Matter

Physical Science | Lesson Guide

1st Grade

Photo Description

This picture shows tall metal arches that curve up and down. The arches are shiny and silver. They stand in front of buildings with palm trees around them.

Scientific Phenomena

This image represents the Anchoring Phenomenon of structural engineering and forces acting on curved structures. The metal arches demonstrate how engineers design structures to be both strong and beautiful. The curved shape helps distribute weight and forces evenly, making the structure stable. The arches are made of metal, which is strong and can bend without breaking, allowing them to maintain their curved shape while supporting their own weight.

Core Science Concepts

1. Materials and Their Properties: The arches are made of metal, which is strong, shiny, and can be shaped into curves without breaking.

2. Shapes and Structures: The curved arch shape is strong because it spreads out forces and weight evenly along the curve.

3. Push and Pull Forces: The arches experience pushing forces from their own weight and pulling forces from wind, but their shape helps them stay standing.

4. Human-Made vs. Natural Objects: These arches are human-made structures, different from natural curved shapes we might see in nature like rainbow arcs or bent tree branches.

Pedagogical Tip:

Use physical manipulatives like play dough or pipe cleaners to let students create their own curved structures. This hands-on experience helps them understand how materials can be shaped and how different shapes have different strengths.

UDL Suggestions:

Provide multiple ways for students to explore structures: tactile exploration with building blocks, visual comparison charts of curved vs. straight structures, and kinesthetic activities where students use their bodies to form arches.

Zoom In / Zoom Out

1. Zoom In: At the microscopic level, the metal is made of tiny particles called atoms that are tightly packed together in a pattern. This tight packing makes the metal strong and able to hold its curved shape without breaking apart.

2. Zoom Out: These decorative arches are part of a larger urban environment system where humans design and build structures that serve both practical and aesthetic purposes. They connect to broader concepts of city planning, community spaces, and how humans modify their environment.

Discussion Questions

1. "What do you notice about the shape of these arches?" (Bloom's: Remember | DOK: 1)

2. "How do you think these metal arches stay standing up?" (Bloom's: Analyze | DOK: 2)

3. "What would happen if we tried to build these arches with different materials like paper or wood?" (Bloom's: Evaluate | DOK: 3)

4. "Where else have you seen curved structures in your neighborhood?" (Bloom's: Apply | DOK: 2)

Potential Student Misconceptions

1. Misconception: "Curved things are weaker than straight things."
   Clarification: Curved shapes like arches can actually be very strong because they spread forces out evenly along the curve.

2. Misconception: "Only heavy materials can make strong structures."
   Clarification: The shape and design of a structure is just as important as the material. Even lighter materials can be strong when shaped properly.

3. Misconception: "All metal is the same."
   Clarification: There are many different types of metal with different properties. Some are stronger, some are lighter, and some resist rust better than others.

Cross-Curricular Ideas

1. Math - Shapes and Symmetry: Have students identify and draw curved shapes they see in the photo. They can practice creating symmetrical arch designs using paper folding, measuring the height of arches with non-standard units (like block lengths), and comparing the sizes of different curves.

2. ELA - Descriptive Writing and Storytelling: Students can write or dictate sentences describing what they see: "The arches are shiny and silver." They can create simple stories about structures in their community, or label pictures of different buildings and structures using descriptive words (tall, curved, metal, strong).

3. Social Studies - Community Helpers and Planning: Discuss the people who designed and built these arches (architects and builders). Talk about how communities decide where to put structures and why beautiful designs make neighborhoods nice places to visit. Students can draw their own community spaces they'd like to create.

4. Art - Sculpture and 3D Design: Students can create their own arches using pipe cleaners, straws, or clay. They can paint or decorate their structures and display them as a classroom sculpture garden, discussing which designs are strongest or most beautiful.

STEM Career Connection

1. Architect: An architect is a person who draws and designs buildings and structures before they are built. Architects think about what shapes and materials will make buildings strong, safe, and beautiful—just like the people who designed these metal arches! Architects use math and creativity to plan buildings. Average Annual Salary: $82,320 USD

2. Structural Engineer: A structural engineer is a scientist and builder who figures out how to make structures strong so they don't fall down. They test materials and shapes to see which ones work best, and they make sure buildings, bridges, and arches like these can hold up their own weight and stay safe. Average Annual Salary: $87,640 USD

3. Metal Worker or Welder: A metal worker is a person who shapes and joins pieces of metal together to create structures and art. Metal workers use special tools and techniques to bend metal into curves, like the arches in this photo, and make sure all the pieces fit together perfectly and safely. Average Annual Salary: $41,380 USD

NGSS Connections

- Performance Expectation: 1-PS4-4. Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.
- Disciplinary Core Ideas: K-2-ETS1.A (Asking questions, making observations, and gathering information are helpful in thinking about problems)
- Crosscutting Concepts: Structure and Function (The shape and stability of structures are related to their function)

Science Vocabulary

* Arch: A curved structure that is strong and can support weight.
* Metal: A strong, shiny material that can be shaped and doesn't break easily.
* Structure: Something that is built to stand up and stay in place.
* Curve: A smooth, rounded line that bends like part of a circle.
* Force: A push or pull that can make things move or change shape.

External Resources

Children's Books:
- "The Three Little Pigs" by James Marshall (explores different building materials and their strength)
- "Iggy Peck, Architect" by Andrea Beaty (introduces engineering and building concepts)
- "Bridges!" by Gail Gibbons (shows different types of structures and their shapes)