

STEM ACTIVITY GUIDE



DEER DROP PARACHUTES

Swap game night with invention night and kick it off with this fun STEM activity for kids! You will be challenged to create your own parachute in order to help your toy animal safely land.



MATERIALS NEEDED

- Deer toy or stuffed animal
- Tape
- Scissors
- Objects found around the house or classroom
- String
- Plastic bags

AT-HOME INSTRUCTIONS

The challenge is to safely parachute a toy deer (or another toy of your choice). With a parent's permission, scour the basement, recycle bin, junk drawer and garage for items you can use to construct your parachute. Old clothes and grocery bags are great items, but don't stop there. What items can you upcycle to build a parachute for a deer? When everyone has finished, have an adult safely stand on a high space (such as an outdoor stairwell, the top of the slide at the park or launch from a window) and gently toss your creations. Have your family count down from 10 as you launch the parachutes. Cheer when deer lands slowly and safely. Make modifications and retest to improve the safety of the landing as many times as needed!

EDUCATORS: USE THIS ACTIVITY IN THE CLASSROOM WITH THESE MODIFICATIONS!

Break students into teams to create their parachutes. If weather allows, test your parachutes from the top of the slide or playset on the playground. If you need to stay inside, consider using a stage or bleachers in the gymnasium to test the parachutes. After the first trial, discuss what was successful and what could be improved and allow each team 10 minutes to make modifications before retesting as a class.

WHAT ARE WE LEARNING?

Why does the parachute work? When you toss the parachute up, if the canopy fills with air, the deer will slowly land on the ground. (At least slower than when not attached to a parachute!) Air resistance is pushing the parachute upward, and gravity is pulling the parachute downward. If the forces were equal in strength, the parachute would not move; it would be stuck in the air. But since gravity is stronger, the parachute is attracted downward and it floats down slowly, protecting the deer from impact.

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ROCKET LAUNCH

Design, build and launch your very own rocket ship! Once completed, try hitting different targets by adjusting the launch angle and predict where your rocket will land.



MATERIALS NEEDED

- Cardstock, craft foam or thin cardboard
- Foam insulation tube or thin pool noodle (12-inch piece)
- Plastic drinking straw (1)
- Wide rubber band (1)
- Scissors
- Yardstick or long stick (1)
- Yarn (3-foot piece)
- Zip tie (1)

AT-HOME INSTRUCTIONS

PART 1 - BUILD YOUR ROCKET

1. Fold the yarn in half lengthwise.
2. Tie the middle of the yarn to the rubber band.
3. Tie the loose ends of yarn together in a knot at the end opposite the rubber band.
4. Use a straw to push the rubber band and yarn through the foam tube, so that the rubber band sticks out at one end of the tube, and the yarn is visible at the other end of the tube.
5. Wrap a zip tie around the end of the foam tube near the rubber band. Have an adult help secure it as tight as it will go, so it holds the rubber band in place and does not come out when you pull on it. Use scissors to trim off the excess zip tie so that it does not stick out.
6. Create fins out of recycled cardstock, craft foam or thin cardboard by cutting a four-inch square from the material. Fold and cut the square on a diagonal to form two triangles.
7. Attach fins to the outside of the foam tube with duct tape, near the end with the yarn.
8. Alternatively, create a rocket of your own design out of recyclables!

PART 2 - LAUNCH YOUR ROCKET

1. Slip the rubber band over your finger, a yardstick, or another type of long stick. Use your other hand to pull back on the yarn approximately 12 inches.
2. Stretch the rubber band and prepare to launch.
3. Aim the rocket, steering clear of people, animals and fragile objects. Countdown and then launch!
4. Experiment with launching the rocket at different angles. Try to hit a variety of targets and predict where the rocket will land.

EDUCATORS: USE THIS ACTIVITY IN THE CLASSROOM WITH THESE MODIFICATIONS!

Split your students into teams and have them compete to see who can design a rocket that will launch the farthest. Create multiple rounds where teams take turns launching their rocket. Record how far each team was able to launch their creation and give them five minutes between rounds to make changes to their design or launch angle to see if they can improve their distance. Alternatively, assign various targets around your classroom a particular point value, and have students launch their rockets at these targets to see how many points they can score.

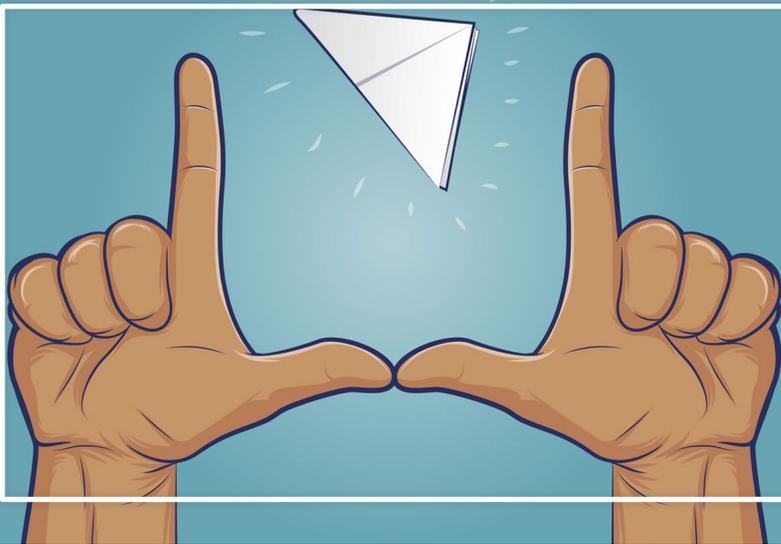
WHAT ARE WE LEARNING?

In this activity, students learn how rockets follow a certain trajectory or flight path based on the degree from which they are launched. By experimenting with the launch angle, students will be able to predict where their rockets will land.

INSPIRATION

This STEM activity was inspired by National Inventors Hall of Fame® Inductee George Alcorn, inventor of the Imaging X-Ray Spectrometer – a device that has been used with space telescopes and satellites to search for new planets and collect data.





PAPER FOOTBALL

Explore the science of aerodynamics by playing this unique take on paper football. Encourage children to experiment with many different shapes to see how far they can flick their custom-made "footballs."

MATERIALS NEEDED

- Recyclables and other objects from around the home (straws, paper cups, cardboard tubes, etc.)
- Scissors
- Tape
- Paper

AT-HOME INSTRUCTIONS

1. Build two goalposts using objects found around the house.
2. Find a smooth, flat surface to use as the game field.
3. Fold sheets of paper into different shapes including triangles and squares, or try crumpling the paper into a ball.
4. Attempt to make field goals by flicking these newly created shapes through the goalposts.
5. Discover which paper shapes travel the farthest and highest!

EDUCATORS: USE THIS ACTIVITY IN THE CLASSROOM WITH THESE MODIFICATIONS!

Incorporate the power of teamwork by splitting students into multiple teams, having them work together to design and create "footballs" with different shapes and sizes. Encourage them to predict which of their designs will perform best, and then have them record their data. By organizing this game into multiple rounds, students will have the opportunity to engage in creative problem solving by improving on their designs over time.

WHAT ARE WE LEARNING?

In this activity, children explore the science behind projectile motion and experience firsthand how gravity causes a thrown, kicked or flicked object to fall in what's known as a parabolic arc. Additionally, students learn that geometry is everywhere – even in sports!

INSPIRATION

Become inspired by National Inventors Hall of Fame® Inductee Beulah Louise Henry, a prolific inventor who created products ranging from an umbrella with interchangeable covers to a vacuum-sealed ice cream freezer. Did you know that Henry is also credited with inventing a valve for inflatable articles like footballs?

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BIRDS OF A FEATHER

Learn about feathers and how nature can be a great source of inspiration in this fun STEM activity!

MATERIALS NEEDED

- Item with VELCRO® Brand fastener
- Magnifying glass
- Recyclables and other objects from around the home
- Scissors
- Tape
- Turkey/bird feather (or other large feather)

AT-HOME AND IN-CLASSROOM INSTRUCTIONS

Gather a turkey/bird feather (or other large feather) from your local craft store and check out the detail of the design under a magnifying glass. The soft, feathery part extending out from the stem of the feather has barbs (like fishing hooks) with tiny hooklets. These barbs and hooks attach to each other, holding the strands of the feather together, making it smooth and retaining its shape even in windy conditions.

This barb and hook structure is similar to the VELCRO® Brand fastener, the design of which was inspired by nature! National Inventors Hall of Fame® Inductee George de Mestral went on a walk, and while pulling burrs from his jacket, he began to think about how burrs could stick to clothing and his dog's fur. Upon further investigation with a microscope, de Mestral discovered that there were tiny hooks that entangled themselves in the loops of fabric and fur. This allowed the seedpod to catch a free ride on the fur of passing animals. This discovery inspired de Mestral to design a unique, two-sided fastener just like VELCRO® Brand! One side was made up of stiff hooks like the burrs, while the other side had soft loops like fabric or fur. Check out the VELCRO® Brand fastener under the magnifying glass, too!

YOUR TASK

What might you build that is inspired by nature? Will it be able to attach one object to another? With the help of an adult, gather scissors, tape and recyclables from around the house or classroom to build with. Draw a sketch of your ideas and then start creating your prototype!

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THE BIG GAME

Check out this STEM activity for sports and science fans alike. Use the story of game-changing inventor and National Inventors Hall of Fame® (NIHF) Inductee Stan Honey to help you create your own game or sports invention!

MATERIALS NEEDED

- Football (or other sports ball)
- Recyclables and other objects from around the home
- Scissors
- Tape

AT-HOME INSTRUCTIONS

Get ready for the next big game by inventing your own sports accessory or a whole new game! Start by grabbing a football, recyclables and other objects from your home or classroom. How might you create a new game or sports accessory that can bring the action to the viewers? Can you think of a whole new game? Or maybe a way to transform your favorite sport with new ways to score points on the field? Brainstorm ideas with your family or friends. Then, play like a champion! After giving your new game or invention a try, rethink your innovation to see if there are additional ways you can improve your idea to make it even more useful and fun.

INSPIRATION

Become inspired by NIHF Inductee Stan Honey, who forever changed how the game of football is watched by inventing the Virtual Yellow 1st & Ten® line. Now found in almost every football game, the digitally superimposed yellow line has been hailed as one of the most important developments in sports broadcast technology since the debut of instant replay in 1963. Stan Honey improved the viewing experience of millions of sports fans by allowing viewers to get in on the action!

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SCIENCE SPOT

Create a special spot for exploring science and invention! The best way to make these fascinating subjects an everyday part of life is to keep them top of mind.

MATERIALS NEEDED

- Consumables (e.g., aluminum foil, straws, string)
- Recyclables
- Science-type toys or objects (e.g., magnets, magnifying glasses, washers)
- Scissors
- Tape
- Writing and drawing materials (e.g., markers, paper, pencils)

AT-HOME INSTRUCTIONS

1. Identify a spot that shouts “Science and invention happen here!” It could be a corner of a room, garage or basement, or even a small tub on an open shelf. The idea is to have easy access to materials that encourage exploration and discovery.
2. Search through the toy bin, junk drawer and recycling bin to find items that can be used for science exploration and invention prototype (model) making.
3. Consider adding a sign, some hooks and maybe even a few containers or baskets.
4. Upcycle mint tins for tiny parts, ask a florist for spare water tubes to use as test tubes or purchase eye droppers at the drug store to experiment with colored water. There’s no way to go wrong with creating a special spot for science and invention!

EDUCATORS: USE THIS ACTIVITY IN THE CLASSROOM WITH THESE MODIFICATIONS!

Find a spot in your classroom that can serve as a dedicated science corner. If you have space, consider adding a cart with recyclable materials. Sometimes businesses and factories have scrap materials they are willing to donate (e.g., bottle caps, fabric pieces, containers, etc.) that can be used by children to make invention prototypes (models). Include paper, pencils and markers for idea sketching, as well as books and objects from nature. Be sure to help students understand that this space is for them to pursue their curiosity as a scientist, maker and inventor!

WHAT ARE WE LEARNING?

While inventing or exploring science does not require an official spot or location, creating one can help children (and adults) be more mindful of weaving science into everyday activities. When children approach a space of this nature, they are reminded that they have the ability to make, experiment, discover and invent!

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CANDY CATAPULT

This fun STEM activity is kid-approved! Create a catapult and set goals to see how far your catapult can launch a piece of candy. When you meet your goal, keep the excitement going by testing with other items, such as small, soft toys!

MATERIALS NEEDED

- Candy (or other soft, non-breakable items)
- Tape
- Scissors
- Objects found around the house or classroom
- A ruler, tape measure or yardstick

AT-HOME INSTRUCTIONS

Swap game night with invention night and kick it off with this fun idea! Tell your family that today's challenge will be to catapult candy 10 feet. With a parent's permission, scour the basement, recycle bin, junk drawer and garage for items you can use to construct your catapult. Clothespins, spoons and scrap wood work great, but don't stop there. Look for items you can upcycle to build a catapult! Simple machines are everywhere. Give your family 20 minutes to build their catapults. When everyone has finished, set up a launching pad and a target 10 feet away. Have your family count down from 10 as you test your catapults. Cheer when the candy lands on the target. Redesign your catapults if you are not successful the first time! Next, try launching marshmallows, other candy or soft toys to test how materials of different weights travel different distances!

EDUCATORS: USE THIS ACTIVITY IN THE CLASSROOM WITH THESE MODIFICATIONS!

Want to take this activity into the classroom? Use these modifications to the at-home instructions to have fun while learning with the whole class!

- Split the students into teams of two or three with the same 20-minute period to build their catapults together
- Provide the class with a materials bin including rubber bands, pipe cleaners, binder clips, plastic spoons, activity sticks, etc. or allow students to use existing art supplies and items from the recycling bin to complete the challenge

WHAT ARE WE LEARNING?

Why does a catapult fling candy so far? Catapults use a simple machine: the lever. The purpose of a lever is to make a load (in this case, candy) easier to move. There are four parts to a lever: a rigid bar (arm), pivot point (fulcrum), the object being moved (load force) and the force applied to move the load (effort force). Catapults use stored potential energy to eject the candy across the room. This stored potential energy transfers to kinetic energy as the candy is launched. Combining kinetic energy with a simple machine makes a task like hurling a piece of candy very exciting!

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LAND AHOY

In this activity, boats aren't just for water! Children use a limited selection of materials and their creativity to build a land boat that sails across different surfaces.

MATERIALS NEEDED

- Tape
- Straws
- Paper

AT-HOME INSTRUCTIONS

1. Using only tape, straws and paper, have children design land boats that they can sail across a table or floor surface. Challenge them to think about the boat's body shape. Will it have sails? If so, how many? Ask what materials will help it sail smoothly. How will they keep it from tipping over?
2. Designate an area as the "pond" and have children race their land boats across the pond. After testing their boats, have them make changes based on their discoveries and then retest them. Encourage children to think creatively and critically by asking them what is working well, what needs problem solving and what other imaginative ideas they have for making changes. To keep the fun going, select a new "pond," changing the surface material the boats must sail on. Consider any readily available surface: table tops, tile flooring, carpeting, tin foil, plastic or even grass!

EDUCATORS: USE THIS ACTIVITY IN THE CLASSROOM WITH THESE MODIFICATIONS!

This activity is classroom ready! Consider using paper from the recycling bin to show students how you can upcycle items for new uses.

WHAT ARE WE LEARNING?

In this activity, children are challenged to learn the importance of accepting failure as an obstacle and the value of making modifications and retesting. Creative problem solving comes into play as children determine what is working well and what could be improved upon in their designs. Introducing new challenges with the "pond" surface encourages children to think creatively and be innovative to overcome obstacles!

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THE GREAT MARBLE PASS

Are you ready to take the challenge? In this activity, get the kids together for a fun and exciting race filled with innovation and creativity. Challenge children to think creatively, test their inventions and make modifications to retest!

MATERIALS NEEDED

- Two marbles
- A full recycling bin or craft supply area
- Scissors and tape

AT-HOME INSTRUCTIONS

Gather the whole family or invite some friends over for this fun activity! Divide into even teams and have each team form a line, standing side by side, with a few inches in between each person. Tell them that their challenge is to use recyclable items to pass a marble from one end of the line and back as fast as possible, making sure no one's hands ever touch the marble.

Give 10 minutes for individuals to build their inventions for moving the marble quickly to the next team member. Once done, have them return to their lines to begin the races!

Once teams have completed their first race, have them brainstorm ways of adapting their passing mechanisms and strategies to improve their speed. After a third round, tell teams that they must make at least three changes to their approach and try again. Encourage creativity, open mindedness and ingenuity!

EDUCATORS: USE THIS ACTIVITY IN THE CLASSROOM WITH THESE MODIFICATIONS!

Consider breaking into additional teams based on the number of students in the class.

If there is an odd number of students, join in on the fun to make the teams even!

WHAT ARE WE LEARNING?

In this fun activity, students are learning the importance of thinking creatively and making improvements and modifications to achieve even better results. Students are challenged to face failure and overcome assumptions to test and retest until they find the best solution to move their marble as quickly as possible!

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THE SUPERFAST SUPERCOOL

Science is super cool – especially when ice and salt are involved. Supercool water below freezing point and then discover how to make ice on demand in this ice experiment!



MATERIALS NEEDED

- Glass, very clean
- Ice cubes (made from tap water)
- Mixing bowl, large
- Salt (1/4 cup)
- Thermometer (optional)
- Water, purified or distilled

AT-HOME INSTRUCTIONS

1. Fill a mixing bowl with ice.
2. Pour a couple tablespoons of purified or distilled water into a clean glass.
3. Nestle the glass with water into the center of the bowl of ice so that the ice is higher than the level of water in the glass. Be very careful not to spill any ice into the glass of water.
4. Generously and carefully sprinkle the salt onto the ice. DO NOT get any of the salt in the glass of water.
5. Wait approximately 15 minutes for the water to cool below freezing (known as supercool). Optionally, you can carefully insert a thermometer into the glass of water to confirm if it is supercooled (less than 32 degrees Fahrenheit).
6. Place a fresh ice cube or frozen ice pack on a small plate or other dry surface.
7. Carefully remove the glass of supercooled water and slowly pour the water directly onto the ice and watch it freeze instantly on the ice.

EDUCATORS: USE THIS ACTIVITY IN THE CLASSROOM WITH THESE MODIFICATIONS!

This is easy to demonstrate in the classroom on top of any desk or table. Prepare the materials and use this activity as an energizer or fun opening exercise to warm up your students' minds for further investigation and discovery.

WHAT ARE WE LEARNING?

Purified water can be chilled below freezing temperature and still remain in liquid form. This is possible because ice crystals need surfaces to grow upon. With purified water, however, there are not enough impurities in the liquid for ice crystals to form. When purified water is supercooled and then carefully poured onto a fresh ice cube or frozen ice pack, the cube or pack serves as the surface upon which the ice crystals are able to form. Try making ice on demand with supercooled water!

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