Friction

Physical Science | Lesson Guide

Kindergarten

Photo Description

A long white train moves on tracks. The train has many windows and gets power from wires above it. The train looks smooth and modern.

Scientific Phenomena

This image represents the Anchoring Phenomenon of electric-powered transportation. The train (light rail) demonstrates how electrical energy travels through overhead wires to power motors that make the train move. The electrical current flows from the power source through the pantograph (the metal arm on top) into the train's electric motors, which convert electrical energy into mechanical energy to move the train forward along the tracks.

Core Science Concepts

1. Energy Transfer: Electrical energy moves from power lines through wires into the train to make it go
2. Motion and Forces: The train needs a push (force) from its motors to move forward along the tracks
3. Simple Machines: The wheels and axles on the train are simple machines that help it roll smoothly
4. Electrical Circuits: The overhead wires, pantograph, and train motors form a complete circuit for electricity to flow

Pedagogical Tip:

Use toy trains and battery packs to let students physically connect circuits and observe cause-and-effect relationships between electrical connections and motion.

UDL Suggestions:

Provide multiple ways for students to explore this concept through hands-on manipulation of toy trains, visual diagrams of energy flow, and kinesthetic activities like pretending to be electricity flowing through wires.

Zoom In / Zoom Out

1. Zoom In: Inside the electric motors, tiny particles called electrons flow through copper wires, creating magnetic fields that spin the motor parts and turn the wheels
2. Zoom Out: This train is part of a larger transportation system that connects different parts of a city, helping reduce air pollution by moving many people efficiently without individual cars

Discussion Questions

1. What do you think makes this train move forward? (Bloom's: Analyze | DOK: 2)
2. How is this train different from a car or bus? (Bloom's: Compare | DOK: 2)

3. What would happen if the wire above the train broke? (Bloom's: Predict | DOK: 3)
4. Why do you think trains have so many wheels? (Bloom's: Analyze | DOK: 2)

Potential Student Misconceptions

1. Misconception: "The train makes its own electricity like a battery toy"
   Clarification: The train gets electricity from power lines above it, not from batteries inside
2. Misconception: "The wires above just hold the train up"
   Clarification: The overhead wires carry electricity to power the train, they don't support its weight
3. Misconception: "All trains need gasoline like cars"
   Clarification: This electric train uses electricity instead of gasoline to make it move

Cross-Curricular Ideas

1. Math - Counting and Patterns: Count the windows on the train or the wheels visible in the photo. Create patterns using train shapes (long train, short train, long train, short train). Measure toy train tracks to practice length and distance concepts.

2. ELA - Storytelling and Descriptive Language: Read "Freight Train" by Donald Crews and have students describe what they see in the photo using color and position words (the white train, the black windows, wires above). Create a class story about where the train is going and who might ride it.

3. Social Studies - Community Helpers and Transportation: Discuss how train drivers help our community by moving people to different places. Talk about different ways people travel (cars, buses, trains, bicycles) and why electric trains are good for our cities and environment.

4. Art - Collage and Color: Create a train collage using white, gray, and black paper. Paint or draw overhead wires and power lines. Design a simple picture showing the train's journey through a city neighborhood.

STEM Career Connection

1. Train Engineer/Operator: A train engineer is the person who drives the train and makes sure it stops and goes at the right times. They use special controls and follow safety rules to keep passengers safe. Train engineers check that all the electrical systems are working before each trip. Average Salary: $68,000 - $75,000 per year

2. Electrical Engineer: An electrical engineer designs and fixes the electrical systems that power trains. They figure out how to make electricity flow safely through the wires and into the train's motors. They test equipment to make sure the train can move smoothly and safely. Average Salary: $105,000 - $115,000 per year

3. Track Maintenance Worker: A track maintenance worker takes care of the train tracks and makes sure they are safe and in good condition. They also work on the overhead power lines that give electricity to the train. They check for problems and fix anything that is broken or damaged. Average Salary: $55,000 - $65,000 per year

NGSS Connections

- Performance Expectation: K-PS2-1: Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object
- Disciplinary Core Ideas: K-PS2.A - Forces and motion exist everywhere in the universe
- Crosscutting Concepts: Cause and Effect - Events have causes that generate observable patterns

Science Vocabulary

* Electricity: Energy that flows through wires to make things work
* Motor: A machine part that uses electricity to make things move
* Energy: The power needed to make things happen or move
* Circuit: A complete path that electricity follows to flow from one place to another
* Force: A push or pull that can make things move or stop

External Resources

Children's Books:
- Freight Train by Donald Crews
- The Little Engine That Could by Watty Piper
- Trains by Gail Gibbons