Friction

Physical Science | Lesson Guide

1st Grade

Photo Description

This is a long white train that moves on tracks. The train has windows and doors for people to get on and off. It uses electricity from wires above to move.

Scientific Phenomena

The anchoring phenomenon is electric-powered transportation. This light rail train demonstrates how electrical energy is converted into mechanical motion. The train collects electricity through a pantograph (the arm-like device on top) that connects to overhead power lines. This electrical energy powers motors that turn the wheels, creating the force needed to move the heavy train along the tracks.

Core Science Concepts

1. Energy Transfer: Electricity flows from power lines through the train's systems to create movement
2. Push and Pull Forces: The train's motors create a pushing force that moves the train forward along the tracks
3. Motion and Speed: The train can start, stop, speed up, and slow down based on how much electrical energy is used

Pedagogical Tip:

Use toy trains or battery-powered cars to help students make concrete connections between the electrical energy they can see (batteries) and the motion they observe. This builds understanding before introducing more abstract concepts like overhead power lines.

UDL Suggestions:

Provide multiple ways for students to explore this concept: kinesthetic learners can push toy trains, visual learners can watch videos of trains in motion, and auditory learners can listen to train sounds while discussing how electricity makes the movement possible.

Zoom In / Zoom Out

Zoom In: Inside the train's motors, tiny particles called electrons flow through copper wires. When electrons move through the motor's coils, they create magnetic forces that spin the motor parts, which turn the wheels.

Zoom Out: This train is part of a larger transportation system that helps reduce air pollution in cities. Many electric trains together use less energy and create less pollution than if all those people drove separate 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 electricity stopped working? (Bloom's: Predict | DOK: 2)
4. Why do you think people choose to ride trains instead of driving cars? (Bloom's: Evaluate | DOK: 3)

Potential Student Misconceptions

1. Misconception: "The train moves by itself like a toy car"
   Reality: The train needs electricity from outside sources (power lines) to move, unlike battery-powered toys

2. Misconception: "Only cars and buses can transport people"
   Reality: Trains, boats, planes, and other vehicles also move people using different types of energy

Cross-Curricular Ideas

1. Math - Counting and Measurement: Count the number of windows or doors on the train. Measure the length of toy train tracks using non-standard units (like blocks or hand-spans). Create simple graphs showing "trains" vs. "cars" in your classroom.

2. ELA - Storytelling and Writing: Read Freight Train by Donald Crews and discuss the colors and movement. Have students dictate or draw a story about a train ride to a favorite place. Create simple sentences: "The train is fast. The train helps people."

3. Social Studies - Community Helpers and Transportation: Discuss the train operator/conductor as a community helper. Talk about how trains help people get to work, school, and visit family. Explore maps showing train routes in your city or area.

4. Art - Color and Design: Create paintings or collages of trains using white, gray, and black paper. Design your own colorful train car by decorating paper plates or boxes. Draw overhead power lines and pantographs to extend understanding of the train's parts.

STEM Career Connection

1. Train Driver/Operator: A train driver is the person who controls the train and makes it go fast or slow. They follow special rules to keep passengers safe and arrive on time. They sit in the front of the train and use controls to steer. Average Annual Salary: $65,000

2. Electrical Engineer: An electrical engineer designs the systems that make trains run using electricity. They figure out how to get power from the overhead wires to the train's motors. They make sure everything is safe and works properly. Average Annual Salary: $104,000

3. Train Mechanic: A train mechanic fixes and checks trains to make sure they work well. They look at the wheels, motors, and electrical parts to find problems and repair them so the train stays safe. Average Annual Salary: $58,000

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 Idea: K-PS2.A - Pushes and pulls can have different strengths and directions

- Crosscutting Concept: Cause and Effect - Simple tests can be designed to gather evidence to support or refute student ideas about causes

Science Vocabulary

* Electricity: A type of energy that can make things move or light up
* Energy: The power needed to make things work or move
* Motion: When something moves from one place to another
* Transportation: Ways people and things move from place to place
* 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