Railroad

Physical Science | Lesson Guide

Kindergarten

Photo Description

This picture shows long metal rails laid on the ground in a straight line, stretching far away into the distance. Tall trees with green and yellow leaves grow on both sides of the tracks, and small rocks are spread between the metal rails to hold them in place.

Scientific Phenomena

Anchoring Phenomenon: Why do railroad tracks go straight and far away?

Railroad tracks are linear pathways designed to guide trains safely from one place to another. The two parallel metal rails (made of steel) are held firmly in place by wooden or concrete ties and ballast rocks underneath. This structure creates a sturdy, stable pathway that allows heavy trains to roll smoothly and predictably along the same route repeatedly. The trees lining the track show us that this pathway has been maintained in the same location for a long time—notice how the trees have grown around it.

Core Science Concepts

* Patterns in Nature and Human Design: Railroad tracks show a clear repeating pattern (rail-tie-rail-tie). Kindergarteners observe patterns everywhere—in nature, buildings, and transportation systems.

* Stability and Support: The rocks and wooden ties beneath the rails act as a foundation that keeps the tracks level and prevents them from sinking into the ground or shifting.

* Linear Motion: Trains move in straight lines along these tracks because the rails guide them. Objects (like trains) need pathways or forces to move in predictable directions.

* Materials and Properties: Steel rails are shiny, hard, and strong—properties that make them ideal for supporting heavy trains. The wood ties are also strong but more flexible than metal.

Pedagogical Tip:

For Kindergarten, avoid overly technical explanations. Instead, use direct observation and sensory language: "See the shiny metal? Feel how smooth it is. That metal is very strong—stronger than wood—so it won't bend when a heavy train rolls on it." Let students touch safe materials (wood ties, gravel) to build understanding through tactile experience.

UDL Suggestions:

Representation: Provide photos, videos, and real objects (wood blocks, toy train tracks) so students can see and touch examples. Use simple diagrams showing how ties hold rails apart. Action & Expression: Let students build their own "tracks" with blocks or sticks, then test rolling a toy car along them. Engagement: Connect to student experiences—"Have you ever ridden on a train? What did it feel like? What did you see?"

Discussion Questions

1. Why do you think the railroad tracks are made of metal instead of wood? (Bloom's: Analyze | DOK: 2)
   Students think about material properties and why engineers make specific choices.
2. What would happen if the rocks under the tracks were not there? (Bloom's: Evaluate | DOK: 3)
   Students predict consequences and think about the purpose of the foundation.
3. How are these railroad tracks similar to the sidewalk or path near your home? (Bloom's: Compare | DOK: 2)
   Students connect new learning to familiar experiences and recognize patterns in human-made structures.
4. Where do you think this train goes, and why do you think it travels in a straight line? (Bloom's: Create | DOK: 3)
   Students use imagination while reasoning about the function of tracks.

Extension Activities

Activity 1: Build a Track with Blocks
Give students wooden blocks, toy train tracks, or sticks to build their own "railroad." Ask them to create a straight path, then try a curved path. Roll a toy car or marble along each design. Discuss: "Which path is easier for the toy to follow? Why?" This builds understanding of how structure guides movement.

Activity 2: Explore Materials
Bring in samples of wood, plastic, and metal (or pictures of these materials). Have students feel the weight and stiffness of each. Ask: "Which one is strongest? Which one would a heavy train need?" Connect material properties to design choices.

Activity 3: Rocks and Stability
Create a simple model using two pencils as "rails" and small stones as "ballast." Have students place the pencils on a table without stones underneath, then with stones. Gently push the table. Ask: "When do the pencils stay in place? When do they move? Why does the ballast help?" This demonstrates the function of support structures.

NGSS Connections

Kindergarten Physical Science 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.

Relevant Disciplinary Core Ideas:

K-PS2.A - Forces and Motion: Pushes and pulls can change the speed or direction of an object's motion. (Train motion along tracks is guided by the structure of the rails.)

K-PS2.B - Types of Interactions: When objects push or pull on each other, they can change motion. (Rails push/guide the train's wheels to keep it on a straight path.)

Crosscutting Concepts:

Patterns - Patterns exist in the repeating structure of railroad ties and rails; observing patterns helps us predict what will happen.

Stability and Change - The stable structure of the tracks allows trains to move reliably along the same path over many years.

Science Vocabulary

* Rail: A long, thin piece of metal (usually steel) that is part of the track for a train.

* Tie (or Sleeper): A wooden or concrete bar that holds the two rails the right distance apart and keeps them stable.

* Ballast: The rocks and gravel underneath the ties that hold the track in place and help water drain away.

* Track: The pair of rails together that form the pathway a train travels on.

* Steel: A very strong metal made from iron that is used to build things like trains and rails.

External Resources

Children's Books:

Freight Train* by Donald Crews
Simple, colorful illustrations of different colored train cars and what they carry—perfect for Kindergarten.

The Little Engine That Could* by Watty Piper
A classic story about a train climbing a hill; builds excitement about trains and persistence.

Trains* by Gail Gibbons
Nonfiction book with clear diagrams showing how trains work and what different types of trains do.

YouTube Videos:

* "How Trains Work" by National Geographic Kids (3 min)
Clear, animated explanation of how trains move on tracks with engaging visuals.
https://www.youtube.com/watch?v=ZR9qK6pEFsA

* "Toy Train on Tracks" by Kids Learning Tube (5 min)
Simple demonstration showing a toy train following tracks; helps visualize the anchoring phenomenon.
https://www.youtube.com/watch?v=9tG-A5VNM-s

Teacher Notes: This lesson emphasizes observable phenomena, hands-on exploration, and connections to student experiences. For Kindergarten, keep activities short (10–15 minutes), use concrete materials, and allow plenty of time for free exploration and discussion.