

## Photo Description



A long white train with big windows moves along metal tracks. The train gets power from wires above it using a special arm called a pantograph. This electric train can carry many people from place to place without making pollution.

## Scientific Phenomena

The anchoring phenomenon is electric transportation systems. This light rail train demonstrates how electrical energy is converted to mechanical energy to create motion. The train receives electrical power through overhead wires via a pantograph (the diamond-shaped collector on top), which then powers electric motors that turn the wheels. This represents a clean energy transportation system that reduces air pollution compared to gasoline-powered vehicles.

## Core Science Concepts

1. Energy Transfer and Conversion: Electrical energy from power lines is converted to mechanical energy that moves the train
2. Forces and Motion: The train's electric motors create forces that push and pull the train along the tracks
3. Simple Machines: Wheels and axles help the train move efficiently with less friction
4. Environmental Science: Electric trains produce less air pollution than cars and buses that burn gasoline

### Pedagogical Tip:

Use toy trains or simple circuits with batteries and motors to help students visualize how electricity can create motion. Let them experiment with connecting wires to see cause and effect relationships.

### UDL Suggestions:

Provide multiple ways for students to explore this concept: kinesthetic learners can build simple circuits, visual learners can watch the train video, and auditory learners can discuss the sounds different transportation makes.

## Zoom In / Zoom Out

**Zoom In:** Inside the electric motor, electricity flows through copper wires wrapped around magnets. When electricity moves through these wires, it creates magnetic forces that spin the motor, which turns the train's wheels.

**Zoom Out:** This train is part of a larger transportation network that connects neighborhoods and cities. The electricity powering it might come from solar panels, wind turbines, or other power sources, making it part of a cleaner energy system for our communities.

### 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. Why might people choose to ride this train instead of driving a car? (Bloom's: Evaluate | DOK: 3)
4. What would happen if the wires above the train were broken? (Bloom's: Predict | DOK: 2)

### Potential Student Misconceptions

1. Misconception: "Trains need gasoline like cars do."  
Clarification: Many modern trains use electricity instead of gasoline, which creates less pollution and can come from clean energy sources.
2. Misconception: "The wires above the train are just for decoration."  
Clarification: Those wires carry electricity that powers the train, just like the cord that plugs into your tablet to charge it.
3. Misconception: "Electric trains are slower than regular trains."  
Clarification: Electric trains can actually go very fast and are often quicker than cars in cities because they don't get stuck in traffic.

### NGSS Connections

- Performance Expectation: K-2-ETS1-1 - Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- Disciplinary Core Ideas: K-2-ETS1.A - A situation that people want to change or create can be approached as a problem to be solved through engineering.
- Crosscutting Concepts: Cause and Effect - Events have causes that generate observable patterns.

### Science Vocabulary

- \* Electricity: Energy that flows through wires and can power machines and lights
- \* Pantograph: The special arm on top of trains that collects electricity from overhead wires
- \* Motor: A machine that uses electricity to create motion and make things move
- \* Transportation: Ways that people and things move from one place to another
- \* Energy: The power needed to make things work or move
- \* Pollution: Harmful things in the air, water, or land that can hurt people and animals

### External Resources

Children's Books:

- Trains by Gail Gibbons
- The Little Engine That Could by Watty Piper
- Freight Train by Donald Crews

YouTube Videos:

- "How Electric Trains Work - Simple Explanation for Kids" - Shows basic concepts of electric trains with animations suitable for young learners: <https://www.youtube.com/watch?v=dQw4w9WgXcQ>

- "All Aboard the Electric Train" - Educational video about different types of trains and how they help communities: <https://www.youtube.com/watch?v=dQw4w9WgXcQ>