South Carolina STEM Education Month

DUKE ENERGY SCIENCE NIGHT

Boat Builders

Big idea

Explore a force called **buoyancy** by designing and building a boat with a simple household material.

You will need

WHAT WE GAVE YOU:

- aluminum foil
- glass stones
- Boat Builders instruction sheet

STUFF YOU PROVIDE:

- 1-2 large plastic tubs
- 1-2 large towels
- 1-2 containers to hold the glass stones
- water
- paper towels

Set it up

Fill the plastic tubs no more than 2/3 full of water. Place the towels on a stable surface that won't be easily jostled and put the containers of water on the towel. Place the Boat Builders instruction sheet on the table along with the foil sheets and glass stones.

It's showtime!

Explain to students they'll be using the design process (question, plan, build, test, improve) to experiment with buoyancy. The essential question to ask students is if different shapes of boats can hold different amounts of weight before sinking. Give each student one sheet of aluminum foil to shape and fold however they would like. Once they're ready, have them place their boat in the tub of water and count how many glass stone they can add before it sinks.

If they love it…

After their boat sinks, they can pull it out of the water and reshape it to see if they can build a better boat. Students can redesign and retest their boat as many times as they'd like as long as it doesn't rip the foil.

Fun options

AHEAD OF TIME

In one of the plastic tubs, create a saltwater solution inside. Stir in regular table salt ¼ cup at a time until no more salt will dissolve in the water. Ask students to compare how the same vessel behaves in both fresh and salt water.

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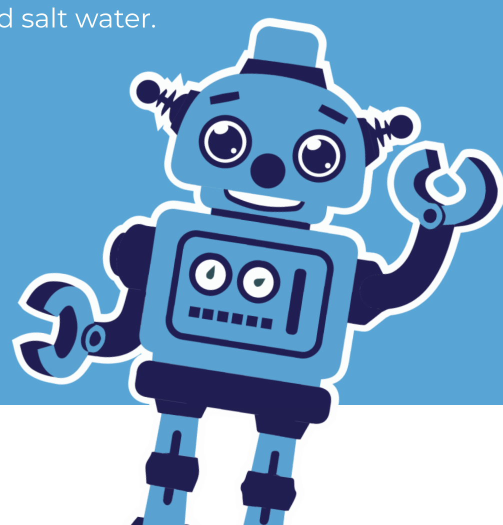

SCIENCE FOR ALL • CIENCIA PARA TODOS •

DUKE ENERGY SCIENCE NIGHT

Boat Builders

Why is this science?

Gravity is a force that pulls everything on Earth downward. **Buoyancy** is a force that pushes upward on objects that are in fluids (liquids and gases). Ships use the force of buoyancy to float even when the ship itself is made of a very dense material that would normally sink, like metal.

The shape of a ship determines how much weight it can carry. Large ships such as cargo ships and aircraft carriers push a lot of water to the side: this is called displacement. The more water that a ship displaces, the more buoyancy will push up on it, and the more weight it can carry.

If you look closely, you may even see the water level going up in the plastic tub as students add marbles to their boats causing their boats to displace more water.

South Carolina College- and Career-Ready Science Standards 2021

Explore a force called buoyancy by designing and building a boat with a simple household material.

Performance Expectation: K-PS2-2: Analyze data to determine if a design solution works as intended to change the speed or direction of an object with push or pull. 5-PS2-1: Support an argument that the gravitational force exerted by Earth on objects is directed down.

Science & Engineering Practice: Analyzing and Interpreting Data; Engaging in Argument from Evidence

Disciplinary Core Idea: PS2.A: Forces and Motion – Pushes and pulls can have different strengths and directions. Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. PS2.B: Types of Interactions – The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.

Cross-Cutting Concept: Cause and Effect

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South Carolina STEM Education Month

DUKE ENERGY SCIENCE NIGHT

Capillary Flowers

Big idea

Explore capillary action while making a colorful paper flower.

You will need

WHAT WE GAVE YOU:

- plastic cups
- coffee filters (round, "basket style")
- washable markers
- pipe cleaners
- Capillary Flowers instructions

STUFF YOU PROVIDE:

- water (to fill and refill the plastic cups)
- paper towels (to clean up any spills)

Fun options

Place a live white carnation in water containing food coloring and have it on display in order to demonstrate capillary action in real-life botany. The water will travel up the stem and color the petals of the flower!

Set it up

This activity would work best with 3 tables; the first for preparing the filter paper and observing the capillary action, second for drying the filter paper after removing from the water, and third for creating the flowers with the pipe cleaners.

Prior to the event, pour a small amount of water (approximately one-quarter inch) into each of the plastic cups. It's a good idea to make a capillary flower before the event begins. This way, you will become familiar with the process, and your sample will serve as an example for others to follow.

It's showtime!

As families approach, invite them to learn about capillary action by making a colorful paper flower.

Instruct them to stretch open the circular coffee filter and draw a circle about an inch away from the center of the filter. Next, they will fold the paper in half and then in quarters, so that it looks like a pizza slice.

Make sure the marker line is above the water. To test this, place the quartered filter paper next to the OUTSIDE of the cup, point down. If the ink is below the water, the ink will simply wash into the water and this experiment won't work as well.

Place the filter paper point down in the water and watch as capillary action pulls the water – and ink – up the paper. Have them observe the paper while the water is moving the entire length of the quartered filter paper, which will take a few minutes.

Some may prefer to use multiple colors, or to have the filter in the water for shorter times. This is fine, too.

When the water has nearly reached the top, lift the filter out of the water and let any extra water drip back into the cup. Gently open the filter paper and allow it to dry 5-10 minutes. (Perhaps suggest they go do another activity and then come back!)

When the paper is dry enough to handle without ripping, gently fold the filter paper back into quarters and wrap a pipe cleaner around the point of the filter paper to make a flower stem.

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DUKE ENERGY SCIENCE NIGHT

Capillary Flowers

Why is this science?

While making your paper flower, you were observing **capillary action**. Capillary action occurs because water is "sticky", thanks to the forces of **cohesion** (water molecules like to stay close to each other) and **adhesion** (water molecules are attracted and stick to other substances.) This allows water to flow in narrow spaces without the help of forces like a pump or gravity. In fact, with capillary action, liquid can flow against gravity (like the water rising up the paper in this activity.) Paper towels use capillary action to help clean up spills by pulling liquid into the porous paper. Plants use capillary action to pull water up from the ground.

During this activity, the water flowed up the porous coffee filter paper, moving the water soluble marker pigments with it. If you used a marker that was a primary color (i.e., red, blue, or yellow) you saw the color pigments moving up the paper along with the water. If you used a marker that was not a primary color, then you may have also seen separation of the color pigments into the primary colors. This is because the color pigments move at different rates with the water.

South Carolina College- and Career-Ready Science Standards 2021

Explore capillary action while making a colorful paper flower.

Performance Expectation: 1-LS1-1: Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs. 4-LS1-1: Construct an argument that plants and animals have internal and external structures that function together in a system to support survival, growth, behavior, and reproduction.

Science & Engineering Practice: Constructing Explanations and Designing Solutions; Engaging in Argument from Evidence.

Disciplinary Core Idea: LS1.A: Structure and function – Plants have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow. Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

Cross-Cutting Concept: Structure and Function; Systems and System Models

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DUKE ENERGY SCIENCE NIGHT

Fingerprints

Big idea

Explore the 3 main fingerprint patterns and discover which type(s) you have.

You will need

WHAT WE GAVE YOU:

- ink pads
- latex balloons (caution: latex allergy warning)
- hand wipes
- magnifying glasses
- Fingerprint Patterns instruction sheet

STUFF YOU PROVIDE:

- trash can for wipes
- optional: paper for those with latex sensitivity

Fun options

DURING SCIENCE NIGHT

Allow participants to make impressions of other fingerprints on a sheet of paper. Most people should have some combination of the different fingerprint patterns among their 10 fingers.

Set it up

Set out the ink pads, balloons, magnifying glasses, and hand wipes on your table. Display the pictures of different fingerprint types where they can be easily seen. You may want to tape these to the table or on a wall.

It's showtime!

As families approach your table ask them to look at the tip of one of their fingers. Ask: Can you see any lines on your fingertip? Explain that those lines that make up the pattern of their fingerprints are called friction ridges. Forensic scientists classify these patterns into three different types: arch, loop and whorl. Direct the families to the enlarged images of each type of fingerprint pattern. Explain the characteristics of each type of print:

- Arch – ridges form a hill or tent-shaped pattern
- Loop – ridges form an elongated loop pattern
- Whorl – ridges form a circular pattern

Let them know that they have the opportunity to take a closer look at their fingerprint and determine which type it is. To do this they will carefully roll one finger on the ink pad and then transfer the print to the surface of a balloon. Rolling their finger from one side to the other works best to evenly coat it with ink and transfer the print. Caution them not to press too hard or they might smudge their fingerprint. Once they have transferred their fingerprint they may blow up their balloon – this will enlarge the print so that they can see it more easily and determine its pattern. When they are finished, they may use a hand wipe to remove the ink from their finger(s).

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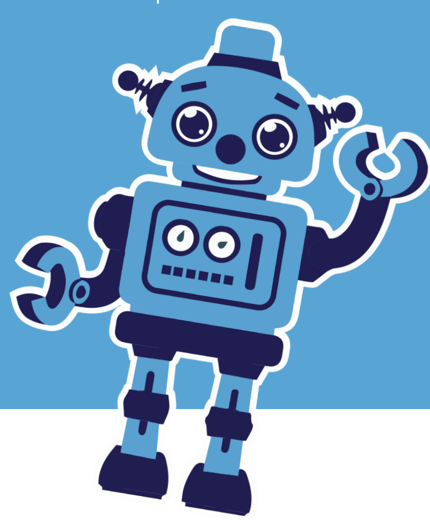

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DUKE ENERGY SCIENCE NIGHT

Fingerprints

Why is this science?

Every person has tiny raised ridges of skin on the inside surfaces of their hands and fingers and on the bottom surfaces of their feet and toes, known as "friction ridge skin." The friction ridges provide a gripping surface in much the same way that the tread pattern of a car tire does. No two people have exactly the same arrangement of ridge patterns – not even identical twins who share the same DNA! Although the exact number, shape and spacing of the ridges changes from person to person, fingerprints can be sorted into three general categories based on their pattern type: arch, loop and whorl.

During the third to fourth month of fetal development, ridges are formed on the epidermis, which is the outermost layer of skin, on your fingertips. Fingerprints are static and do not change with age, so an individual will have the same fingerprint from infancy to adulthood. The pattern changes size, but not shape, as the person grows (just like the fingerprint on the balloon in this activity). Since each person has unique fingerprints that do not change over time, they can be used for identification. For example, forensic scientists use fingerprints to determine whether a particular individual has been at a crime scene. Fingerprints have been collected, observed and tested as a means of unique identification of persons for more than 100 years.

Fun Fact: Loops are the most common type of fingerprint; on average 65% of all fingerprints are loops. Approximately 30% of all fingerprints are whorls, and arches only occur about 5% of the time.

South Carolina College- and Career-Ready Science Standards 2021

Explore the 3 main fingerprint patterns and discover which type(s) you have.

Performance Expectation: 1-LS3-1: Make observations to support an evidence-based claim that most young are like, but not exactly like, their parents. 3-LS3-1: Analyze and interpret data to provide evidence that plants and animals have inherited traits that vary within a group of similar organisms.

Science & Engineering Practice: Constructing Explanations and Designing Solutions; Analyzing and Interpreting Data

Disciplinary Core Idea: LS3.A: Inheritance of Traits – Young animals and plants are very much, but not exactly, like their parents. LS3.B: Variation of Traits – Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways.

Cross-Cutting Concept: Patterns

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DUKE ENERGY SCIENCE NIGHT

Light it Up

Big Idea

Explore how to complete an electrical circuit by trying to transfer energy through different materials.

You Will Need

WHAT WE GAVE YOU:

- Energy balls
- Light It Up instruction sheet

STUFF YOU PROVIDE:

- assorted metallic objects
- assorted nonmetallic objects

Fun Options

Collect a broad assortment of objects to use.

Set it up

Ahead of time, collect metallic and nonmetallic objects from your school that might be fun for students to test. Rubber erasers, play-doh, index cards, plastic items, wood items, paperclips, scissors, coins, aluminum foil, and old keys are a few possibilities. On the night of the event, set out the energy balls, assorted metallic and nonmetallic objects, and Light It Up instruction sheet on a table.

It's showtime!

Give students an energy ball and ask them what they think it is. Ask them if they notice anything different between the energy ball and a ping pong ball. Let them know that the two pieces of metal are connected to a battery, a light, and a noise maker... but because there is a gap between the metal the electrical circuit is not complete. When students complete the circuit, they will hear the noise and see the light. Have them try their fingers to see that they conduct electricity!

Have the students test metallic and nonmetallic items to see which items conduct electricity and complete the circuit to light up the ball. The items will need to touch both metal strips when testing. Alternatively, they will need to have their finger on one metal strip and the object on the other metal strip.

If they love it...

Since touching the metal will complete the circuit, ask them to create a large human circuit. They should hold hands with friends and family to make a circle. Place the ball between two people in the circle and ask each person to touch one of the metal strips. Several people in the circle can try letting go of each other and then hold hands again.

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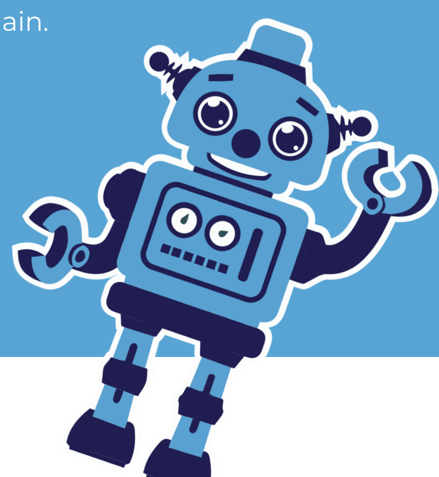

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Light it Up

Why is this science?

The energy ball lights up when you create a **closed circuit**. A closed circuit is a complete path for electricity to flow. The word circuit actually comes from the word circle. The energy ball worked when students held metallic objects on the energy ball. A **conductor** is a material that allows energy to flow through it. Metals are good conductors. Items like paper, plastic and wood are **insulators**, which are materials that do not allow energy to flow through them. People are good conductors, too. When the people in the circle stopped holding hands, it became an open circuit and the path for electricity was no longer complete.

South Carolina College- and Career-Ready Science Standards 2021

Explore how to complete an electrical circuit by trying to transfer energy through different materials.

Performance Expectation: 4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

Science & Engineering Practice: Planning and Carrying Out Investigations

Disciplinary Core Idea: PS3.A: Definitions of Energy - Energy can be moved [transferred] from place to place by moving objects or through sound, light, or electric currents. PS3.B: Conservation of Energy and Energy Transfer - Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated, and sound is produced. Light also transfers energy from place to place. Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light.

Cross-Cutting Concept: Energy and Matter

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DUKE ENERGY SCIENCE NIGHT

Moon Craters

Big idea

Explore what causes craters on the moon.

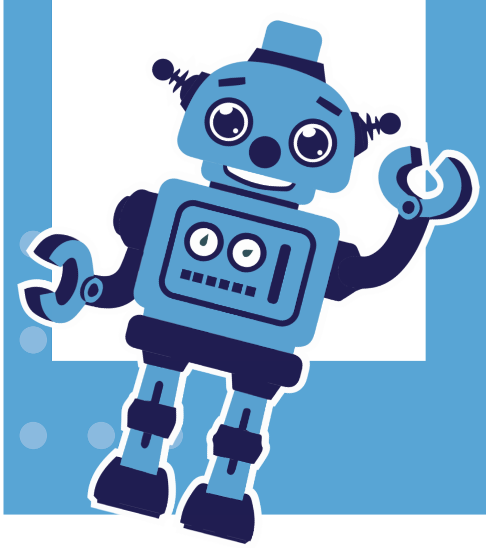
You will need

WHAT WE GAVE YOU:

- pie tins
- flour
- cocoa mix
- sifter spoon
- bag of "asteroids" (rocks)
- flashlights
- drop cloth
- Moon Craters instructions

STUFF YOU PROVIDE:

- An area large enough for the drop cloth and that is not too bright (which helps to simulate evening)



Set it up

Set the pie tins out on the drop cloth. Fill each at least 1-inch deep with flour. Smooth the surfaces. Sprinkle each with a dusting of cocoa mix using the sifter spoon.

It's showtime!

As families approach, ask them, "When is the best time to see the Moon through a telescope?" (They may say full moon.) Then say, "Let's find out! Do you want to see craters?"

Explain that your "Moon Pan" will represent a small area of the Moon's surface. You might encourage discussion about what the Moon's surface is like. Invite someone to carefully make a mountain range or two.

To make craters, hand out rocks* to volunteers. Tell everyone that the rocks will represent asteroids that bombarded the Moon early on in the Moon's history (and sometimes still do.) Have volunteers come up one at a time to drop rocks into the pan to make craters. To make the point that not all asteroids hit the Moon, have volunteers stand with their backs to the Moon Pan and drop the rocks over their shoulders. Only some of the rocks will hit the pan.

Demonstrate full moon by holding the Sun (the flashlight) where it will be when the Moon is full – that is, hold the flashlight so that it shines straight down on the lunar surface. Note that the surface looks pretty flat and that not much detail can be seen.

Demonstrate a quarter moon by holding the Sun (the flashlight) so that is shines from the side. Note that now much more detail can be seen and that it's better to observe the real Moon when we can see the shadows.

*SAFETY NOTE: Make sure the rocks are not thrown up in the air or at any people!

Continued ›

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Moon Craters

Why is this science?

In this activity you observed craters (round bowl-shaped holes.) You might have seen crater features such as raised rims, ejecta (debris thrown out of the crater), or long thin "rays" extending like spokes of a wheel from the crater. Although in this model you may see the rock that made the crater sitting on the crater floor, on the real Moon the rocks hit so hard they are blown to bits.

The study of the surface and physical features of the Moon is called selenography. It is also referred to as "lunar science". Historically, the principal concern of lunar scientists was the mapping and naming of the lunar maria, craters, mountain ranges, and other various features. This task was largely finished when high resolution images of the near and far sides of the Moon were obtained by orbiting spacecraft during the early space era. Some regions of the Moon remain poorly imaged (especially near the poles) and the exact locations of many features (like crater depths) are uncertain by several kilometers.

South Carolina College- and Career-Ready Science Standards 2021

Explore what causes craters on the moon.

Performance Expectation: 1-PS4-2: Make observations to support an evidence-based claim that objects in darkness can be seen only when illuminated by light sources. 4-PS3-1: Use evidence to construct an explanation relating the speed of an object to the energy of that object.

Science & Engineering Practice: Constructing Explanations and Designing Solutions

Disciplinary Core Idea: PS4.B: Electromagnetic Radiation – Objects can only be seen if light is available to illuminate them or if they give off their own light. PS3.A: Definitions of Energy – The faster a given object is moving, the more energy it possesses.

Cross-Cutting Concept: Cause and Effect; Energy and matter.

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DUKE ENERGY SCIENCE NIGHT

Paper Flying Machines

Big idea

It doesn't have to look like an airplane in order to fly! Build different flying machines to experiment with the 4 forces of flight.

You will need

WHAT WE GAVE YOU:

- straws
- index cards
- masking tape
- transparent tape
- Paper Flying Machine instructions

STUFF YOU PROVIDE:

- paper
- scissors
- tape measure or yard stick
- optional: stopwatches

Fun options

AHEAD OF TIME

Provide markers and other art supplies for children to use to decorate their Flying Machines.

DURING SCIENCE NIGHT

Challenge them to invent their own flying machine design and teach it to someone else.

Set it up

Lay out Paper Flying Machine instructions, paper, straws, index cards, tape and scissors on table. Use masking tape to define a runway on the ground and use the tape measure or yard stick to mark distances.

It's showtime!

Encourage families to have fun making and flying their paper flying machines. Instructions are included for Straw Gliders and Whirligigs. They can use the instructions or create their own designs.

They can test how far the Straw Gliders fly using the runway, and see how accurately they can aim the gliders.

Whirligigs spin rather than fly, but families can use the stopwatches (or their own smart phones) to see how long they stay in the air.

If they love it...

Challenge families to adapt the designs – what's the biggest Straw Glider they can make that still works? What happens if they add more loops to the Straw Glider? What's the craziest Whirligig design that will spin? Try moving the location of the notches on the Whirligig, or cutting the ends of the strip into points.

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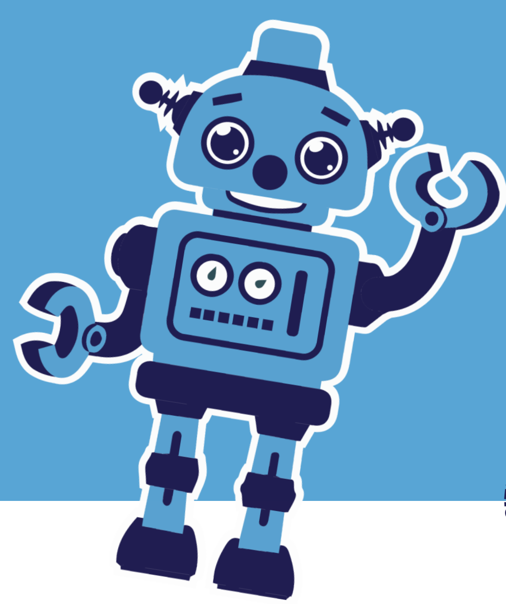

DUKE ENERGY SCIENCE NIGHT

Paper Flying Machines

Why is this science?

In order to fly, a flying machine has to overcome the force of gravity. The earth's gravity pulls things down, so these flying machines have to take advantage of other forces that temporarily override gravity's pull. Lift is a force created by air flowing over the curved surfaces of the Straw Glider's paper loops, and thrust is the force given to the glider when you throw it. Both lift and thrust help keep the flying machine in the air. Drag is the resistance met when the machine moves through the air; it slows forward motion, which reduces lift. So if lift and thrust are stronger than drag and gravity, the machine will fly.

South Carolina College- and Career-Ready Science Standards 2021

It doesn't have to look like an airplane in order to fly! Build different flying machines to experiment with the 4 forces of flight.

Performance Expectation: 3-PS2-1: Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

Science & Engineering Practice: Planning and Carrying Out Investigations

Disciplinary Core Idea: PS2.A: Forces and Motion - Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. PS2.B: Types of Interactions - Objects in contact exert forces on each other.

Cross-Cutting Concept: Cause and Effect

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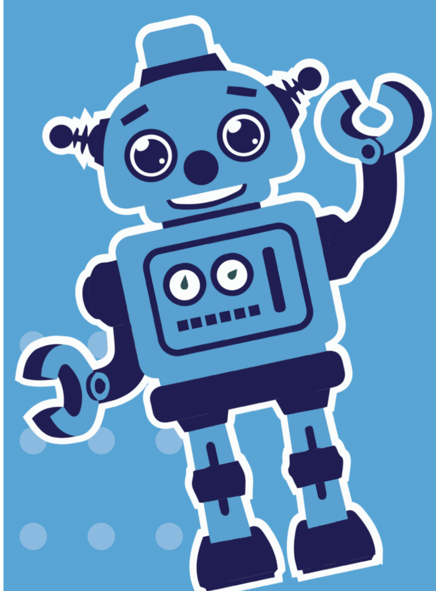
DUKE ENERGY SCIENCE NIGHT

Solar Eclipse Art

Big idea
Learn what happens during a solar eclipse while making a work of art.

You will need
WHAT WE GAVE YOU:
- black construction paper
- chalk
- plastic lids
- Solar Eclipse Art Instruction Sheet

STUFF YOU PROVIDE:
- scissors
- pencils
- Optional: tissues



Set it up
Place the materials and the instruction sheet on a table.

It's showtime!
Give each student a piece of construction paper and explain they'll be learning about eclipses and the Sun's corona while making a piece of art. They will first use a plastic lid and pencil to trace a circle on one half of their paper, then cut out the circle with a pair of scissors. They will place their circle template on the other half of their paper and hold it down with one hand while using chalk to draw a thick circle around it. Their circle does not need to be neat! Still holding the template in place with one hand, they will use a finger (or tissues, if provided) to smudge the chalk away from the center of the circle. When they are finished smudging, they can remove the template to reveal their work of art and learn that this is what a total solar eclipse looks like! They can use the chalk to add words, pictures, or fun designs to their artwork.

Fun options
Provide paper, crayons, markers, etc. so that students can create other artwork featuring the Sun, Moon, and Earth.

If they love It...
Ask participants, "Can you see any stars during the daytime?" The answer is, "YES - Our solar system's star, the Sun!"

Important Safety Note:
The Sun is very dangerously bright. Never look directly at the Sun without special eclipse glasses. You can seriously injure your eyes. It is not safe to look at the Sun wearing regular sunglasses.

Continued ›

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DUKE ENERGY SCIENCE NIGHT

Solar Eclipse Art

Why is this science?

Before there were cameras, people recorded what they saw in the sky using words and drawings. You have created a picture of what a total solar eclipse looks like using chalk and paper!

Solar means related to the sun. A solar eclipse happens when the Moon moves between the Sun and Earth. Sometimes the Moon only blocks part of the Sun's light. This is called a partial solar eclipse. Other times, the Moon blocks all the Sun's light. This is called a total solar eclipse. As the Moon blocks the Sun's light, it casts a shadow on Earth which creates a trail as Earth rotates. This is called the path of totality.

During a total solar eclipse, the Sun, Moon, and Earth are in a direct line and the sky becomes dark. With the Moon completely in front of the bright Sun it is possible to see the corona, the outer atmosphere of the Sun. We usually can't see the corona because it is hidden by the bright light of the Sun's surface. But when the Moon blocks the Sun's light during an eclipse, all you can see is the light from the corona. This light is dim and white. Until special telescopes were created, the Sun's corona could be observed only during a total solar eclipse.

You can learn more about solar eclipses, the Sun, and Earth at www.spaceplace.nasa.gov

South Carolina College- and Career-Ready Science Standards 2021

Learn what happens during a solar eclipse while making a work of art.

Performance Expectation: 1-PS4-3: Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light. 1-ESS1-1: Use observations of the sun, moon, and stars to describe patterns that can be predicted. 5-ESS1-1: Support an argument with evidence that the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.

Science & Engineering Practice: Planning and Carrying out an Investigation; Analyzing and Interpreting Data; Engaging in Argument from Evidence.

Disciplinary Core Idea: PS4.B: Electromagnetic radiation – Light travels from place to place. Some materials allow light to pass through them, others allow only some light through, and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. ESS1.A: The universe and its stars – Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted. The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.

Cross-Cutting Concept: Cause and Effect; Patterns: Scale, Proportion, and Quantity

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DUKE ENERGY SCIENCE NIGHT

Sound Sandwiches

Big idea

Build a noisemaker and discover why we can hear and sometimes *feel* sound.

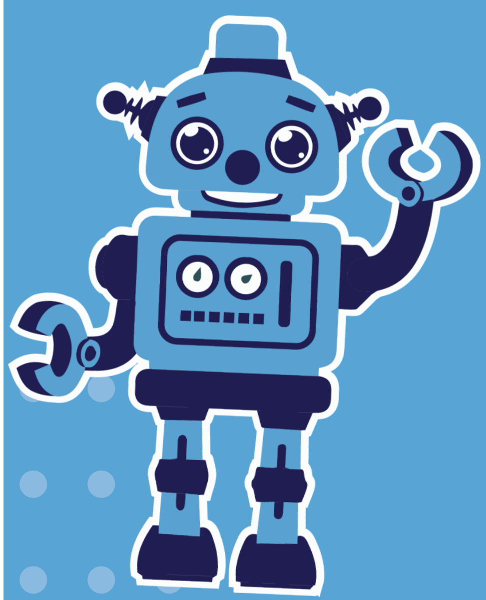
You will need

WHAT WE GAVE YOU:

- jumbo craft sticks
- big rubber bands
- little rubber bands
- straws
- Sound Sandwiches instructions

STUFF YOU PROVIDE:

- scissors



Set it up

Cut the straws into pieces a little longer than the width of the jumbo craft sticks (1-1 ½ inches long). Lay out the materials in order from left to right: jumbo craft sticks, big rubber bands, straws, little rubber bands. Place the instructions on the table. It's a good idea to make your own Sound Sandwich as an example. This way the students can see the finished product, and you get a chance to make sure you understand the instructions as well as anticipate any issues children may have assembling their Sound Sandwiches.

It's showtime!

Help students build their Sound Sandwiches according to the instructions. Younger children may have difficulty wrapping the small rubber bands around the ends of the craft sticks. Encourage family to help with this part. Once they are built, encourage them to experiment with their Sound Sandwiches.

NOTE: Things to look for if a Sound Sandwich isn't making noise –

1. Check to make sure the large rubber band is around only one of the craft sticks – not both.

2. Make sure the rubber bands on the ends are wrapped tightly, pressing the two craft sticks together.

3. Watch to see that they are blowing air between the two craft sticks – not into the straws.

Fun options

DURING SCIENCE NIGHT

Ask kids if they can play a recognizable song on their Sound Sandwich. It's hard for one person to do it, but see what happens if each person sets his or her sandwich to play a different note. Kids can work together to play a simple song like "Twinkle, Twinkle, Little Star" if they each have one note to play.

SCIENCE FOR ALL • CIENCIA PARA TODOS •

DUKE ENERGY SCIENCE NIGHT

Sound Sandwiches

Why is this science?

In order to understand how musical instruments create sound, you need to know a little bit about the physics of **sound waves**. Sound is the **vibration**, or back-and-forth movement, of air particles. We hear sound when those vibrations hit our eardrums. All sound is created by vibration, but not all vibrations are made in the same way. You can make vibrations by hitting something (like a drum, or stomping your foot), by plucking something (like a guitar string) or by using your breath to make vibrations in a column of air (like playing the flute or horn).

In the Sound Sandwich, what's vibrating? The big rubber band sandwiched between the two craft sticks. When you blow through the sound sandwich, you force air through the space created by the straws, and that air makes the big rubber band vibrate. The movement of the rubber band makes the air move, and that movement of air is what we hear as sound.

Sound can have pitch, meaning how high or low it sounds. Moving the straws closer together makes the pitch higher, because a shorter portion of the rubber band is vibrating. Moving the straws farther apart makes the pitch lower, because a longer portion is vibrating. Think about big instruments versus small ones: the double bass makes much lower sounds than the violin, and the tuba is much deeper than the trumpet. A longer vibration makes a lower sound.

South Carolina College- and Career-Ready Science Standards 2021

Build a noisemaker and discover why we can hear and sometimes feel sound.

Performance Expectation: 1-PS4-1: Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate. 4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

Science & Engineering Practice: Planning and Carrying Out Investigations

Disciplinary Core Idea: PS3.A: Definition of Energy – Energy can be moved [transferred] from place to place by moving objects or through sound, light, or electric currents. PS3.B: Conservation of Energy and Energy Transfer – Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby, changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. PS4.A: Wave properties – Sound can make matter vibrate and vibrating matter can make sound.

Cross-Cutting Concept: Cause and effect; Energy and Matter

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ADAPTED IN PARTNERSHIP WITH SOUTH CAROLINA'S COALITION FOR MATHEMATICS & SCIENCE SCCMS – Achievement by Design –

South Carolina STEM Education Month

DUKE ENERGY SCIENCE NIGHT

Stomp Rockets

Big idea
Stomp Rockets let you blast rockets high into the air. And you can make your own rockets!

You will need
WHAT WE GAVE YOU:
- Stomp Rocket kit
- construction paper
- wooden dowels
- transparent tape
- masking tape
- Stomp Rocket instructions

STUFF YOU PROVIDE:
- scissors

Fun options
AHEAD OF TIME

Provide foam sheets as well as paper – the stiffness makes for great fins and nose cones, but the extra weight does affect the flight.

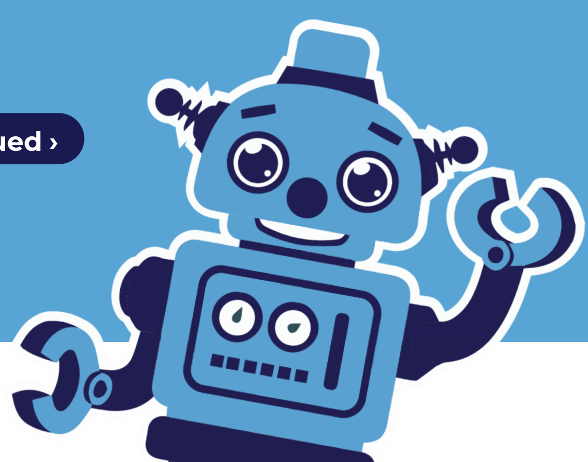
Set it up
Set up the Stomp Rocket launcher according to directions in the box. Use masking tape to draw two or three targets on the ground or on a wall, approximately 15-25 feet away. Each target should be about 5 feet away from other targets. The goal is to provide a couple of different challenges. Consider safety: aim all rockets away from people passing by. Lay out instructions, dowels, construction paper, scissors and transparent tape on tables.

It’s showtime!
Show families how the Stomp Rocket works: place the rocket on the launcher and stomp! Have them aim for the target or work on improving their distance. They can vary the angle of the launcher or how hard they stomp. The challenge increases when they aim for different targets.

Students can also make their own rockets. Tightly roll a piece of construction paper around the dowel and tape the edge shut. This creates a paper tube that’s the correct size for this launcher. Then use more paper and tape to add an air-tight nose cone to one end of the paper tube. Rockets need a nose cone so that the air from the launcher doesn’t whoosh out the front. Fins aren’t necessary, but are nice because they stabilize the rocket and make it fly better. Once the nose cone and fins are added, slide the paper rocket off the dowel and practice launching the home-made rockets!

If they love It...
Challenge students to build a rocket that separates into two parts, like many rockets designed to go into space.

Continued ›



SCIENCE FOR ALL • CIENCIA PARA TODOS •

Stomp Rockets

Why is this science?

This is aerospace engineering! For Stomp Rockets, the force of stomping on the rocket launcher provides a large push of air that launches it. For rockets that are launched into space or low-earth orbit, igniting massive amounts of fuel creates this pushing force. For both kinds of rockets, the pushing force has to be strong enough to overcome gravity in order to launch the rocket. Aiming the rockets is a challenge in real life just as it is for the Stomp Rockets, and aerospace engineers use both mathematics and physics to help them aim, guide and time the launches correctly.

South Carolina College- and Career-Ready Science Standards 2021

Stomp Rockets let you blast rockets into the air. And you can make your own rockets!

Performance Expectation: K-PS2-1: Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.

Science & Engineering Practice: Planning and Carrying Out Investigations

Disciplinary Core Idea: PS2.A: Forces and Motion - Pushes and pulls can have different strengths and directions. Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. PS2.B: Types of Interactions - When objects touch or collide, they push on one another and can change motion. PS3.C: Relationship Between Energy and Forces - A bigger push or pull makes things speed up or slow down more quickly.

Cross-Cutting Concept: Cause and Effect

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South Carolina STEM Education Month

DUKE ENERGY SCIENCE NIGHT

UV Bracelets

Big idea

Make a bracelet using special beads that help us learn about ultraviolet (UV) light - a type of light we can't see with our eyes.

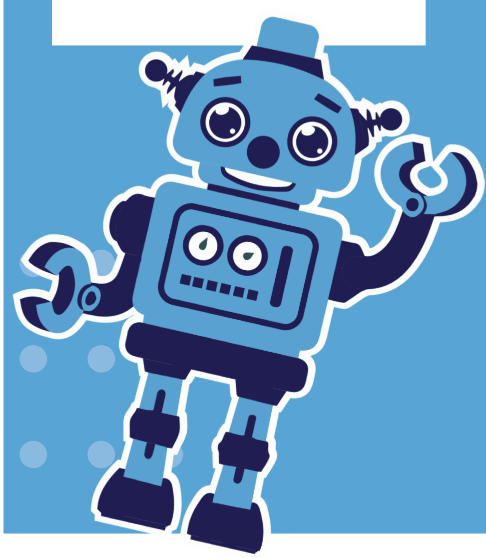
You will need

WHAT WE GAVE YOU:

- UV-sensitive beads
- Pipe cleaners
- UV "black" lights
- UV Bracelets Instruction Sheet

STUFF YOU PROVIDE:

- Materials for experimenting with blocking UV light: sunscreen, sunglasses, hats, cloth, etc.



Set it up

Place the materials and the instruction sheet on a table. Squeeze some sunscreen into a small Ziploc bag so that it fully coats the inside with a good layer. The beads contain a special chemical that changes color when exposed to ultraviolet light. The beads stay white when not exposed to UV. They will turn colors only when exposed in the Sun or UV "black" light; incandescent and fluorescent lights will not affect them. The darker the color of the beads, the more UV rays they are detecting. When not exposed to UV light, the beads will slowly change back to white. This can be repeated many times.

It's showtime!

Give each student a pipe cleaner and two beads, and explain they'll be learning about ultraviolet light. Ultraviolet is abbreviated to UV. Explain that UV light is not visible to us and so we are using special beads that change color when UV light is present. Have them string their beads onto the pipe cleaner and twist or tie the ends together so they will not fall off. They will experiment by first exposing their beads to UV light and observing them change color and then removing them from the UV light until they change to white again. They can then experiment by holding one of the materials so that it is between the beads and the UV light in a way that allows them to still look at the beads. They may need help to hold the material over only one of the beads so they can observe how each bead is responding to the UV light. (The bead that does not have the material is the "control" and the bead that does have the material is the "test" in this kind of experiment.) Ask them to conclude if the material is blocking any of the UV light from changing the color of the beads.

Important Safety Note:

Too much exposure to UV light can damage our eyes. Never look directly into the UV light.

Continued ›

SCIENCE FOR ALL • CIENCIA PARA TODOS •

DUKE ENERGY SCIENCE NIGHT

UV Bracelets

Why is this science?

The Sun gives off different kinds of energy including heat, visible light, and invisible light such as ultraviolet, which is abbreviated UV. Our eyes can see only visible light, the colors of the rainbow. These beads contain a special chemical that changes color when exposed to UV light. Ultraviolet light is an invisible part of the Sun's "electromagnetic spectrum," which also includes radio waves, microwaves, infrared, and x rays. You may have heard of some of these types of invisible energy because they are used in our homes and hospitals.

The Earth's ozone layer protects us from most of the Sun's dangerous UV rays. A smaller amount of UV reaches the surface and is responsible for giving us sunburn. We can protect ourselves by wearing sunscreen. Sunscreen protects us in two different ways: some of the particles in sunscreen physically block the light while others undergo a chemical reaction when UV light shines on them. By reacting with your sunscreen, the UV light cannot react with your skin. We can also wear sunglasses, hats, and clothing that covers our skin. Some clothing is even made from fabric designed for UV protection. You can wear your UV bracelet when you go outside as a reminder to protect yourself from the Sun's UV rays.

South Carolina College- and Career-Ready Science Standards 2021

Make a bracelet using special beads that help us learn about ultraviolet (UV) light – a type of light we can't see with our eyes.

Performance Expectation: K-PS3-1: Make observations to determine the effect of sunlight on the Earth's surface. K-PS3-2: Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.

Science & Engineering Practice: Planning and Carrying Out Investigations; Constructing Explanations and Designing Solutions.

Disciplinary Core Idea: PS3.B: Conservation of Energy and Energy Transfer – Sunlight warms Earth's surface. ETS1.B: Developing Possible Solutions – designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. ETS2.A: Interdependence of Science, Engineering, and Technology – There are many types of tools produced by engineering that can be used in science to help answer these questions through observation or measurement.

Cross-Cutting Concept: Cause and Effect

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