Sean Kenney's

BRICK MASTERS STUDIO

Build with LEGO® bricks like a pro

produced by imagine

EDUCATOR GUIDE

TABLE OF CONTENTS

INTRODUCTION TO THE EXHIBITION:

Brick Masters Studio is a visually stunning exhibition. It is an immersive and interactive experience that explores the intersection of creativity and science through captivating sculptures built with LEGO® bricks by acclaimed artist Sean Kenney. *Brick Masters Studio* is a unique showcase that takes students on a journey to uncover the scientific principles and creative process of Sean's artwork - all made with LEGO bricks! Students learn what it takes to design and build these stunning works of art, and gain insight into the inspiration for and fun facts about Sean's sculptures. Students learn the concepts behind the art through engaging hands-on build challenges and thoughtful exercises.

Brick Masters Studio showcases Sean's amazing ability to use his artistic and engineering knowledge to create incredible works of art that depict our natural world using simple toys. Much of Sean's work illustrates his personal interpretations of the natural world and humankind's connection with nature. This exhibition will inspire students to learn more about the world around them by immersing themselves in Sean's amazing sculptures.

ABOUT THIS GUIDE

The guide is composed of ten activities that embody the ideals of STEAM and are aligned with the Next Generation Science Standards. These lessons and activities bridge the learning from the exhibition to the classroom.

ACTIVITIES

There are five 3rd – 5th grade activities and five middle school activities that highlight the themes from the main exhibits in the exhibition. The activities cover a variety of performance expectations so teachers can choose which activities are best aligned with their curriculum and which best fit their students' needs and interests. The lessons are follow-up activities designed to be completed after your field trip to enhance and expand students' experience with the *Brick Masters Studio* exhibition.

SEAN'S STUDIO

In Sean's studio, students learn about Sean's process for creating art. In the activities below, students will go through a similar process to create and scale their own art.

ACTIVITY: SCALING A MURAL

Students work together to construct a giant mural out of many pieces of paper to demonstrate that objects are all composed of smaller parts.

GRADE LEVEL:
5th

NGSS STANDARD:
5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen.

MATERIALS:
- o Camera (if you only have a phone that works!)
- o Graph paper (large grid)
- o Rulers
- o Magnifying glass (optional)
- o Markers

DESCRIPTION:

- When visiting *Brick Masters Studio* take note of the giant sculptures. Ask students how the artist was able to create such large objects using only LEGO bricks? Point out how each LEGO piece by itself is nothing but when put together they make something beautiful.
- Take pictures throughout the exhibition.

- When you return to class tell students that you want to create something GIANT and beautiful in class similar to what was in the exhibition. However, since you don't have LEGO pieces we will use paper.
- Show students the pictures you took of the exhibition and have students vote on what is their favorite sculpture. Print the image of the class's favorite sculpture on graph paper and tell students that they are going to make a giant copy of this image to hang in the classroom.
- On the graph paper have students label the rows alphabetically and the columns numerically. Tell students that they are each going to be responsible for one cell on the graph paper and that once everyone draws their cell they will put them all together as a class to make the mural.
- Assign a cell to each student and have them draw what is in that cell on a large square piece of paper. Students should measure where lines meet the edges of the cell to enhance precision.
    - ***Students should be creative in their drawings. It doesn't need to be an exact replica. It can be their own interpretation.***
- Have students tape their images together on a wall so that the image is complete. What do they notice? What do they wonder? Ask them how they could improve on this process and repeat with either the same or a new image.
- Talk to students about how the brick models, the mural, our bodies, the desk – EVERYTHING is made up of tiny parts that don't function on their own but when put together make amazing things.

SEAN'S STUDIO

ACTIVITY: SCIENCE AND ART CONNECTION

In Sean's studio students learn about Sean's process for creating art. In the Science and Art Connections activity, students engage in various activities that explore how shadows, colors, and optical illusions highlight the connection between art and science.

DESCRIPTION:

- Before visiting the *Brick Masters Studio* exhibition, discuss with students the connection of art and science. Ask: "What do science and art have in common?" Highlight connections between science and art:
  - Chemistry: Mixing paints and pigments
  - Physics: Light and color.
  - Biology: How our eyes and brain interpret art.

- **ACTIVITY 1: CHEMISTRY: MIXING PAINTS AND PIGMENTS**
  - Ask students "What is color?" After your discussion, shine a flashlight through a prism to show how white light splits into a rainbow. Explain how artists use light and color to create mood and depth.
  - Show how primary colors (red, blue, yellow) mix to form secondary colors (green, orange, purple).
  - Let students mix paints or crayons to create new colors. Challenge students to make new colors by mixing multiple colors together.
  - Ask students to discuss why the paint turns dark when multiple colors are mixed.

GRADE LEVEL:
Middle School

PERFORMANCE STANDARDS:
MS-PS4-2 Waves and their Applications in Technologies for Information Transfer: Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

MATERIALS:
- o White paper or canvas
- o Pencils, markers, and crayons
- o Watercolors or acrylic paints
- o Paintbrushes and sponges
- o Mirrors and flashlights
- o Color wheel (printed or projected)
- o Optional: Kaleidoscopes, prisms, or magnifying glasses for light experiments

ACTIVITY 2: PHYSICS: LIGHT AND COLOR.

- Use a flashlight and an object to cast shadows on paper. Have students trace the shadow and create art from the outline.
- Talk about perspective. Discuss how shadows change based on light angles. Show examples of how artists use perspective to make art look 3D.
- Have students recast the light on the object from various angles and have students trace the different shadows. Compare all the drawings and discuss how the different angles affected the feel and look of the drawings.

ACTIVITY 3: BIOLOGY: HOW OUR EYES AND BRAIN INTERPRET ART.

- Explain how the brain processes visual information and why we see optical illusions. Show a simple optical illusion (e.g., lines that look curved but are not).
- Tell students that they are going to create their own optical illusions. Guide students to draw a simple illusion, such as parallel lines that appear to curve using shading and line spacing. Give students time to research various optical illusions and have them try to recreate them.
- Discuss why our brains create these optical illusions and how they can be used in art.

Ask students how science helps you create your art? Discuss how artists use scientific techniques, like mixing colors or understanding light, to make their art more realistic or creative.

SCULPTING WITH SHAPE

In the Sculpting with Shape Studio students learn about the role of shading and how shadows play in Sean's art. The activities below showcase how shadows can not only enhance art but are a key tool in science.

ACTIVITY: SHADOWDIAL

Students use their understanding of shadows and of Earth's rotation to create a Shadowdial that tells time.

GRADE LEVEL:
3rd-5th

PERFORMANCE STANDARDS:
3-5-ETS1-1 Engineering Design: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

MATERIALS:
- o Gnomon (The part of a sundial that casts a shadow. This can be a pencil or anything that is straight and thin)
- o Paper plates or cardboard cut into circles
- o Ruler
- o Protractors (optional)

DESCRIPTION:

- After visiting *Brick Masters Studio* ask students to reflect on the role of shadows on the art. What caused the shadows and how were the shadows used as a tool to enhance the exhibition? Discuss with students how it is not only artists who use shadows but scientists also use shadows as a tool to learn about our world.
- Ask students how did people tell time before clocks were invented?

- Explain the concept of a shadowdial (sundial) and how it works using the Sun's position, Earth's rotation and shadows.
- Introduce vocabulary "gnomon" (the part of a sundial that casts a shadow), "solar time," and "rotation."
- Ask students how they can use shadows to tell time and tell them they are going to create a device that tells time using shadows.
- Go outside and have students observe their shadows at different angles by standing in the sunlight and moving around. Ask how shadows change based on the position of the Sun?
- Return to the classroom and discuss how to create a shadowdial. Below are construction directions but these can change based on student responses.
    i. Students draw a large circle on the paper plate or cardboard (or use a pre-cut plate). Divide the circle into 12 equal sections using a ruler (like a clock face).
    ii. Push the stick or pencil through the center of the plate, ensuring it stands upright. Secure it with glue or tape. Allow students to color and decorate their sundial faces.
    iii. Have students take their shadowdials outside on a sunny day. Have students trace the shadow the gnomon casts and label the line with the time.
    iv. Every hour, go outside and mark where the shadow falls on the sundial. Label the hour lines accordingly (e.g., 9 AM, 10 AM, etc.).
- Discuss how the Earth's rotation causes shadows to change direction and length. Ask what might happen if we use the sundial in a different season or location?
    i. Have students predict where the shadow lines will be in 6 months. Have students put those lines on their shadowdial. Return to the dials in 6 months and discuss how accurate the students' predictions were and why the position of shadows vary throughout the year.

SCULPTING WITH SHAPE

ACTIVITY: USING SHADOWS TO MEASURE EARTH'S CIRCUMFERENCE.

In the Sculpting with Shape exhibit students saw the role that shadows play in art. In this activity students learn about Eratosthenes' method to measure Earth's circumference and design an experiment to test it out!

GRADE LEVEL:
Middle School

PERFORMANCE STANDARDS:
MS-ESS1-3 Earth's Place in the Universe: Analyze and interpret data to determine scale properties of objects in the solar system.

MATERIALS:
- o A stick (or meter stick/dowel rod) for each group
- o Protractor
- o Measuring tape or ruler
- o Compass (for finding cardinal directions)
- o Calculator
- o Globe or map
- o Sunny outdoor location
- o Optional: Online collaboration tool to work with students in a different location (to simulate Eratosthenes' two cities)

DESCRIPTION:

- While visiting the *Brick Masters Studio* exhibition, have students focus on how Sean Kenney uses light and shadows to enhance his art.
- After returning to the classroom, show students a globe or map and ask: "How did people figure out the size of Earth before satellites and modern tools?"
- Introduce Eratosthenes (276–194 BCE) and his experiment:
  - He used the Sun's angles and simple geometry to estimate Earth's circumference.
  - He explained how he observed shadows in two cities (Syene and Alexandria) and used the difference in shadow angles to calculate Earth's circumference.
  - Discuss how the Earth is a sphere, how the Sun's rays are essentially parallel when they reach Earth and that the angle of the shadow depends on the curvature of Earth.
- Create a simple sundial by giving each group a pencil, paper plate and a flat surface. Place the stick upright in the ground or a base. Ensure it is vertical using a ruler or protractor.
- Go outside when the Sun is at its highest point (local solar noon) and have each group measure the length of the shadow cast by the stick and record it. Groups should also measure and record the height of their stick. Be as precise as possible!

- Return to class and calculate the Angle of the Shadow (you can use a calculator):
  - i. Use the formula for the tangent of the angle:
    1. tan(ø)=shadow length/stick height
  - ii. Solve for ø = tan-1(shadow length/stick height)
- Discuss with students how they need to obtain this same data from another location. Ask students to brainstorm where and how they could get this information.
  - i. If collaborating with another class in a different city, explain how to share data. You need to be sure you both record your data at local solar noon and on the same day.
  - ii. If you cannot find another class to collaborate with you can use this data from Anchorage, Alaska to help with your calculations. You will need to first identify the distance from your school to Anchorage. Then you can use the following ø values for the dates listed below.

DATE	SOLAR ELEVATION ANGLE (Ø) AT LOCAL SOLAR NOON
DECEMBER 21	~5.5˚
MARCH 21	~28.5˚
JUNE 21	~52.5˚
SEPTEMBER 21	~6.0˚

- Explain how the angle difference between two locations corresponds to the arc of the Earth's circle. Eratosthenes used this equation to calculate the Earth's circumference.
  - i. Earth's Circumference = (Distance Between Cities × 360)/Angle difference.
- Have students calculate their estimate of Earth's circumference and compare their results with the actual circumference (~40,000 km). Discuss what factors could lead to errors (e.g., inaccurate measurements, distance estimates).
- Reflect on Eratosthenes' achievement by asking why was his work groundbreaking for ancient science and how do modern tools compare to his method? Can you think of another way to measure Earth's circumference?

CRAFTING WITH COLOR

What is the connection among the electromagnetic spectrum, color and light manipulation, and primary colors? In the Crafting with Color exhibit students will learn how these concepts are integrated into Sean's artwork and how they can be applied to scientific principles.

ACTIVITY: CHROMATOGRAPHY BUTTERFLIES

Students learn about the science of chromatography while creating vibrant butterfly art.

GRADE LEVEL:
5th

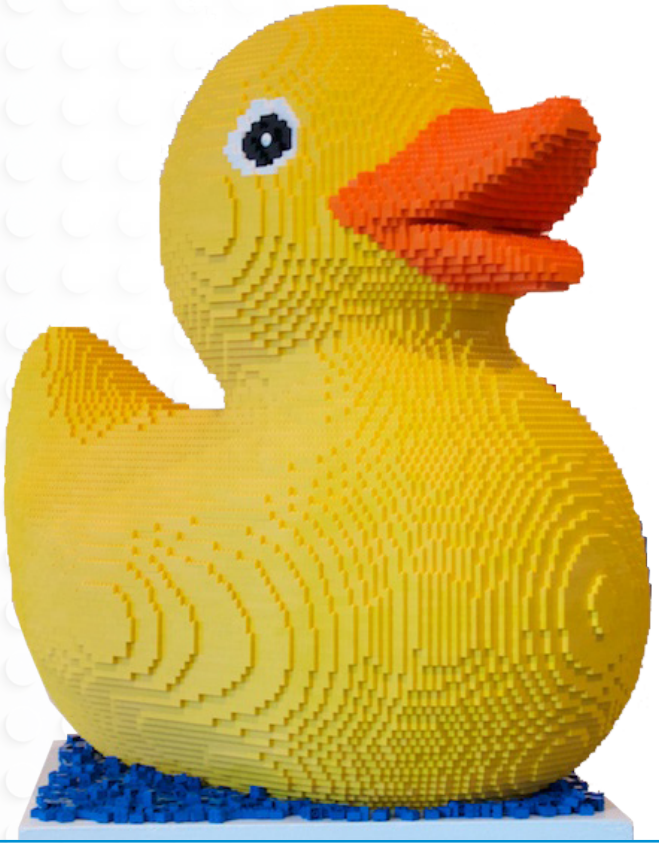
PERFORMANCE STANDARDS:
5-PS1-3 Matter and Its Interactions: Make observations and measurements to identify materials based on their properties.

MATERIALS:
- o Coffee filters
- o Washable markers (various colors)
- o Cups of water
- o Droppers or pipettes
- o Pipe cleaners
- o Paper towels
- o Scissors (optional)

DESCRIPTION:

- After visiting the *Brick Masters Studio* exhibition, students discuss what they learned and how they applied their newly honed skills to bring their ideas to life in the exhibition.
- Ask students to discuss what they learned about colors and mixing colors.
- Tell students that today they are going to learn about a process called chromatography. This is a process scientists use to separate components of a mixture and today you will use this concept to create butterflies.

- Give each student a coffee filter and have them draw designs or color patterns on the filter using washable markers. Students should only draw and not color their designs. Encourage creativity!
- Place the colored coffee filter on a paper towel. Using a dropper or pipette, gently drop water onto the center of the coffee filter. Watch as the colors spread and blend.
- Discuss how water carries the pigments in the markers, separating them into different colors (e.g., black marker may reveal blues, purples, and greens).
- Once the colors have fully spread, let the coffee filter dry on a clean paper towel.
- Have students share their coffee filters and discuss how and why the various colors separated.
- Give students a new coffee filter and tell them they are now going to create butterflies. Have students repeat the steps of drawing designs and slowly adding water to the filter. This time students should try to make their filter have a design that will look like butterfly wings.
- After the filters are dry, pinch the center of the filter and wrap a pipe cleaner around it to create a butterfly's body. Twist the ends of the pipe cleaner to form antennae and spread out the wings. Hang the butterflies around the class so everyone can see how students used science to create pieces of art.



CRAFTING WITH COLOR

ACTIVITY: CAPTURING WAVES

Students use a digital camera and TV remotes to observe similarities and differences of infrared and visible light.

GRADE LEVEL:
Middle School

PERFORMANCE STANDARDS:
PS4-MS-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

MATERIALS:
- **For each group:**
  - **Remote controllers that do not have a light that you can see when you push a button**
  - **Digital camera**
  - **Sheet of glass or plastic**
  - **Black trash bag**
  - **Aluminum Foil**
  - **Mirror**

DESCRIPTION:

- Ask students to reflect on how light is used in the Crafting with Color section of the exhibition. Ask students to discuss how a prism can separate colors and what they learned about the electromagnetic spectrum.
- Tell students that today they are going to experiment with a type of light called infrared light. Ask students if they have heard of or know what infrared is. Give each group a remote control and turn off the lights. Have students press the power button and ask if they can see anything. Ask them if there is nothing there or if they just can't see anything. Turn the lights back on.
- Have groups press the power button on the remote control while looking through the digital camera. Be sure to disable the infrared filter on your camera. Ask students why they can see the light through the camera but not with their eyes.
- Have students predict if the light from the remote control will go through the foil, glass or black plastic. Ask them if they think it will behave like visible light or behave differently. Have students put the foil, glass and black plastic in front of the camera and predict then test if the UV light passes through these materials.
- Have students predict and test if the light from the remote will reflect off the mirror.
- Come back together as a class and debrief. Ask students to try to explain what is happening and explain that the light from the remote is infrared light which has a longer wavelength and lower frequency than visible light and is out of the range of what the human eye can see. Infrared light bounces off of metals and mirrors just like visible light but can pass through some substances like black plastics while visible light cannot.
- Ask students to discuss the various light waves (X-rays, UV, Radio, etc.) and explain how they are similar and different and how they are used in our daily lives.

STRUCTURE WITH STYLE

In the Structure with Style sections of the *Brick Masters Studio* exhibition students learn the physics, engineering and architectural principles used in supporting Sean's giant sculptures.

ACTIVITY: THE ART OF STAYING CENTERED

In the Sculpting with Style section of the exhibition students learn the concept of the center of gravity and use their understanding to create their own mobile.

DESCRIPTION:

- While in the Sculpting with Style section of the exhibition, ask students to focus on the concept of the center of gravity and how it is used in art. Explain that the center of gravity is the point where the weight of an object is evenly distributed in all directions and the force of gravity is balanced.

GRADE LEVEL:
3rd

PERFORMANCE STANDARDS:
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.

MATERIALS:

- Rulers
- String
- Small objects (e.g., paperclips, washers, or erasers)
- Cardboard or thick paper
- Scissors
- Glue or tape
- Markers, paint, or colored pencils
- Images of sculptures and paintings that emphasize balance (e.g., Alexander Calder's mobiles or Renaissance paintings)

- Have students stand on one leg and ask where their center of gravity is. Provide students with irregularly shaped objects (e.g., cardboard cutouts, clay). Have them find the center of gravity by balancing the objects on a pencil tip or finger. Discuss why the object balances at that point and how it relates to real-world examples (e.g., tightrope walkers).
- Have each group cut out an irregular shape from cardboard and have them predict where the center of gravity is. Have them mark that spot.
- Have students put 3 holes in their cutout. Students hang (vertically) their cutout from the first hole until it settles. Once it does, students should draw a line directly down from the hole to the edge of their cutout. Repeat for the second and third whole. The intersection of the lines is the center of gravity.
- Have students discuss where the center of gravity is in comparison to their prediction.
- Tell students that they are being challenged with creating a mobile to demonstrate balance and center of gravity.
- Have groups use string, small objects (paperclips, beads, or cardboard shapes), and dowels or sticks to create their mobile. They should think about how the mobile will hang. Students need to make the mobile balanced.
- Have students attach a string to the mobile's center of gravity and hang them around the classroom. Observe the other group's mobiles.
- Discuss how student's understanding of the center of gravity helped with their mobiles. Discuss where they see the center of gravity used in real life (architecture, sports, etc.).

STRUCTURE WITH STYLE

ACTIVITY: TERRIFIC TOWERS

Students are challenged with building the largest and most attractive tower they can using the concepts they learned in the Sculpting with Style section of the exhibition.

GRADE LEVEL:
Middle School

PERFORMANCE STANDARDS:
MS-PS2-2 Motion and Stability: Forces and Interactions: Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

MATERIALS:
- **Give equal amounts of the following (or whatever you have) to each group**
  - **Toothpicks**
  - **Straws**
  - **Marshmallows**
  - **Dried pieces of spaghetti**
  - **10 inches of tape**
  - **Aluminum Foil**

DESCRIPTION:

- While in the Sculpting with Style section of the *Brick Masters Studio* exhibition, ask students to focus on how Sean is able to support his giant sculptures. Discuss what "the center of gravity" means and how it applies to these sculptures.
- When back in the classroom, reflect on how lower centers of gravity and wide bases contribute to stability in buildings. Tell students that they are going to be challenged with creating the tallest tower using the materials provided.
- Pass out materials to groups. Have each group discuss and sketch out their ideas for their tower.
- Ask students what they are going to do to enhance the beauty of their sculpture.
- Tell students that the height of their tower will be measured from the tabletop to the top of the highest marshmallow on their tower.
- Give students 20 minutes to construct their towers and revise their designs.
- Measure all the towers and declare which is the highest.
- Have students walk around the room and observe the other towers. Ask which is "most attractive" and why? Does the shape influence its beauty? Declare a "most beautiful" tower.
- Give groups time to revise their plans and reconstruct their towers. Measure the heights and vote on "most attractive" again. Discuss what changed in the design. How did groups integrate the idea of "center of gravity" into their designs? How did trying to create a beautiful tower influence their design?

GROWING IDEAS

In the Growing Ideas sections of the exhibition students are able to put the new skills they have learned into practice. Students apply these science concepts in creating works of art.

ACTIVITY: PERSONAL PROJECTION

Students make a projector out of cardboard that goes over their head and projects an image to demonstrate how real cameras reflect light.

GRADE LEVEL:
4th

PERFORMANCE STANDARDS:
PS2-4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen

MATERIALS FOR EACH GROUP:
- o 2" x 2" cardboard box or larger
- o Printer paper
- o Duct tape
- o Aluminum foil
- o Pin
- o Utility knife
- o Dark towel or scarf (something to wrap around your neck)

DESCRIPTION

- While visiting the *Brick Masters Studio* exhibition, have students take a selfie with their favorite sculpture. When you return to class, ask students how your phone is able to capture your image. Discuss with students how back in the day photography techniques were different but used some of the principles they learned about in the *Brick Masters Studio* exhibition.

- Tell students that today they are going to make their own camera to demonstrate how light reflects off of everything. They will do this by putting a box on their head. Pass out the materials and ask students how they think they can project an image inside the box with the supplies they are given? Listen to the students' ideas and then have students follow these directions:
  - Tape a sheet of the printer paper to one of the side walls on the inside of the box.
  - Seal box shut with duct tape.
  - Cut a hole in the bottom of the box just large enough to squeeze your head through. When you put your head through, it should face the white paper inside.
  - Seal the box with duct tape so no light gets in. Put your head through to check for leaks. Patch leaks with duct tape.
  - Cut a 2 x 2 inch hole in the box just above where the back of your head is when it's in the box and tape a piece of foil over the hole.
  - Use a push pin or sharp pencil to poke a tiny hole in the foil.
  - Go outside and have students take turns putting the box over their heads. It is helpful to use the scarf to block any Sun from coming in the neck hole.
- It will take a couple minutes for students' eyes to adjust but eventually they will be able to see whatever is behind them projected upside down on the white sheet of paper in front of them. Allow groups to experiment with making a larger, smaller and multiple holes in the foil (or whatever other ideas they have!)
- Come back inside and ask students to discuss what happened. Tell them that what they saw was the light being reflected off the objects behind them through the pinhole. After focusing on the light through the pinhole it is flipped and reflected off the paper. Students should also notice that the smaller the pinhole the clearer the image is and the wider the hole the brighter the image is. This is the basis for all of photography!
  - You can expand on this project by asking students why the image is upside down.

GROWING IDEAS

ACTIVITY: PROTECT THE ART!

Students are challenged to build a container that can transport sculptures made of LEGO bricks without having them break if dropped or mishandled.

GRADE LEVEL:
Middle School

PERFORMANCE STANDARDS:
MS-ETS1-1 Engineering Design. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MATERIALS FOR EACH GROUP:

- A variety of LEGO bricks
- Materials for packaging (these are suggestions but you can swap in whatever you have available)
  - 6" x 6" cardboard square ($10)
  - 2" x 2" pieces of tape ($1)
  - 8.5" x 11" piece of printer paper ($3)
  - Sheet of tissue paper ($2)
  - 6" x 6" piece of aluminum foil, wax paper and plastic wrap ($3)
  - Paper plate ($4)
  - Toothpick ($1)
  - Paperclip ($1)
  - Foam piece ($6)

DESCRIPTION

- Discuss with students the various innovations they learned in the Growing Ideas section of the *Brick Masters Studio* exhibition. After they share an innovation, ask them what problem that innovation was trying to solve.
- Talk to them about the role of engineers and how they generally start with a problem and then design solutions to that problem. Tell students that today they are going to be engineers.
- Put students in groups of 3-4. Tell them that these are their engineering teams and they are going to compete to solve a problem.
- Have each group make a sculpture using LEGO bricks. We suggest looking up how to make a super simple brick figure but any kind of sculpture is fine as long as all the groups make the same sculpture and that the sculpture is breakable (meaning it can't be a solid block. It needs pieces that can fall off relatively easily).

- Tell students that Sean Kenney has developed a new line of mini brick sculptures that he is going to ship to every middle school student in the country and he needs engineers to develop the packaging for it. The sculptures will be shipped individually and need to be able to withstand the wear and tear of being in a middle schoolers backpack. The main concerns are that the sculpture stay intact and that the costs are low. Here is your challenge:
  - Design a package for a single LEGO brick sculpture so that the sculpture can withstand a fall from 6 feet without breaking.
  - Make the package as inexpensive as possible.
  - The materials for this project are listed in the materials section along with their price. The winning team will build a package that works and that costs the least to build.
- Give teams about 20 minutes to design their package. Be sure they list out all the materials they need and calculate the cost.
- After reviewing the designs, have teams collect their materials, construct their package and test it on their sculpture.
- Give groups another 20 minutes to revise their package. They can either rebuild or revise their package, but they need to calculate the cost of their final product.
- Have groups come to the front of the class to present and test their final package. They need to explain their design, share the cost and then test their package by dropping it from 6 feet. Groups then unwrap their package to see if their sculpture is in one piece.
- On the board, list which teams passed the test and which didn't and the cost of each team's package.
- Discuss as a group which team won the challenge and why (the cheapest package that passed the test). What went into their design? Did they make modifications after the first attempt? Discuss what they would do if they were able to design a third package.
- Discuss how trial and error is such an integral part of the design process. The important part is to keep trying!
- If time allows, have students revise their package one final time using what they learned from observing their peers work.