map.

CONTOUR MAP EXAMPLES:

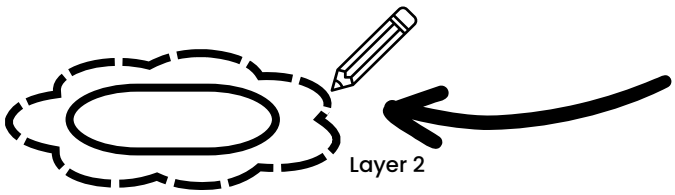


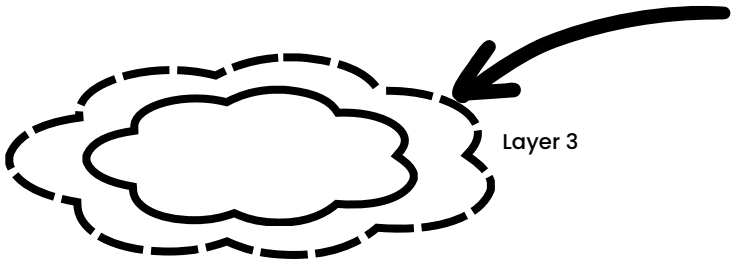
You can be creative with the shape of your mountain! Maybe it has multiple peaks, or areas where the slope is steeper (or more gradual) than the surrounding areas!

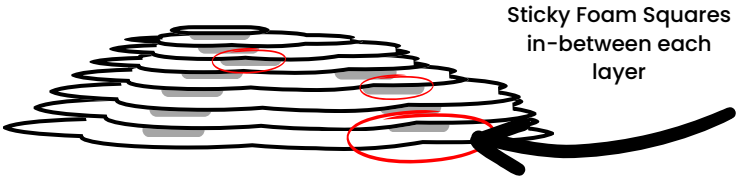


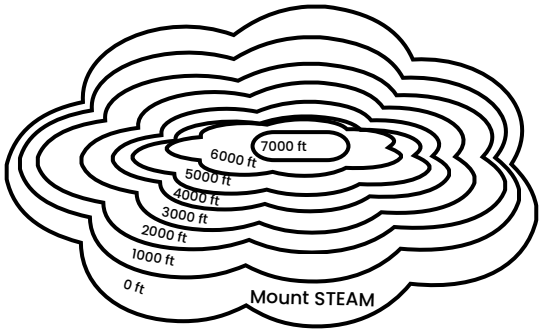
The mountains we make may be three dimensional, but when you look at them from above, they look flat! This is the concept behind a contour map!

MAPPING A MOUNTAIN









From above, your 3D mountain looks like a 2D contour map!

ACTIVITY DIRECTIONS

1. Have students cut out the peak of their mountain using the dark red paper. Remember, this is the tallest–and also smallest–part of the mountain.

2. Lay the dark red shape on top of the light red piece of paper. Trace a shape sightly larger than the dark red shape and cut it out. This is the second highest layer of the mountain.

3. Lay the light red shape on top of the orange piece of paper. Trace a shape sightly larger than the dark red shape and cut it out. Repeat this process for the remaining pieces of paper until students have 8 layers (go in this order: dark red → light red → orange → yellow → light green → dark green → blue → purple). The shapes will change over time–encourage students to be creative with the shape of their mountain!

4. Using the sticky foam squares, have students stack the layers of your mountain. They will likely need 2-3 squares on the lower layers, and may need to cut a square in half for the top layer if the peak is smaller than the sticky square.

5. Have students stand directly above their contour map and look down at all the layers. Do you see how, from above, our 3D map looks flat? This is how we're able to map a mountain on a flat piece of paper! Hikers know how to read these maps, and it helps them on their excursions!

6. Make students give their mountain a name! If they want, they can label the elevation on each layer of the contour map, or draw in features like rivers and trees!

MAPPING A MOUNTAIN

OBSERVATION & EXPLANATION

Contour maps show lines of elevation. Elevation is usually measured in feet and it describes how high above sea level a landform is. So, how tall was your "mountain" from the place you built it upon?

Our paper mountain is a model. We cannot build something that is as tall as a real mountain, so we have build a smaller model to understand the bigger idea. A flat contour map is an even simpler representation of a mountain than our 3D models.

Scientists use models all the time! Just like we can use construction paper to understand a huge mountain, scientists use simple models to understand big or complicated concepts. Can you think of some models that scientists use?

Ask the students to think about some features of their mountains. If there's time, some students can share with the class.

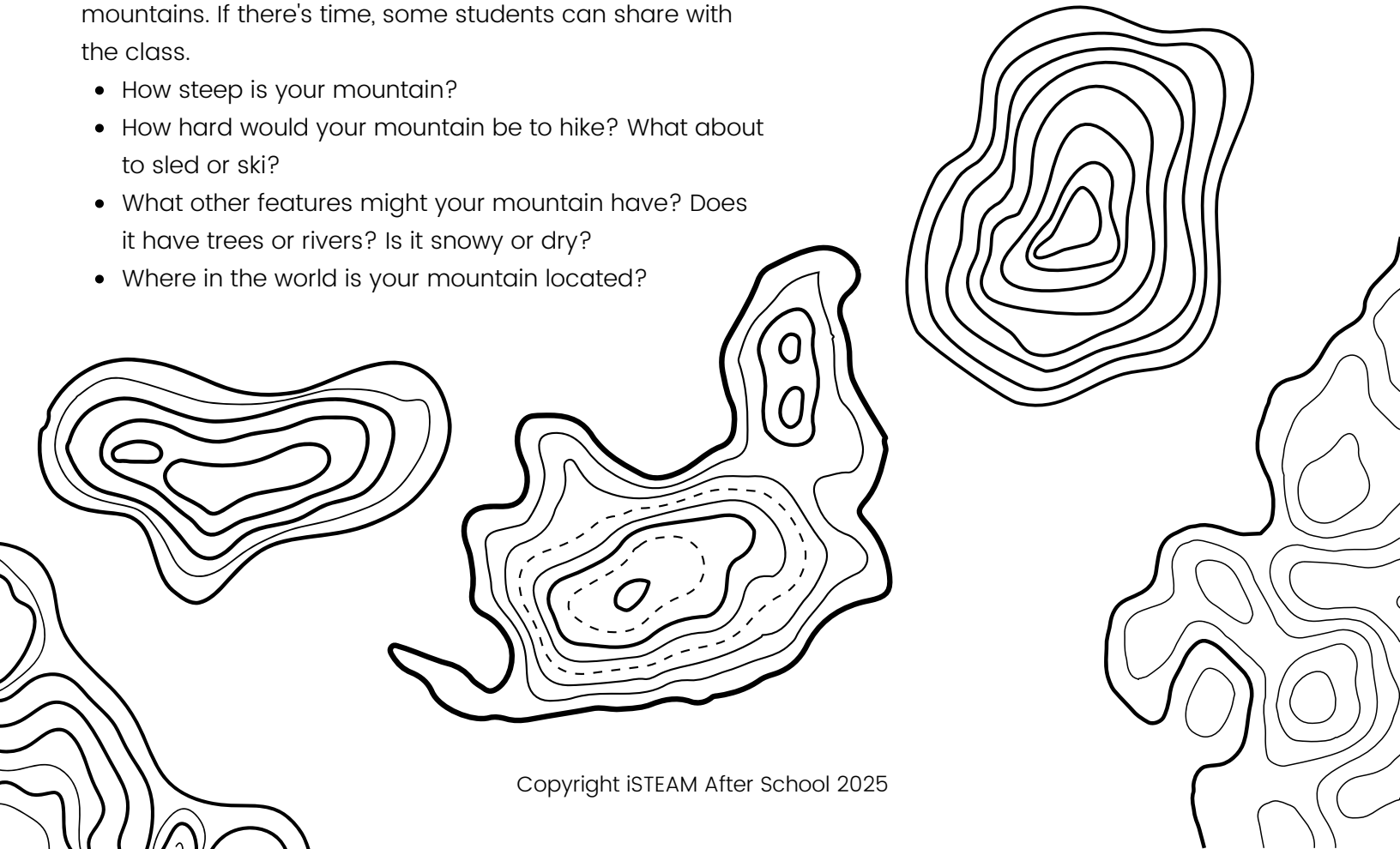
- How steep is your mountain?
- How hard would your mountain be to hike? What about to sled or ski?
- What other features might your mountain have? Does it have trees or rivers? Is it snowy or dry?
- Where in the world is your mountain located?

EXTENSION

Older students can do the math and create labels for each layer in feet, so that if the "mountain" was divided evenly, each line might go up 20 feet or 100 feet, depending on how tall they want want their mountain to be.

Students can also try to recreate their mountains as a flat contour map by drawing on a sheet of paper.

Students can also try to draw contour maps for other types of mountains and try to visualize what they would look like in three dimensions!



BENEATH THE SURFACE:

EARTH'S CORE

SUPPLIES

ITEMS NEEDED

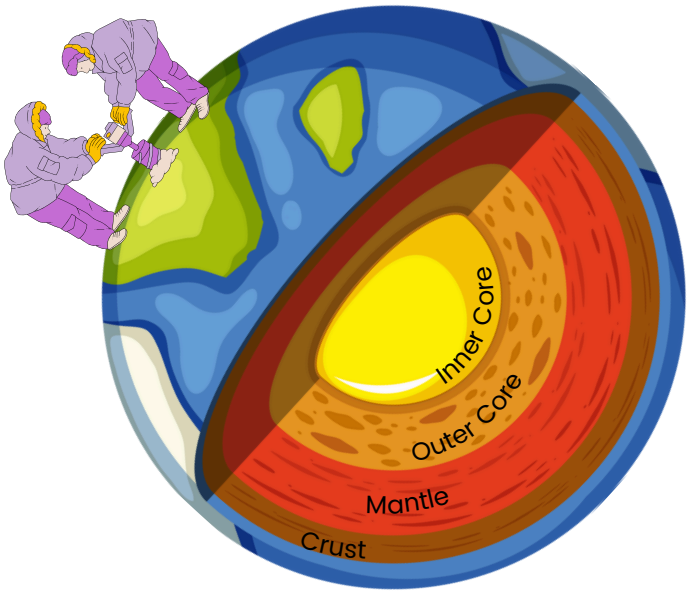
- Play-Doh (4 colors)
- Clear straw
- Earth's Layers Handout
- Plain Paper
- Ruler
- Pencils

OBJECTIVES

- [x] Learn what a core sample is and what it is used for
- [x] Create a core sample of a play-doh model planet earth

HOOK

- What is the Earth made of? Did you know that the earth has different layers, like an onion? What else has layers?
- How many layers do you think the earth has?



INTRODUCTION

Did you know there are trees existing today that are hundreds and even thousands of years old? Trees grow a new ring in their trunk for every year they are alive. One way to determine the age of trees is by doing a core sample. A long, strong, hollow tube is twisted through the trunk. When they pull the tube out, scientists have a section of the tree to study. They can tell a lot about the tree by the rings! If the rings are really close together it might mean the tree didn't grow much that year.

Coring can be used in the ground in rock layers to tell us the history of an area. When different layers are uncovered, we can tell what was happening at a certain point in time. For example, if a core sample has a layer of volcanic ash, there's a good chance there was a volcanic eruption in that area in the past!

Coring was even used on the Indianapolis Speedway to show the layers of years of pavement materials that were used on the track! This sample went from gravel and limestone to brick to asphalt.

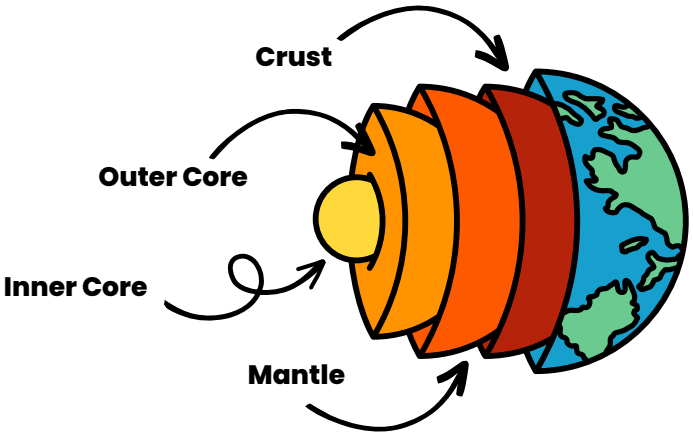
Because the Earth also has layers, we can create core samples of a model planet earth using play-doh! The different layers will be represented by different colors of play-doh.

EARTH'S CORE

DISCUSSION

In real life, we couldn't take a core sample of the entire Earth. The Earth is way too big, and the core sample would contain some dangerous layers! Before starting the activity, ask students if they know what we call the Earth's four layers.

- The Crust: the outermost layer is called the crust, and contains everything on the ground. The dirt, rocks, minerals, and mountains are all part of the crust! The crust is a very thin layer, between 3 and 43 miles thick. If the earth was an apple, the crust would be the apple skin!
- The Mantle: Underneath the crust is the mantle, which is full of molten rock that is very thick and moves very slowly.
- The Outer Core: underneath the Mantle is the Outer core, which is full of liquid metal like iron. All of this iron gives our planet it's magnetic poles!
- The Inner Core: and lastly, the very center of the earth, underneath the Outer core, is called the Inner Core. This central layer is solid and under extreme pressure from the surrounding layers.



PROJECT PREP

1. Locate all supplies.
2. Print the handouts for this lesson, "Earth's Layers," and
3. make sure each student gets one.
   Pass out 4 containers different colored play-doh to each student.
4. Pass out boba straws to each student and a few pairs of scissors for them to share.

ACTIVITY DIRECTIONS

1. Use the Earth's Layers handout and squish a small amount of one color play-doh into the small 1-inch circle

2. Peel off the squished playdoh, roll into a ball

3. Using the second color you choose, squish and flatten a piece of playdoh onto the "Outer Core" of the Handout. LEAVE FLAT.

4. Repeat STEP 3 on the other sections of the hand out labeled "Mantle" and "Crust" with the last two unique colors you choose. Leave these play-doh disks flat as well.

EARTH'S CORE

ACTIVITY DESCRIPTION CONT.

5. Stack up the four layers, from top to bottom: Inner Core, Outer Core, Mantle, Crust.

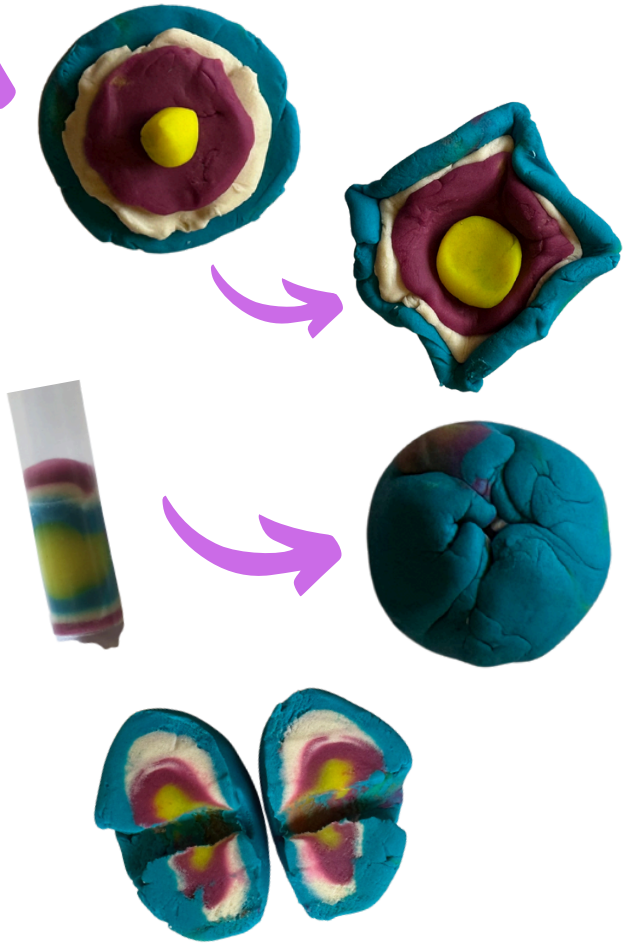
6. Pinch together the sides like a dumpling to wrap the outer layers around the Inner Core.

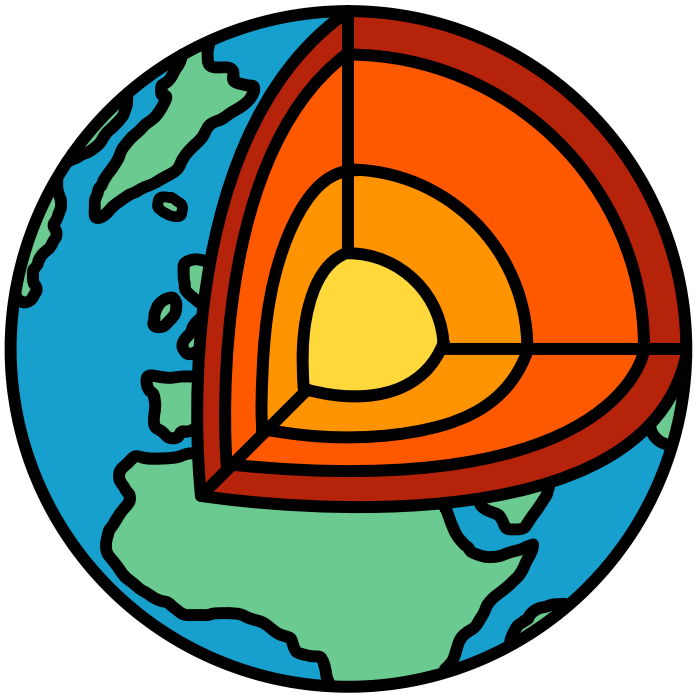
7. Roll the ball between your hands to make it more smooth.

8. Take a straw and push it through the center of the "Earth," and all the way through, then remove.

9. When you have cored out the play-doh, you can use the scissors chop off the part of the straw that has the sample. This will allow for multiple core extractions

10. Have students view the layers and guess which layer is which part of Earth.





OBSERVATION

See the different colors in the straw? How did they get that way? How many layers do you see? Review the layers of the Earth you learned. What does each layer represent for the Earth?

Given what we have learned about the Earth's layers, do you think it would be possible to dig a tunnel that goes all the way through the Earth? Why would this be an impossible task? What challenges would you encounter as you dig? Discuss together!

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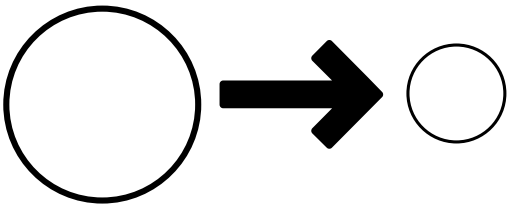
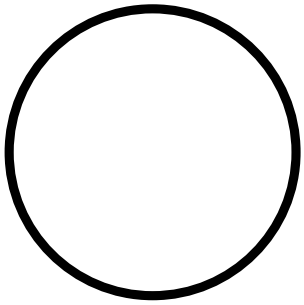
EARTH'S CORE

EARTH'S LAYERS TEMPLATE



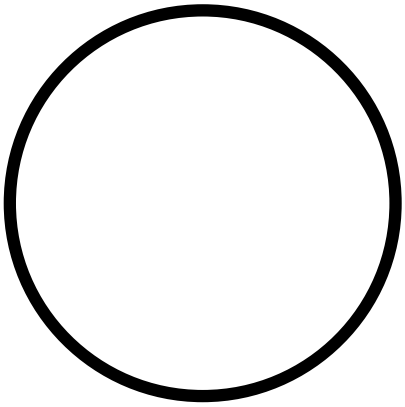
1 inch flat
0.5 rolled into ball

Inner Core



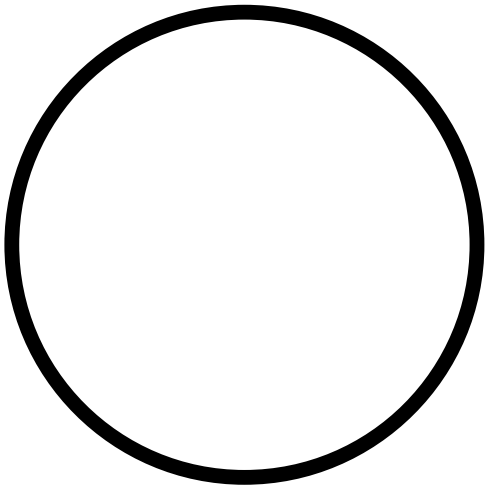
1.5 inches flat

Outer Core



2 inches flat

Mantle



2.5 inches flat

Crust

BEE-UTIFUL : POLLINATORS

SUPPLIES

ITEMS NEEDED

- Pipe cleaners
- Clothespin
- Pom-poms
- Paper Cup
- Straws
- Tape
- Toothpicks
- Pencil
- Planning Page
- Construction paper
- Glue
- Cornmeal (1 cup)

OBJECTIVES

- [x] Understand the importance of pollination
- [x] Design and create a model of a new method for pollinating plants

HOOK

- Have you ever thought about how our fruits and flowers grow?
- What if all the bees, butterflies, and other pollinators disappeared?
- How would we make sure plants still get pollinated?"

INTRODUCTION

Pollination is like a special delivery service for plants. It's how plants make more of themselves and grow fruits and vegetables for us to eat.

Imagine flowers as tiny houses with a dust called **pollen** inside. This pollen needs to travel from one flower to another for new plants to grow. But flowers can't move around, so they need helpers!

These helpers are called pollinators. They are messengers that carry pollen from flower to flower. Some common pollinators are bees, butterflies, hummingbirds, and bats.

Even the wind can be a pollinator! It blows pollen from some plants to others. When these pollinators visit different flowers, they drop off the pollen they've collected. This helps plants make seeds, fruits, and vegetables.

Let's imagine that one day all of the pollinating creatures stopped doing their jobs. As engineers we have to come up with a way to pollinate the Earth. Today, we will design and create models of pollinator machines!

POLLINATORS

ACTIVITY DIRECTIONS

1. Learn about pollinators:
   - Introduce and discuss the basics of pollination using the Pollination Diagram.
   - Read and discuss the Pollinator Fact Sheets. You can introduce all the pollinators one at a time.

2. Introduce the following constraints for the pollinator designs:
   - Must have a way to pick up and transfer pollen (sticky/fuzzy surface or carrier)
   - Must be able to move between flowers (wings, legs, or other locomotion)
   - Must be lightweight enough to land on a flower without crushing it. It should be inspired by at least one real pollinator
   - Bonus: create a part that can reach into a flower to extract nectar(like a proboscis or beak)

3. Lay out materials listed at the beginning of the lesson.

4. Design Phase! Before beginning the construction of their pollinators, students should carefully consider which materials will work best for different parts of their design. Have them record and sketch their ideas on the Planning Page. Here are some examples and tips to guide their thinking:

Pollinator Body

- Using pipe cleaners to create a lightweight and fluffy body that can mimic the fuzziness of a bee or butterfly. Another option is using a clothes pin for the structure, which will make the pollinator strong and sturdy.

Tongue or Beak

- Toothpicks can be used to mimic the long tongues of butterflies, bats, and hummingbirds.

Movement (legs, wings, etc.)

- Construction paper can be used to make wings.
- Use pipe cleaners or toothpicks to create legs or feet. Pipe cleaners are flexible and can be shaped easily. Toothpicks are sturdy and can provide support.

Sticky Parts/Carrier

- Apply a small amount of glue or tape to the body or legs to mimic the stickiness that helps bees collect pollen.
- Pom-poms or pipe cleaners that pollen can stick to.

POLLINATORS

ACTIVITY DIRECTIONS CONT.

5. Build the Pollinator:
Allow students to build their pollinator models using the provided materials. If students are having trouble coming up with a design, show them examples from the curriculum.

6. Build the Flower Models:

- Use a small paper cup to act as a flower. Cut several slits on the side and pull them open to make a flower shape--these will represent the petals of a flower. Students can color the cup if they would like. See the sample image.
- Pollen: fill the bottom of the cup with a layer of cornmeal powder. This will represent the pollen.

7. Test the Pollinators:
Explain the Testing Process:

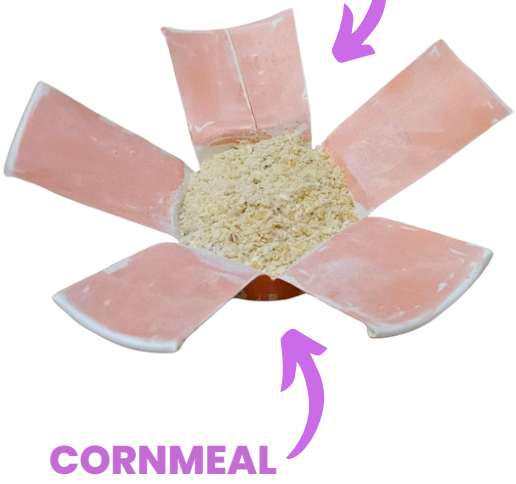
- Gather students and explain the process of testing their pollinators. Emphasize the goal of transferring pollen from one flower model to another flower model.
- Demonstrate the testing process with a sample pollinator and flower model if necessary.

Test the Pollinators:

- Have each group of students bring their pollinator to a testing area.
- Instruct students to use their pollinator to transfer "pollen" from one flower model to another flower model.

DID YOU KNOW?

Did you know that nearly one-third of our food supply depends on insect pollination, most of which is accomplished by bees!



8. Observe Performance:

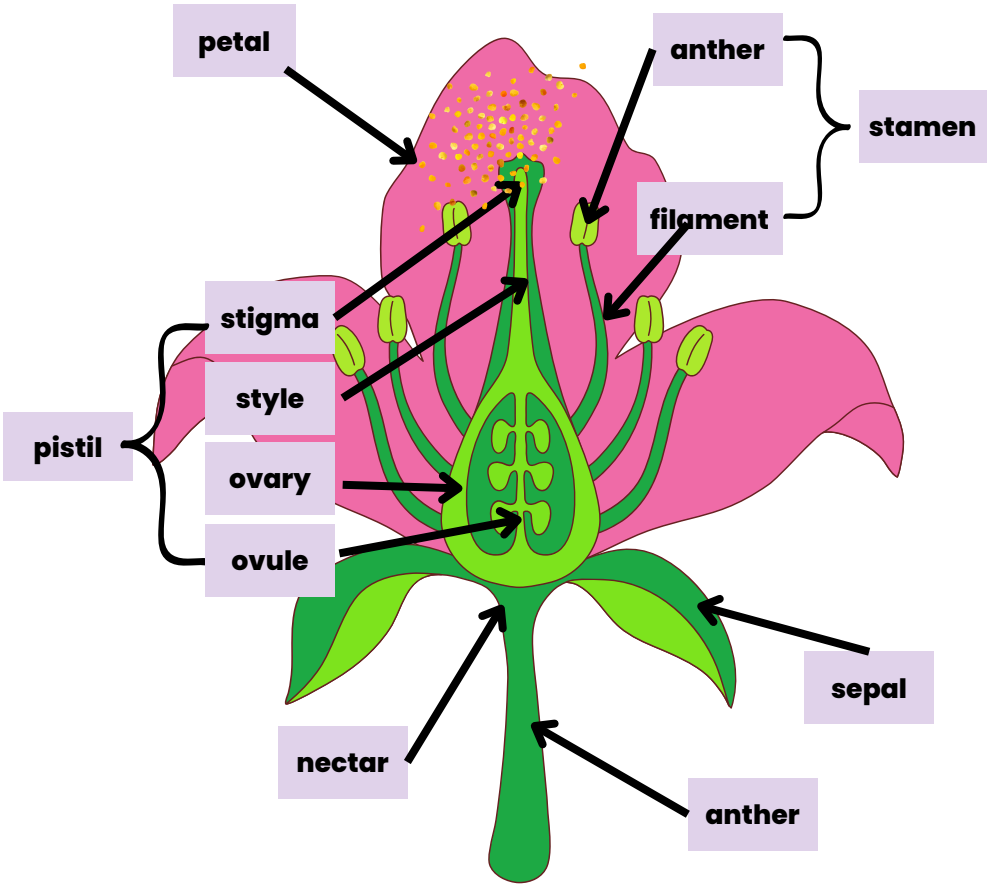
- Encourage students to observe their own and others' pollinators to see different designs in action. Which designs moved the move pollen?

CONCLUSION

Pollination is incredibly important–without it, there would be way less food to eat! More than half the bat species in the United States are declining. Bees are also disappearing. It is crucial that we taken action to save these animals from extinction, like preserving their natural habitats. But what if these animals did go extinct? How would we pollinate fruits, vegetables and flowers?!

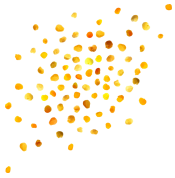
POLLINATION DIAGRAM

Parts of a Flower



1. Flowers produce sweet and fragrant nectar.

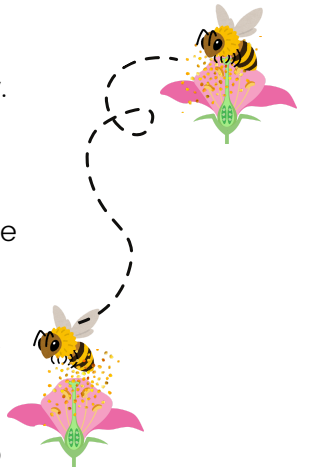
2. The flower's stigma produces tiny grains of pollen. Pollen is like tiny yellow dots that flowers need to make seeds.



3. A busy bee, butterfly, or hummingbird is attracted to the the flower's sweet nectar and comes to visit. The pollinator drinks the yummy nectar from the flower.

5. While the bee, hummingbird, butterfly, or bat is busy drinking nectar, pollen from one flower sticks to its body.

6. The pollinator flies to a new flower. At the new flower, some pollen falls off onto the sticky stigma. The pollen travels down a tube called the style to reach the ovary.



7. In the ovary, the pollen helps turn tiny egg cells into seeds. This helps flowers make new flowers and fruits.

POLLINATOR FACT SHEET

Fuzzy Bodies

Bees are covered in tiny hairs. These hairs help pollen stick to them as they visit flowers.

Bees

Pollen Basket

Some bees have special areas on their back legs called "pollen baskets." They use these to carry lots of pollen back to their hive.

Long Tongues

Many bees have long tongues that can reach deep into flowers to sip nectar. This helps them pick up pollen from hard-to-reach places.

Special Eyes

Bees can see colors we can't! This helps them find flowers easily.

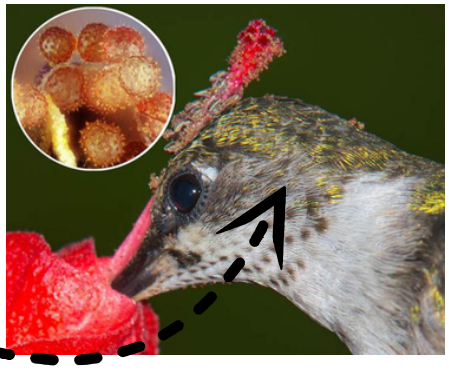
Buzz Power

Some bees can vibrate their bodies to shake pollen loose from flowers. It's like giving the flower a tiny massage!

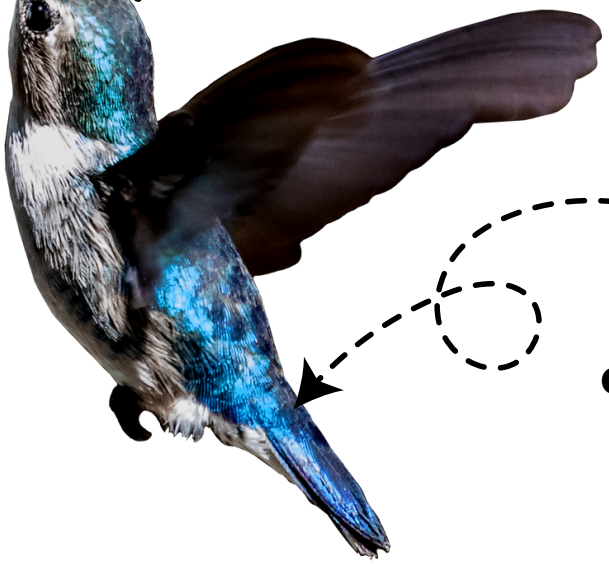
POLLINATOR FACT SHEET

Sticky Feathers

- When a hummingbird sticks its long beak into the flower for a drink of nectar, its head might bump into these anthers.
- This causes the pollen to stick to the hummingbird's feathers, on top of its head.



Hummingbirds

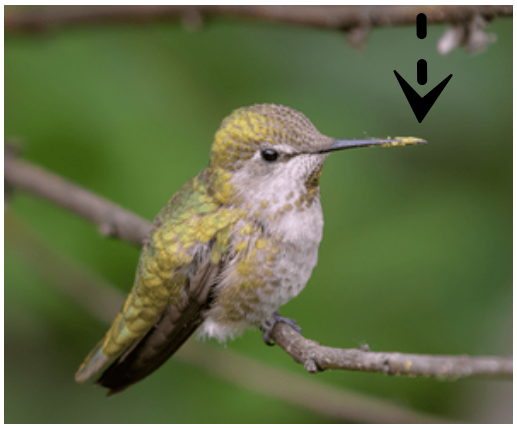


Trumpet Flowers and Beaks

- Hummingbirds love flowers that look like little trumpets! Many flowers have long, tube-like shapes that are perfect for hummingbirds' long, thin beaks.
- The pollen attaches to the hummingbirds beak and the hummingbird transfers it to other flowers.

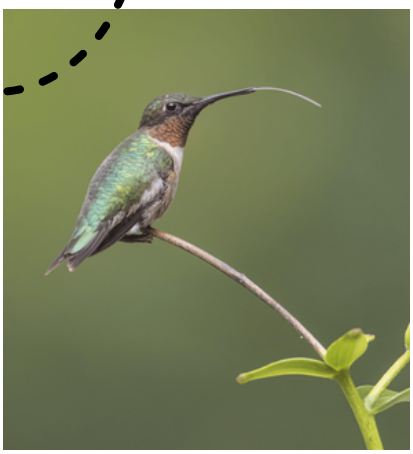
Colorful Feathers

- Their bright, iridescent colors help them find flowers and attract mates.



Long "Straw"

- Hummingbirds have amazing tongues that work like tiny pumps! Their tongues are very long and can stretch out far beyond their beaks. When a hummingbird drinks nectar, its tongue doesn't just lap up the sweet liquid. Instead, it has grooves on the sides that trap the nectar. As the tongue zips in and out of the flower up to 20 times a second, it squeezes the nectar into the bird's mouth.



POLLINATOR FACT SHEET

Tube Tongue

Butterflies have a long, straw-like tongue called a proboscis. It's usually curled up, but when they want to drink, they unroll it like a party blower! When they stretch it out to sip nectar, their faces get close to the flower's center. This helps pollen stick to their head and face. As they move to the next flower, they bring this pollen along!

Butterflies

Scaly Bodies

Their bodies and wings are covered in tiny scales. These scales are perfect for catching and holding pollen. As butterflies move from flower to flower, pollen sticks to these scales like Velcro, making butterflies great pollen transporters.

Long Legs

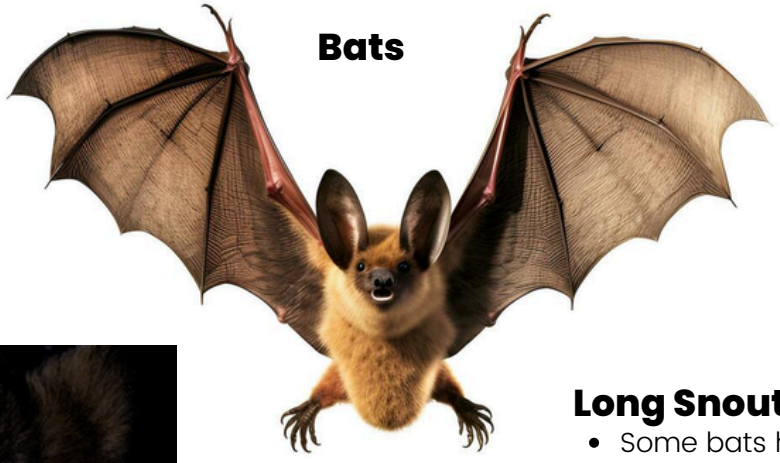
heir long, thin legs often touch the flower's center when they land. This means pollen can stick to their legs too. As they walk around on the flower drinking nectar, they pick up even more pollen to carry to the next flower.

POLLINATOR FACT SHEET

Furry Bodies

Bats have fuzzy fur all over their bodies. This fur is great for catching and holding pollen. As bats fly from flower to flower, they become covered in pollen, like fuzzy flying pollen baskets!

Bats



Long Snouts and Tongues

- Some bats have super long tongues and funny-looking noses that help them drink nectar from flowers, kind of like built-in straws.

Night Vision

- Some flowers open only at night, just for bats! These flowers are often white or light-colored so bats can see them easily in the dark.

PLANNING PAGE

Directions: Use the table below to record your ideas and which materials you will use for the different parts of your design. Use materials that mimic the natural adaptations of pollinators like bees, butterflies, hummingbirds, and bats. You can write or draw your ideas.

Beak/Tongue	Sticky Parts/Pollen Carrier	Movement	Body

Directions: Sketch and label your pollinator below using the categories above.

SKETCH

GUST OF GENIUS: TORNADO PROOF

SUPPLIES

ITEMS NEEDED

- Play-doh
- Popsicle sticks
- Straws
- Paper clips
- Plastic cups
- Tape
- Aluminum Foil
- Tornado Plan
- Construction Paper
- Cardstock Paper
- Pencils
- Glue
- Scissors

OBJECTIVES

- [x] Understand what a tornado is and how it can affect buildings and people.
- [x] Apply the engineering design process to create a tornado-resistant shelter.

HOOK

- Have you ever experienced a tornado or seen one on TV or simulated in a movie?
- How about experiencing a storm with very high winds?
- What types of destruction can tornados cause to towns and nature?

INTRODUCTION

What is a tornado? A tornado is usually attached to the bottom of a thunderstorm. When warm, humid air collides with cool, dry air, the warm air rises through the cool air and can begin to rotate. The currents in the middle of the tornado spin so fast that winds can get above 200 mph. Think about that! If a normal day is considered very windy, the weatherman might say that winds are around 40 or 50 miles per hour. On these days, small branches may fall off trees or furniture may blow off decks. 200 mph can do some real damage! Tornados can tear apart houses, lift cars, and break trees. They can be very dangerous for people and animals.

When a tornado hits, it's important to have strong buildings that can protect us. Engineers design buildings to be strong enough to stay standing even when strong winds try to knock them down.

Today, you will create a structure that can withstand our "tornado" (a fan you create!)Your challenge is to build a structure that is the general shape of a small home that will keep your plastic animal safe. The plastic animal will symbolize a family huddled together inside the house during a dangerous tornado. The goal is to keep the family safe inside and the home intact.

TORNADO PROOF

ACTIVITY DIRECTIONS

1.
   - Locate all materials.
   - We recommend Play-doh, Popsicle Sticks, Straws, Paper clips, Plastic cups, Tape, Aluminum Foil, Construction Paper but feel free to get creative by using art supplies you have at home!

2. Introduce the following requirements for the tornado proof structures:
   - Protect the Inhabitants: The shelter must have a space that houses imaginary occupants--it can't just be a solid object. The shelter should remain intact so the occupant is safe.
   - Stability: During the wind test, the shelter should not tip over and no parts shoiuld fall off.

3. Have students brainstorm and draw their design ideas on the Tornado Plan handout. Guide the students as they plan their structures. If they need guidance, suggest including some of the following elements for their tornado proof structures:

   Super-Strong Walls:
   - Build wind-resistant walls out of multiple different materials, like popsicle sticks over a plastic cup.

   Mega-Anchor Foundation:
   - Create a deep, strong foundation for the house like a tree using "roots" of Play-doh.

   Stable Roof:
   - Create a steeply pitched roof to with cardstock or popsicle sticks to provide wind resistance.
   - Use a rounded or dome-shaped roof using curved pieces of cardboard or flexible straws. These shapes help the wind flow over the shelter more easily, reducing the risk of damage.

4. Time to Build!
   Once all students have a general idea of what their tornado proof shelter will look like, distribute materials and have them start construction.

DID YOU KNOW?

Did you know that the wind from a tornado can top 250 miles an hour. That's even faster than a race car!

TORNADO PROOF

ACTIVITY DIRECTIONS CONT.

5. The wind test:
   - Have students create a paper fan using the paper fan template as a guide. Students will make a paper accordion, fold and then tape one end together to construct a fan shape.
   - Once fans have been constructed, students can attempt to knock over their structures by creating wind with their fans. Try different configurations: have all students stand on one side of the structure and fan, and then try having them circle the structure. Fan from above and all sides! If the structure stands and nothing falls off, the testing phase is a success.

6. Improvements and Redesign:
   - Discuss what worked well and what didn't.
   - Make changes to the shelter to make it stronger.
   - Test the shelter again to see if it improved.

DISCUSSION

After testing and improving their shelters, gather the students for a discussion:

- What features made some shelters more effective at withstanding the wind?
- What challenges were faced during the design and testing process? How did students solve these problems?
- Why is it important to build tornado-resistant structures in certain regions?

CONCLUSION

Tornadoes form when warm, moist air meets cold, dry air, creating a spinning column of air. They can tear apart buildings, lift cars, and uproot trees. Knowing how tornados form helps in designing structures to resist their force.

Building strong structures involves using sturdy materials and smart designs. Reinforced walls, stable foundations, and aerodynamic shapes all contribute to a shelter's ability to withstand strong winds.

As engineers, thinking creatively led to unique and effective solutions. Experimenting with different materials and designs encourages innovative problem-solving. Engineers use creativity and innovation in their designs to push through challenges.

TORNADO PROOF

TORNADO PLAN

Directions: Your task is to design and build a shelter that can withstand the strong winds of a tornado. Use this planning page to organize your ideas and plan out your design. Think about how each part of your shelter will be constructed and which materials you will use.

FOUNDATION:

THE FOUNDATION KEEPS THE SHELTER STABLE AND ANCHORED TO THE GROUND.

PLAN/MATERIALS:

ROOF:

THE ROOF COVERS THE SHELTER AND HELPS IT WITHSTAND WIND FORCES.

PLAN/MATERIALS:

WALLS:

THE WALLS PROVIDE STRUCTURE AND PROTECTION FROM THE WIND.

PLAN/MATERIALS:

SPECIAL FEATURES:

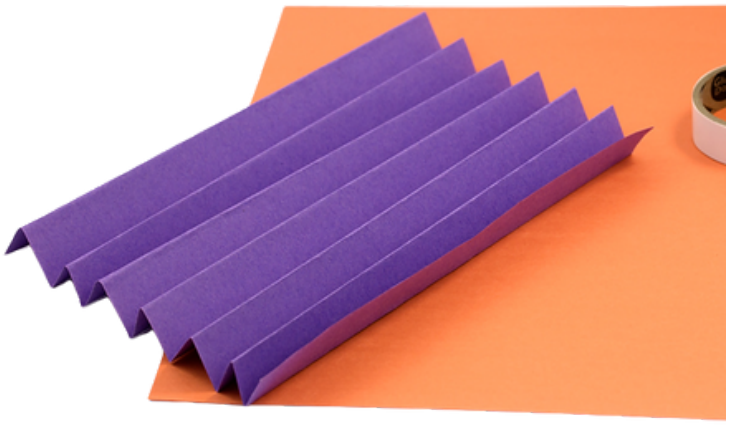
CREATE SPECIAL FEATURES TO INCREASE THE STRENGTH OR USEFULNESS OF THE STRUCTURE.

PLAN/MATERIALS:

SKETCH

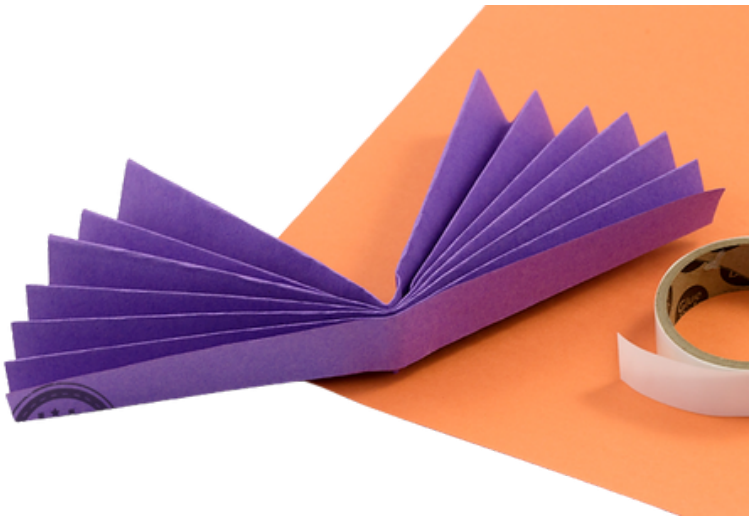
TORNADO PROOF

FAN TEMPLATE



Step 1: Fold paper accordion style keeping each layer even with one another.

Step 2: Fold accordion paper in half.



Step 3: Glue or tape the top edges of the folded paper in order to create one seamless crescent fan.

iSTEAM After School

Thank you!