Alexander Calder and the Circus
Arts Integrated Lesson Brief

Skill level: Grade 5-8

Timing of Project: Five 45-minute classes

Coordinating Basic Plan:

Students will come to the Sailor Circus Arena for a three-hour presentation of circus and how it relates to physics. A workbook will be given to students to take notes and draw. The workbook will be used in the classroom as well.

Circus teaching artists will visit school and introduce the expectations of the unit. Students will have the opportunity to watch different circus acts performed to help them decide what act they would like to research for the science portion of the unit. Students will be introduced to basic circus terminology.

Part One: Circus and Newton's Three Laws of Physics

Timing of Lessons: Two 45-minute classes, plus a school visit by teaching artists and a field trip.

Academic Discipline: Physical Science- Force and Motion, Energy Transformations, and Simple Machines

- Goals / Objectives – Students will conduct research on a chosen circus act
- During their research , students will apply science concepts exhibited as the act is performed.

Students will research a circus act and apply their knowledge of forces and motion and Newton's Laws to create a multimedia presentation that will:

- Describe how forces act on the circus performer
- Identify different types of forces acting upon the circus performer
- Analyze how forces affect motion of the circus performer
- Explain how Newton's first law of motion is demonstrated as a circus performer performs their act.
- Explain how Newton's second law of motion is demonstrated as a circus performer performs their act.
- Explain how Newton's third law of motion is demonstrated as a circus performer performs their act.
- Describe how the law of gravity affects the motion of the circus performer
- Explain how balanced and unbalanced forces affect the circus performer

- Evaluate how unbalanced forces change the speed and/or direction of the circus performer's motion.

Students will create a multimedia presentation demonstrating their understanding of these science concepts as they apply to their circus act.

Activity Directions:

Students will need to choose a circus act to research. Students will create a model of their act as part of this lesson. Their act should be something they are interested in and will hold their interest for the entire project. Students will be provided with a notebook for the project to sort, categorize, remember and creatively interact with the new knowledge they are gaining. The more students process information, the more they will begin to understand it – leading to longer retention.

Materials:

Paper, pencils, pens, web addresses of Circus Acts, Key Terms To Learn Handout, Circus Science Rubric, computers with programs to complete multimedia presentation (PowerPoint, Keynote, Prezi, etc.).

Standards – Florida Next Generation Sunshine State Standards Grades 5-7:

SC.5.P.10.2 Investigate and explain that energy has the ability to cause motion or create change.

SC.5.P.13.1: Identify familiar forces that cause objects to move, such as pushes or pulls, including gravity acting on falling objects.

SC.5.P.13.2: Investigate and describe that the greater the force applied to it, the greater the change in motion of a given object.

SC.5.P.13.3: Investigate and describe that the more mass an object has, the less effect a given force will have on the object's motion.

SC.5.P.13.4: Investigate and explain that when a force is applied to an object but it does not move, it is because another opposing force is being applied by something in the environment so that the forces are balanced.

SC.6.P.11.1: Explore the Law of Conservation of Energy by differentiating between potential and kinetic energy. Identify situations where kinetic energy is transformed into potential energy and vice versa.

SC.6.P.13.1: Investigate and describe types of forces including contact forces and forces acting at a distance, such as electrical, magnetic, and gravitational.
SC.6.P.13.2: Explore the Law of Gravity by recognizing that every object exerts gravitational force on every other object and that the force depends on how much mass the objects have and how far apart they are.

SC.6.P.13.3: Investigate and describe that an unbalanced force acting on an object changes its speed, or direction of motion, or both.

- Make sure that your project includes goals that frame these benchmarks/standards under the theme; and in the project area, how you will have students practice these concepts; and in your assessment, show how each benchmark/standard addressed will be evaluated.

Summary of Essential Concepts

Ever wonder what you can learn by watching and studying circus acts? Students will learn the history and science behind the circus through research and the creation of a multimedia presentation.

Part two: Alexander's Cirque du Calder

Academic Discipline: Technology and Engineering

Art Discipline: Visual Arts

Timing of Lessons: Three 45-minute classes

Concept – Students will design and build a scale-sized Calder Model using found materials (corks, wire, paint, etc.) in the fashion of Alexander Calder's Cirque Calder based on the circus act they are researching in Science Class.

Skill level: Grade 5-8

Timing of Lesson: Three 45-minute classes

Essential Concepts

- Students will design and build a scale-sized Calder Model using found materials (corks, wire, paint etc.) in the fashion of Alexander Calder's Cirque Calder based on the circus act they are researching in Science Class.

Goals /Objectives

Learners will:

- Apply an engineering problem-solving process to solve basic engineering design and analysis problems.
- Identify necessary known and unknown information toward a solution and the process to be followed to arrive at a solution.
- Choose appropriate tools to solve specific engineering problems.
- Work effectively in small teams through well-developed problem-solving skills and be able to organize the team to optimize performance and results.
- Relate how mass and acceleration can change the force of an object.

Teaching and Learning Sequence

Activity Directions:

- Alexander Calder created a miniature circus out of a variety of materials including fabric and wire.

- Students will design and build a model based on Alexander Calder's Cirque Calder. Using corks, 18-gauge wire and found materials (fabric, sequins, pompoms, buttons, etc.) students will create a model based on the circus act they are researching in Science.
- Teachers will read the book: "Sandy's Circus: A story about Alexander Calder" by Tanya Lee Stone.
- Models are made with materials provided. Students should use the information gleaned from their research of their circus act. Students sketch out their model designs and list materials prior to starting their model. Elmer's or craft glue can be used in place of hot glue guns. Hints: corks can be cut in half by teacher using a knife and a cutting board. Hold both sides of wire when cutting with wire cutters to prevent wire from flying through the air. Finished models should be between 2 to 2.5 inches tall.

- Assessment – Completed Calder Model and rubric.

Standards: ITEEA Standards

Design Standard

8. Students will develop an understanding of the attributes of design.

9. Students will develop an understanding of engineering design.

10. Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving

Abilities For a Technological World Standard

11. Students will develop the abilities to apply the design process.

Materials:

Book, "Sandy's Circus: A story about Alexander Calder", by Tanya Lee Stone.

For Calder Models:

Corks, paint, hot glue guns, hot glue sticks, wire (17 or 18 gauge approx. 2 feet/student), wire cutters, pompoms, popsicle sticks, buttons, googly eyes, sequins, fabric, felt, bottle caps, buttons, craft sticks, etc.

Assessments:

- Presentation to class
- Rubric

Extension:

- Props (Trapeze, Russian Bar, high wire, etc.) can be created as an extension. Also as an extension, students can fashion a way for their model to move (a wheel used to show juggling, magnets to attach to hands and feet for trapeze, springs to show movement of the Russian Bar, lever and fulcrum for teeterboard).