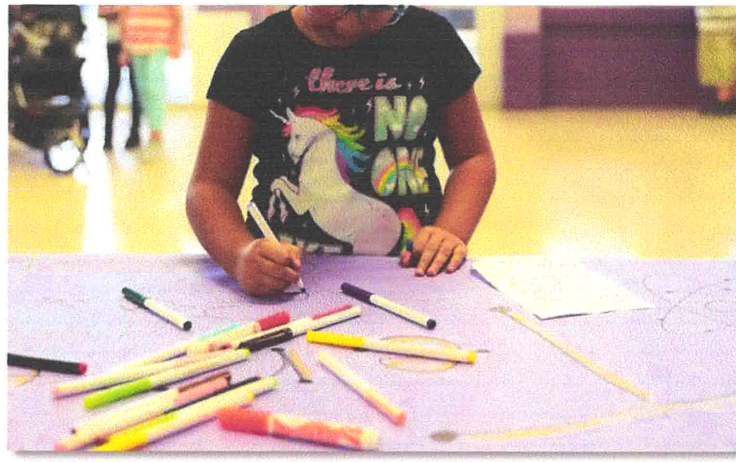
Level 1

STEM Mural

STEM Family Night

Create a visual representation of a STEM theme

STEM Connection	Key Words
Depends on theme	Depends on theme

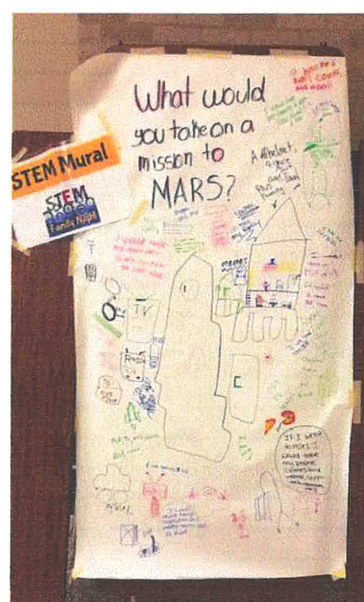


Materials

- ❑ Butcher paper
- ❑ Double sided tape
- ❑ Markers
- ❑ *Optional:* Crayons, pencils, paint, chalk

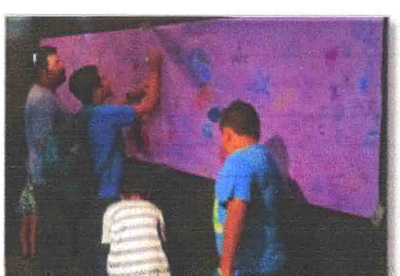
Station Set-up

1. Select an option for the mural.
    - *Option 1:* Select a theme for the STEM Mural that fits the selected activities for students to draw something to represent that theme. Examples include: space, engineering, chemistry, earth, inventions, biology, STEM careers.
    - *Option 2:* Select a STEM-related question that students respond with text or a picture. Examples include: What would you take on a mission to Mars? What problem do you want to solve to make the world a better place?
2. Collect butcher paper about 12 feet long. Write the theme of the mural. Hang up or lay paper in a central location.
3. Place a bin of markers or other art supplies nearby.



Activity Instructions

1. Allow participants to draw and write something related to the theme.
2. Display in the school after the event.



Level 1

Tallest Tower

STEM Family Night

Build the tallest structure using provided materials.

STEM Connection	Key Words
Architect Civil Engineering	Forces Center of gravity Balance Weight

Materials

- ❑ Measuring tape
- ❑ *Optional:* Timer
- ❑ *Optional:* Poster board and sticky notes to record heights

Per team:

- ❑ **50** index cards
- ❑ **1** foot masking tape

Background

Every **civil engineer** knows that a sturdy foundation or base is important to keep a tall structure from falling over. The **forces** acting on the structure must be balanced. This means keeping the **center of gravity** in the middle, or the **weight** evenly balanced, or the structure will fall over!

How do houses get built? First, an **architect** designs the structure. Then a **civil engineer** take the design and determines the best building materials and structure to make it safe.

Station Set-up

1. Sort index cards into stacks of 50.
2. Prepare 1 foot long masking tape.

Activity Instructions

1. Compete individually or in teams.
2. Provide group with supplies (50 index cards + 1 foot tape). Tell them the design rules (below).
3. Set timer for 8 minutes. This is optional depending on amount of people.
4. To keep it competitive throughout the event, record heights on sticky notes (name and height) and place onto butcher paper or poster board.

Design Rules

- Tower must be unsupported. No holding, wedging between tables, or attaching to a surface.
- Only build with provided materials.
- Only 8 minutes to build. (optional)

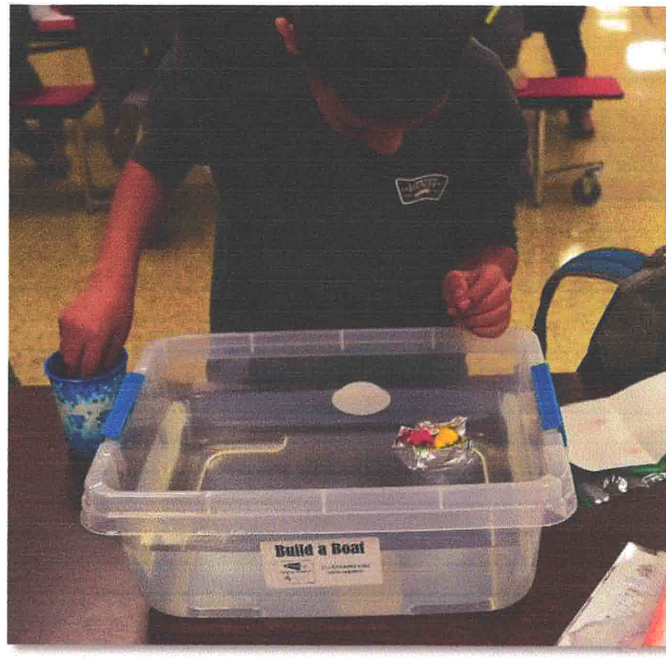
Level 1

Build A Boat

STEM Family Night

Build a boat out of aluminum foil to hold as much weight as possible.

STEM Connection	Key Words
Marine engineer Naval architect	Gravity Buoyancy Density Surface Area



Materials

- ❑ **2** rulers (measure foil)
- ❑ **2** scissors (cut foil)
- ❑ **1** 75 sq ft roll aluminum foil
- ❑ **3 – 4** containers with water
- ❑ **50** weights per container (ex: pennies, washers, plastic bears)
- ❑ **3 – 4** cups to hold weights
- ❑ **2** rolls paper towels

Station Set-up

1. Make 6 in x 6 in sheets of foil by cutting one foot of aluminum foil and dividing into fourths.
2. Fill bins with water and divide materials into 3 – 4 testing areas.

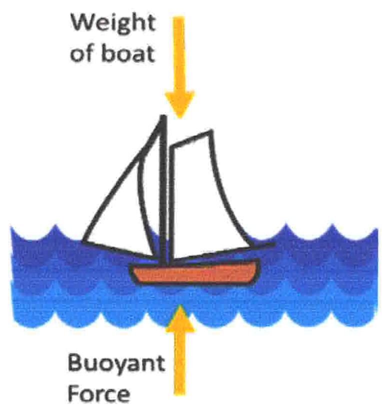
Activity Instructions

1. Determine a location that is suitable for getting wet!
2. Provide each student with a 6 in x 6 in sheet of aluminum foil.
3. Ask participants to build a boat with the sheet of foil to float as many weights as possible.
4. Float the boat in a tub of water and add weights one at a time into the boat until it sinks. Ask student to think about how they can improve their boat design to hold more weights.
5. Ask family members to compete and see who can build the boat to hold the most weight!
6. Consider creating a leaders board with a record of the most weights held by a boat.

Build A Boat

Background

What are the forces on a boat that keeps it from **sinking**? **Gravity** is pulling it downward, determined by the weight of the boat. **Buoyancy** is pushing it upward. The buoyancy force is created by the weight of the water displaced by the boat. How does the **buoyancy** change with a larger **surface area**? As the surface area decreases, the same **weight** is distributed over less area creating higher **density**.



Marine engineers design the mechanical systems of different ships, from aircraft carriers to sailboats. **Naval architects** work on the basic design of ships such as the overall shape and stability of the hulls.

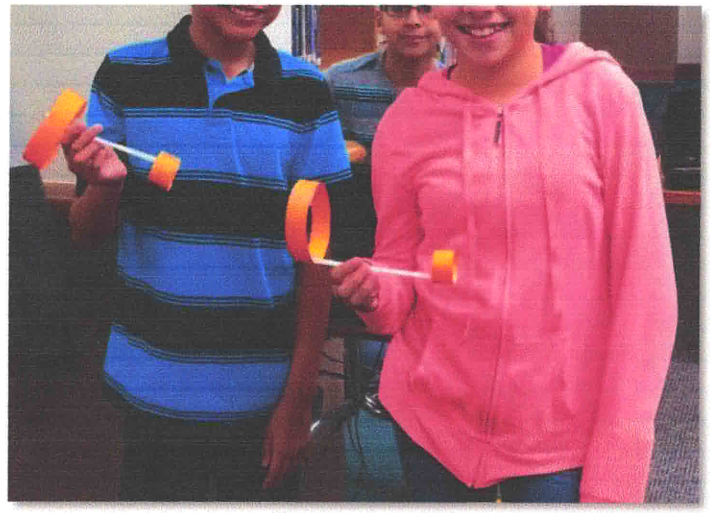
Level 1

Hoop Gliders

STEM Family Night

Build and fly a glider made from a straw with hoops.

STEM Connection	Key Words
Robotics Engineering	Air resistance (drag) Variable Stability Forces of flight



Materials Per Glider

- ❑ **1** index card
- ❑ **1** straight straw
- ❑ **1** ruler
- ❑ **1** pencil
- ❑ **1** roll clear tape or masking tape
- ❑ **1** scissors
- ❑ *To mark distance:* 50 ft measuring tape, 4 index cards, 1 roll masking tape
- ❑ *Optional:* Safety cones to mark off launching zone

Station Set-up

1. Set-up the launch area of about 15 x 40 feet. Lay measuring tape along the launching zone and tape down. Create markers along the launching zone from index cards at 10, 20, 30 and 40 feet.
2. Build a hoop glider as an example and test the launching area. Note that hoop gliders don't always go straight! Make sure there is plenty of space around the launching zone.
3. Set out building materials across tables. For younger students, pre-cut hoop strips.

Activity Instructions

1. Cut index card into 3 separate pieces that measure 1 inch by 5 inches (these can be pre-cut).
2. Take 2 pieces and overlap the pieces about half an inch. Tape together into a hoop. Use the 3rd strip to make a smaller hoop.
3. Tape the paper loops to the ends of the straw (straw is lined up on the inside of the loop)
4. Hold the straw in the middle with the hoops on top. Throw like a dart and angled slightly up.
5. What happens if you change a **variable** on the hoop glider?

Hoop Gliders

Hoop Glider Variables: Students can test the effect of changing a variable on the hoop glider to change the distance or provide stability. Variables include:

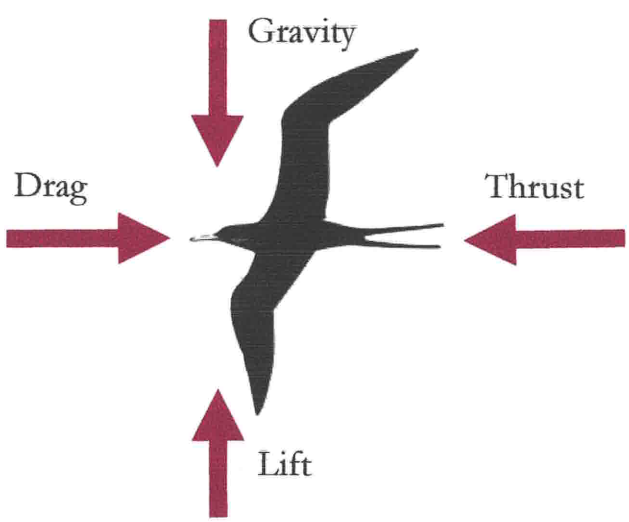
- Size of hoops
- Width of index card
- Placement of hoops (in relation to each other and the straw)
- Length of straw
- Launching technique: different person, angle of throwing, force of throwing

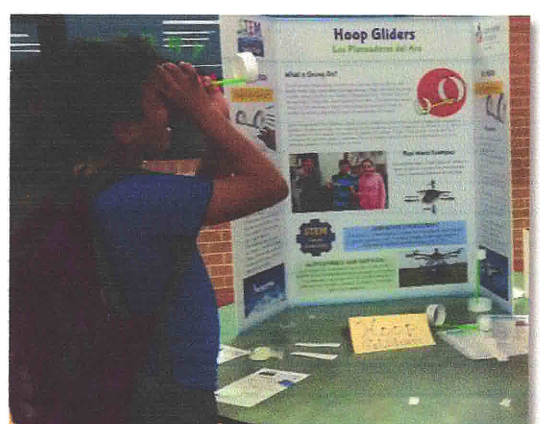
Direct students to change one variable at a time to determine effect on distance or stability. Students can also calculate **average speed** by calculating flight time and distance.

Background

If you throw a plain straw, it doesn't go very far. But when you add paper hoops, the straw glides through the air. That's because the hoops act like wings. Things that fly—like birds and airplanes—all have wings. But wings are not all the same shape and size. Different wings can be better for different kinds of flight. For example, a hawk has long, wide wings that help it glide while a humming bird has short wings that flap quickly that help it hoover in place. The two sizes of hoops help to keep the straw balanced as it flies. The big hoop creates drag or air resistance which helps keep the straw level. The smaller hoop in at the front provides **stability** and keeps it from turning off course. Like birds, the hoop gliders are acting under the four **forces of flight**: thrust from throwing the glider, drag or air resistance from the surrounding air, gravity pulling it downward, and lift pushing it upward.

Robotics engineers design robots to solve problems and help humans with boring or dangerous jobs. Examples include deep sea or space exploration, search and rescue in a war zone, and working in factories. Some robots are designed to mimic animals such as an airplane that flies like a bird.





Level 2

Heart Rate Math

Measure change in heart rate during exercise.

STEM Connection	Key Words
Sports Engineer	Percentage increase Beats per minute Resting heart rate Circulatory system

Materials

- ❑ Stopwatch
- ❑ Pencils
- ❑ Worksheet
- ❑ Calculator

Station Set-up

1. Set-up stations including a stopwatch, pencil, calculator, and worksheet per participant. Test out the stopwatches.

2. Try out the activity. Students may need help to complete the worksheet.

Activity Instructions

1. Find your pulse: on the side of neck, place two fingers in the space between the windpipe and the large muscle in the neck which is below your ear. Press lightly until you feel a pulse.

2. Measure resting heart rate while calmly sitting or standing. For 10 seconds, count the number of heart beats. Do a practice round first then record the result.

3. Continue filling out your heart beats for the different activities. Make sure to measure your pulse immediately after the activity for accurate results

4. A common way to record heart rate is in beats per minute. Convert your recorded number of heart beats into beats per minute (bpm).

5. How much does your heart rate increase? Calculate the percentage increase for each activity compared to your Resting Heart Rate.

Heart Rate Math

STEM Family Night

Family Member 1: ______________________________

Activity	# of heart beats in 10 seconds	Beats per minute (Multiply by 6)	Percentage Increase
Resting Heart Rate			0%
Walk in place for 30 steps			
20 Jumping Jacks			
25 Fast High Knees			

Family Member 2: ______________________________

Activity	# of heart beats in 10 seconds	Beats per minute (Multiply by 6)	Percentage Increase
Resting Heart Rate			0%
Walk in place for 30 steps			
20 Jumping Jacks			
25 Fast High Knees			

Just like any **muscle**, the more you work your heart, the stronger it gets. A stronger heart takes a smaller number of beats to pump the same amount of blood through your body. Knowing your heart rate is an important factor in understanding the health of your heart. Athletes monitor their heart rate to make sure they are efficiently training for the next big sports event.

Download **Human Body by Tinybop** app

Sports engineers combine a passion for engineering and sports! They work to improve sports equipment and enhance athletic performance. For example, sports engineers designed a better golf club for Tiger Woods or a swim suit for Michael Phelps. They also decreased athletic injuries by designing better helmets or shoulder pads for football players.

Level 2 Paper Football

Find your field goal percentage accuracy.

STEM Connection	Key Words
Statistician	Fraction Decimal Percentage accuracy

Material per Student

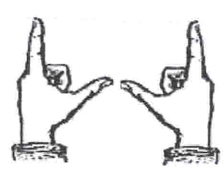
- ❑ Colored paper
- ❑ Pencil
- ❑ Worksheet
- ❑ Calculator

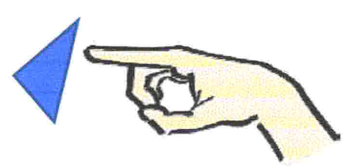
Station Set-up

1. Set out supplies and instructions for making the paper football. For younger students, pre make paper footballs to skip the building step.
2. Try out the activity to fully understand the steps.

Activity Instructions

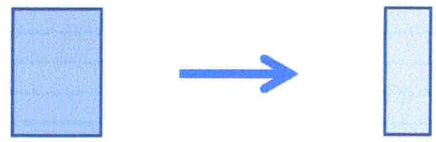
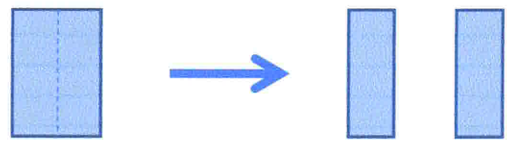
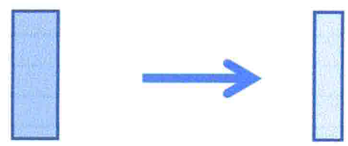
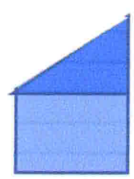
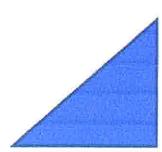
1. Make sure everyone has a partner to play the game. Show students how to make a paper football.
2. To start, one person is the kicker and the second person will create the field goal with his/her hands.
   - **Kicker**: To kick the football, place the paper football vertically on the table. One corner will be on the table and another under your finger. With your other hand, flick the ball with your finger.
   - **Field Goal:** To create a field goal, create an "L shape" with your thumb and index finger on both hands. Then touch your thumbs together and hold up vertically. You now have a field goal!
3. Kick the football 10 times in a row. Keep a tally on how many field goals you make.
4. Switch roles and let the other person kick.
5. Can you calculate your percent accuracy?





Paper Football

Instructions for Making a Paper Football:

Using a piece of paper, fold in half long ways (hot dog style).	
Cut or tear along the fold.	
Using one sheet, fold in half long ways again.	
Placing the paper vertical, fold the top corner down into a triangle.	
Continue to fold down making triangles until you run out of paper to fold.	
Tuck whatever excess paper into the "pocket" on the top of the ball. You now have a paper football!	

Paper Football

STEM Family Night

Family Member 1: ____________________			
Total Attempts	Scored Goals	Fraction of Scored Goals	Percentage Accuracy
10		/ 10	
6		/6	

Family Member 2: ____________________			
Total Attempts	Scored Goals	Fraction of Scored Goals	Percentage Accuracy
10		/ 10	
6		/6	

In sports, accuracy measures how many baskets are scored, passes are completed, or targets hit out of a total number attempted. These actions are recorded as free throw percentage, batting average, and completion percentage. For example, Justin Tucker (Baltimore Ravens) holds the record in football for a field goal accuracy of 92%. In other words, Justin made a field goal attempt 92% of the time.

Download **NBA Hoops** app

STATISTICIANS compile results from different sports games such as basketball and football. These results are used by coaches to improve teams and players and used by the press to compare players and rank teams. Data can improve how sports are played and keep the games interesting for fans. A degree in statistics or computer science is needed for this career.