STEM AT HOME ACTIVITY GUIDE:
Mini Golf Course Challenge

STEM AT HOME GUIDE: Mini Golf Course Challenge
Background Knowledge

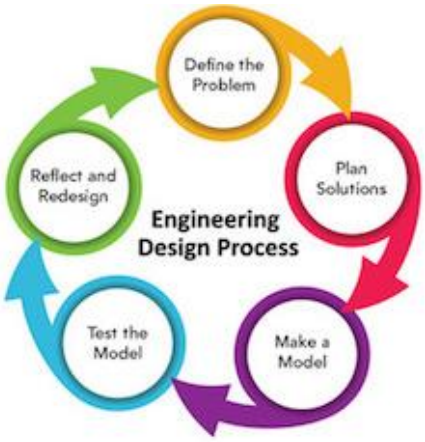
Aim: Design a putter and minigolf course with obstacles and traps made out of household materials.

Problem & Career Focus: Miniature golf, known as mini golf, is an offshoot of the sport of gold solely focused on the putting aspect of golf. Mini golf is known as a fun hobby for any age,

but can be difficult because of all the obstacles, traps, hills, and other objects built into each course! The goal of mini golf is to score the lowest number of points, which can be challenging. Using the engineering design process, your task is to work with your team of civil engineers, physicists, and statisticians to create a challenging mini-golf course in your home, including your putter, obstacles, track and walls.

Educational Standards: Simple Machines, Force, Motion, Energy

Engineering Design Process: STEM professionals use the engineering design process as steps to help solve real-world problems. With your team: define the problem, discuss solutions, design, build, test, and improve a prototype of your solution. One of the most important steps of the engineering design process is to reflect and redesign- if your team notices the capture device isn't working- improve the design. Use the engineering design process steps to guide your exploration during the Mini Golf Course Challenge.



Investigating Questions	Materials
• How could this challenge be used in real-life situations? • What household items and material combinations can you use to make your obstacles and traps? • How can you use force and motion principles of physics to successfully maneuver your ball through your course?	• Cardboard, boxes, foam, pool noodles • Cups, buckets • Paper towel rolls, paper plates • Legos, 3D printer (if desired) • Paper • Ping pong ball, golf ball, etc. • Aluminum foil • Scissors • Tape, glue • Any other household item you desire

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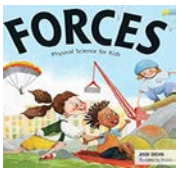
Vocabulary:
Force: the measurement of a push or a pull on an object. Force is measured in newtons.
Energy: the ability to do work. The standard unit of measure for energy is the joule
Momentum: the measurement of mass in motion. It is a vector measured in newton-seconds.

STEM Career Connections:

Civil Engineer	Physicist	Statistician
Are professionals that plan, design, construct, maintain and operate infrastructures	Research and apply the ways that energy and matter interact. They often conduct investigate and conclude solutions or theories in science.	Gather numerical data and display it to help their companies use math to make decisions.
They: build roads, buildings, airports, tunnels, dams, bridges and other systems.	**They**: work in museums, NASA, the government, car companies, research labs and more.	**They**: work for professional sports teams, healthcare, education, in research and so much more.

Real World Applications: You can see force, motion, and energy in your everyday life! It makes things move and stay still. When you ride your bike, ride a roller coaster, use a magnet, lift a toy, and play you are using force, motion and energy.

Literacy Connections:

Max and Marla by Alexandra Boiger	Forces: Physical Science for Kids by Andi Diehn	The Little Aces, a Golf Story by Rose Ostrow
		

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Background Knowledge

Engineering New Ideas in Sports!

This is creative engineering. Mini golf may seem like just a game, but there is a lot of science behind it.

The History of Mini Golf

Many people play traditional golf, which can be very challenging. Mini golf is an entertaining game for the whole family! The origins of mini golf can be traced back to Scotland, The Ladies Putting Club of St. Andrews, built in 1827 for women golfers to practice. Mini golf courses became popular with the Thistle Dhu (which means This'll Do) golf club in North Carolina and Tom Thumb Golf Club in Tennessee. These courses were the first to be made of concrete, pressed sand, fountains, and gardens. The use of artificial grass was much cheaper to use and maintain. Soon after mini golf, or putt-putt, courses were created across the United States.

Modern Day Mini Golf Courses

Mini golf uses the principles of real golf to design courses using really cool features! From water fountains, waterfalls, bridges, natural obstacles made of sand and rocks, and diverse landscaping it really is a sport for everyone of any age! Each layout has different holes, allowing players to use different strategies each time. Roll the ball off the top of a slope which will then bounce off a wall. The goal is to get the lowest number at each hole.

Everyday Science: Mini Golf

In most mini golf courses, there is not a direct path from where you start the ball to the hole. You often have to get the ball around, over or under one or more obstacles. Your goal is to get the ball into the hole by hitting it as few times as possible- which can be difficult with all the stuff in the way. One way to accomplish this is to bounce the ball off walls or other obstacles. By using the ball's path, you could even score a hole-in-one! If you watch the ball carefully when it hits a wall, you will probably notice that the angle at which the ball hits the wall (known as the area of incidence) is identical to the angle the bounces back off the wall (known as the angle of reflection). There might be a slight change, due to the ball's spin, but if you bounce the ball off a wall at a certain angle, it should rebound at roughly the same angle. The kinetic energy of the ball as it rolls is gradually converted to heat due to friction with the ground. Just some physics behind mini golf so you are prepared to create your own obstacles.

Check out these video links!

Mini Golf Kids!

https://www.youtube.com/watch?v=ZfuRpkq1NCY

Force and Motion

https://www.youtube.com/watch?v=ILhckx1zGXw

spark. inspire. engage.

Check out your community and see if there is a mini golf course you can play that's close by.	Billy Nye the Science Guy: Motion https://www.youtube.com/watch?v=eT4n3dzkG3w

STEM AT HOME GUIDE: Mini Golf Course Challenge
Activity Directions

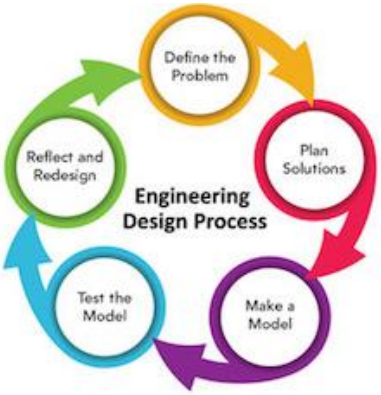
Aim: Design a putter and minigolf course with obstacles and traps made out of household materials.

Instructional Video: https://youtu.be/WuPdfyPvPVc

Investigating Questions
- How could this challenge be used in real-life situations?
- What household items and material combinations can you use to make your obstacles and traps?
- How can you use force and motion principles of physics to successfully maneuver your ball through your course?

Materials
Cardboard, boxes, foam, pool noodles
Paper towel rolls, paper plates
Legos, 3D printer (if desired)
Ping pong ball, golf ball, etc.
Tape, glue
Cups, buckets
Paper
Scissors
Aluminum foil

Any other household item you desire!



Criteria & Constraints:
Engineering design challenges (EDCs) are great opportunities for open-ended activities to grow critical thinking and problem-solving skills. EDCs do not use a list of directions to build a specific design, rather suggest a framework of designing a solution based on the problem and goal. How your team chooses to address the problem and goal is entirely up to you.

- Lay out all materials and items available for the challenge. Plan to give time for your team to discuss the problem relating to your background knowledge. What materials will you use to create your putter? What materials will you use to create your course (*Define the Problem*)?

- Discuss, sketch, and determine what materials your team will use to create both items, putter and course! (*Plan Solutions*).

- Using your sketches and discussions, begin creating the putter and course from your model from materials available. Family adults: allow your child(ren) to experiment with the materials and help them build problem-solving skills (*Make a Model*).

- As you are building your putter, test out the model with the obstacle course you are building! Is the putter long enough? Does it provide enough force on the ball without falling apart? (*Test the Model*)

- With your team, continue to discuss and work through problems with your designed models along the way. What adjustments can your team make to direct the ball through the course and obstacles? If you were to make a new course, what materials would you use or how would your model be different? (*Reflect and Redesign*)

Ideas to Increase Difficulty:

-Make multiple obstacles in one course

-Design the mini golf course outside!

-Limit the number of materials that will be used!

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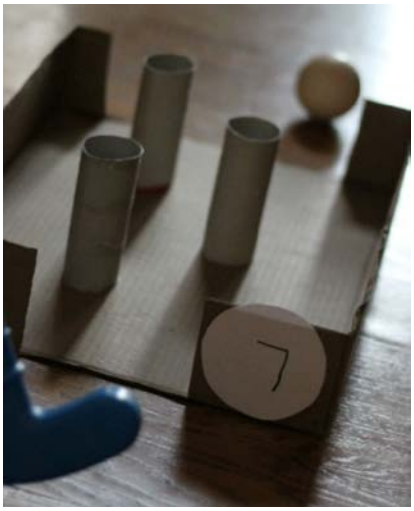
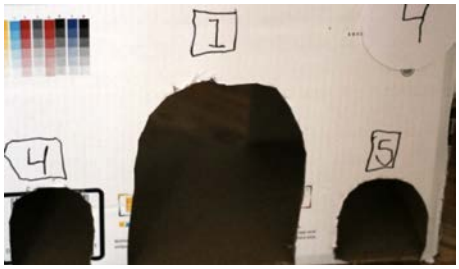
Sample Ideas





Photos courtesy of: Reading Confetti

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STEM AT HOME GUIDE: Mini Golf Course Challenge
Extension Activity

Make A Basketball Hoop

Materials:

Cardboard	Paper	Straws
Tape	String	Scissors
Index cards	Ping pong ball	Popsicle sticks
Plastic spoons	Rubber bands	Other materials at home

Criteria & Constraints:

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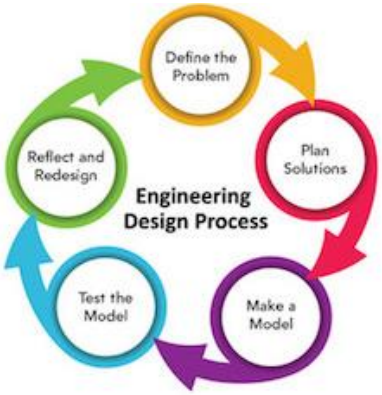

-In this challenge you are designing 2 things: Your basketball hoop AND ball launcher.
-To increase the level of complexity- separate your family into 2 teams! One team will design the basketball hoop and the other team will design the ball launcher/catapult.

- Research and brainstorm designs of basketball hoops and catapults for your ball launcher. What materials can you use to create solutions to the problem (Define the Problem)?
- Sketch your prototype and design of key aspects for the hoop and ball launcher. (Plan Solutions)
- Use research and the sketches from habitat to start brainstorming your bug prototype (What will the hoop look like? Will it be a classic hoop or have new features? (Plan Solutions and Make a Model)
- Plan your ball launcher prototype: draw or sketch the design. Watch some videos on catapults! (Plan Solutions and Make a Model).
- Use your household materials to make a model of your hoop and catapult/ball launcher (Make a Model).
- Test your design! Will you have to modify? Talk with your team about ways you could improve the design of your models (Reflect and Redesign).