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(Above) Anna Hyatt Huntington, American, 1876-1973, Greyhounds Playing, 1936, Bronze, Gift of the Artist 38.3 © Estate of the artist

(Front Cover) Thomas Hart Benton, American, 1889-1975, Engineer’s Dream, 1931, Oil on panel, Eugenia Buxton Whitnel Funds 75.1 © T.H. Benton and R.P. Benton Testamentary Trusts / UMB Bank Trustee / VAGA, New York, NY

July 2019
Lesson Plan

Grade Level: 3rd- 8th grade

Number of Students: 60 maximum

Learning Standards

The following standards are met by the museum tour and the classroom activities.

TN State Standards in Visual Art:
Visual Arts-Creating: Conceiving and developing new artistic ideas and work
Visual Arts-Presenting: Interpreting and sharing artistic work
Visual Arts- Responding: Understanding and evaluating how the arts convey meaning
Visual Arts-Connecting: Relating artistic ideas and work with personal meaning and external context

TN State Standards in English Language Arts:
Comprehension and Collaboration Standard 1 SL.CC.1: Prepare for and participate effectively in a range of conversations and collaborations with varied partners, building on others’ ideas and expressing one’s own ideas clearly and persuasively.

Comprehension and Collaboration Standard 2 SL.CC.2: Integrate and evaluate information presented in diverse media formats, such as visual, quantitative, and oral formats.

Comprehension and Collaboration Standard 3 SL.CC.3: Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric.

Text Types and Protocol Standard 2 W.TTP.2 Write informative/explanatory texts.

Tennessee Academic Standards for Science:
4,8. PS4: Waves and their Application in Technologies for Information Transfer.
3,4,6. PS3: Energy
3,7. LS1: From Molecules to Organisms: Structures and Processes
3,4,6,7. LS2: Ecosystems: Interactions, Energy, and Dynamics
5. LS3: Hereditary: Inheritance and Variation of Traits
3,6. ESS2: Earth’s Systems
4. ESS3: Earth and Human Activity
3,4,5. ETS2: Links Among Engineering, Technology, Science, and Society

Tennessee Academic Standards for Math:
1-2.G.A. Reason about shapes and their attributes.
3.MD.C. Geometric Measurement: understand and apply concepts of area and relate area to multiplication and to addition.
3.MD.D. Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.
4.MD.B. Know and apply the area and perimeter formulas for rectangles in real world and mathematical problems.
Goals of the Tour Experience

Students will use art as a launching point to explore concepts of Science, Technology, Engineering and Math.

Tour Objectives

Students will:
- Practice their speaking and listening skills as they engage in critical thinking and docent led discussions
- Use art to expand their understanding of the natural world
- Draw connections between scientific concepts and art

Objectives Established with Bloom’s Taxonomy

The learner will...

Remember Define STEAM vocabulary terms such as predator/prey, adaption, weather instruments, pixels, and waves.

Understand Articulate STEAM concepts in response to discussion questions.

Apply View, identify, and describe how STEAM concepts can be applied to a variety of art works.

Analyze Use STEAM concepts to derive deeper meanings from art works.

Evaluate Make judgments about selected artworks using concepts of STEAM while supporting ideas with evidence.

Create Use their knowledge of engineering and problem solving to create a work of art.
Classroom Preparation prior to Visit

Introduce your students to the tour vocabulary by using the STEAM PowerPoint. Please note that all of the art work included in the PowerPoint are a part of the Brooks Museum’s permanent collection and your students may see them in person during their visit.

Review Museum Guidelines with students and chaperones, which can be found here: http://www.brooksmuseum.org/school-tours#MuseumGuidelines
Refer to the “Welcome to the Brooks” PowerPoint for a visual teaching aid.

Teacher Resources

Suggested Websites:
1. University of Delaware’s Department of Art Conservation: This website explains the science behind art conservation techniques:
   https://www.artcons.udel.edu/outreach/kress/examinationmethods-and-scientific-terms
2. It’s Ok to be Smart’s The Science of Rainbows: Use this video to introduce concepts of light to your students: https://www.youtube.com/watch?v=5pYnC-ONdXQ
3. Numberock’s Area and Perimeter Song: This song will help reinforce these concepts: https://www.youtube.com/watch?v=Ty9H0kHyl
4. The Brooks Museum Collection Online: This extension of the museum’s website provides images of art works owned by the Brooks, as well as information about each work’s: artist, date, medium, dimensions, and if the work is currently on display.
   http://emuseum.brooksmuseum.org

Suggested Reading:
Vocabulary

Studying and discussing the vocabulary below, prior to your visit, will help ensure that the museum experience will be an enriching experience for your students. Please refer to the STEAM PowerPoint for visual examples.

Life Science:
- **Predator** - an animal that survives by hunting and eating other animals.
- **Prey** - an animal that is hunted and eaten by other animals.
- **Carnivore** - an animal that gets food from killing and eating other animals.
- **Herbivore** - an animal that feeds on plants.
- **Omnivore** - an animal that feeds on both plants and animals.
- **Food Chain** - transfer of energy from producers that use the sun to create food (plants) to an eventual apex predator.

Physical Science:
- **Electromagnetic spectrum** - the entire range of wavelengths or frequencies of electromagnetic radiation, which includes gamma, x-rays, ultraviolet, visible, infrared, microwave, and radio waves.
- **Reflection** - when light bounces off of an object
- **Refraction** - the bending of light as it passes from one substance to another.
- **Prism** - a glass or other transparent object in prism form, especially one that is triangular with refracting surfaces at an acute angle with each other and that separates white light into the seven hues of the rainbow.
- **Coal** - Coal forms over millions of years when the remains of dead plants get buried under rocks, squeezed by pressure, and cooked by Earth's internal heat. Coal is an energy source.
- **Kinetic energy** - energy in the form of movement.
- **Potential energy** - energy waiting to be used later.
- **Steam power** - power that is applied to an engine by the force of steam.

Weather:
- **Barometer** - an instrument that measures atmospheric pressure and is used to forecast the weather.
- **Air Pressure** - the weight of the atmosphere pressing down on the earth.
- **Thermometer** - an instrument for measuring temperature.
- **Temperature** - the degree of heat present in an environment.
Vocabulary

Technology:
Technology- any time science or knowledge is used to solve a problem or invent a useful tool.

Art conservation- science-based discipline that aims to preserve, restore, and analyze artwork.

Engineering:
Engineering- Engineering is the use of science and math to design or make things. People who do engineering are called engineers. They learn engineering at a college or university. Engineers usually design or build things. Some engineers also use their skills to solve technical problems.

Through arch bridge- typically made from steel and concrete, this type of bridge is composed of an arch structure. The deck of the bridge goes through the arch.

Truss bridge- A type of bridge whose main design element is a truss. A truss is a structure of connected elements that form a triangle. Triangles are inherently stable shapes, so creating structures out of interlocking triangles makes very strong, yet incredibly lightweight structures.

Math:
Shapes- Geometric shapes have names, like triangles. Geometric shapes have perfect, uniform measurements. Organic shapes are irregular shapes and are often found in nature.

Perimeter- the distance around the outside of a shape, calculated by adding the length of all sides together.

Area- the amount of space within the boundaries of a 2-d shape.

Volume- the amount of space taken up by a 3-d form.
Classroom Activities

Activity 1  |  Life Science Connection
Help your students brainstorm a food chain, from producer to apex predator. Then provide the students with strips of paper. Allow the students to design a paper strip for each organism, writing its name and drawing a picture. Then demonstrate to your students how to create a paper chain. Encourage your students to put the organisms in the correct order—from producer to apex predator.

Activity 2  |  Physical Science Connection
A simple refraction demonstration is to draw an arrow on a piece of paper and place it behind a clear bottle of water. What happens to the arrow? The water bottle acts as a lens, refracting the light so the arrow is flipped the other way. Allow students to draw pictures and place them behind the bottle of water. Experimenting with rainbows is another way to explore optics in the classroom. Here are some easy techniques for creating rainbows: [https://sciencing.com/create-prism-5257017.html](https://sciencing.com/create-prism-5257017.html)

Tennessee Academic Standards for Science
1,2, 4PS4: Waves and their Application in Technologies for Information Transfer

Activity 3  |  Physical Science Connection
This activity explores color mixing. Use cardstock to print out the wheel with six segments found on page 11. Give your students time to color the wheel with the colors of the rainbow—one color per segment. Please note we are leaving out indigo. Then the students will cut out the wheel and poke a hole through the center with their pencil. Instruct students to place the wheel on top of a piece of scrap paper. Then they will hold the pencil upright through the center of the wheel with one hand and use their other hand to spin the circle as fast as they can. The faster students spin the circle the more white they will be able to see as the colors mix. Students can also experiment with coloring in the wheel with two primary colors and watching them mix to form a secondary color.

Activity 4  |  Weather Connection
Track the air pressure, wind speed, and precipitation on a class chart using data from [https://www.localconditions.com/weather-memphis-tennessee/37501](https://www.localconditions.com/weather-memphis-tennessee/37501) over a period of time. See if there is a correlation between air pressure and storm activity. Another idea is to make a barometer using a jar, balloon, straw, and a needle. View this video for a detailed explanation: [https://www.youtube.com/watch?v=ah8F-xmvB2k](https://www.youtube.com/watch?v=ah8F-xmvB2k)
Activity 1  l  English Language Arts Connection
West Africa is known for its trickster tales. One of these famous tricksters is the spider Anansi, featured in Ashanti stories from Ghana. Read several Anansi stories to your class.

Here are a few options:

Then ask your students to complete an Anansi character web. See the following pages for an accompanying handout. If time allows challenge your students to write their own Anansi story.

More Anansi activity ideas can be found here:

Tennessee Academic Standards for English Language Arts:
K-5.RL.KID.3 Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
K-8 Write narratives to develop real or imagined experiences or events.

Activity 2  l  English Language Arts Connection
Verna Aardema’s West African tale, *Why Mosquitoes Buzz in People’s Ears*, is a great resource for teaching cause and effect. Read the story to your students and ask them to illustrate 2 cause and effects that happen in the story. See the following pages for an accompanying handout. More activity ideas can be found here: [https://www.scholastic.com/teachers/lesson-plans/teaching-content/why-mosquitoes-buzz-peoples-ears-discussion-guide](https://www.scholastic.com/teachers/lesson-plans/teaching-content/why-mosquitoes-buzz-peoples-ears-discussion-guide)

Tennessee Academic Standards for English Language Arts:
K-5.RL.KID.2 Determine central ideas or themes of a text
K-5.RL.KID.3 Analyze how and why individuals, events, and ideas develop and interact over the course of a text.

Activity 3  l  Math Connection
Ifeoma Onyefulu’s book *Emeka’s Gift* is a helpful resource for reinforcing counting concepts. As a young boy named Emeka travels through a Nigerian market he counts what he sees, such as six necklaces and seven musical instruments. For a counting book set in South Africa read Kathryn Cave’s *One Child, One Seed*.

Tennessee Academic Standards for Mathematics:
K.CC. Know number names and the counting sequence
Name

Color in the circle and cut it out. Place the circle on a piece of scrap paper and poke a hole through the center with your pencil. Hold the pencil upright with one hand and spin the circle as fast as you can with the other. What happens to the colors?
Activity 5

Name______________

Fill the frame with your art. Next, calculate the outside perimeter of the frame. Remember, perimeter is measured by adding the length of all the sides together.

___ + ___ + ___ + ___ = ___

Now, calculate area. Remember, area is measured by multiplying the length by the width.

___ x ___ = ___