

Photo Description



This image shows railroad tracks stretching into the distance, surrounded by trees and green leaves. The metal rails are parallel to each other and rest on dark wooden beams called ties, which sit on gravel. The trees create a natural tunnel overhead, and the tracks appear to disappear into the distance, creating a feeling of depth.

Scientific Phenomena

Anchoring Phenomenon: Why do railroad tracks have two parallel rails instead of one, and how do they stay in place?

Scientific Explanation: Railroad tracks are designed with two parallel rails because they provide balance and stability for heavy trains. The metal rails are made of steel, which is strong and doesn't bend easily under weight. The wooden ties underneath distribute the train's weight across a larger area of ground, preventing the train from sinking into the earth. The gravel (called ballast) acts like a cushion that holds the ties in place and allows water to drain away. This system works together to safely support trains that can weigh hundreds of tons.

Core Science Concepts

- Forces and Motion:** Trains move along the tracks because wheels push against the rails. The parallel rails guide the train so it moves in a straight line and doesn't tip over.
- Stability and Balance:** Two rails create a wider base of support than one rail would. This makes the train more stable, similar to how you balance better on two feet than on one foot.
- Materials and Their Properties:** Steel rails are used because steel is very strong, doesn't rust easily, and can support heavy loads. Wood ties are used because they grip the ground and don't slide around.
- Load Distribution:** The weight of the train is spread across many ties and a large area of ground, rather than being concentrated in one spot. This is why the gravel is important—it spreads the weight even more.

Pedagogical Tip:

Students at this age are concrete thinkers, so avoid abstract explanations. Instead, use direct comparisons: "The two rails work like your two legs—they help you balance." Let students physically experience concepts by walking along a line (one rail) versus between two lines (two rails) to understand stability.

UDL Suggestions:

Representation: Provide images of railroad tracks from different angles (aerial view, side view, close-up) so visual learners can understand the 3D structure. Create a simple labeled diagram showing rails, ties, and ballast with pictures.

Engagement: Connect to student interests by asking if they've seen trains or toy train sets. Some students may have family experiences with trains; invite them to share observations.

Action/Expression: Allow students to demonstrate understanding through building (model tracks with craft materials), drawing, or role-playing a train and the rails that guide it.

Discussion Questions

1. Why do you think the railroad tracks are made of two rails running side by side instead of just one single rail? (Bloom's: Analyze | DOK: 2)
2. What would happen to a train if the wooden ties weren't there to hold up the metal rails? (Bloom's: Evaluate | DOK: 3)
3. How do you think the gravel under the ties helps keep the tracks in place? (Bloom's: Explain | DOK: 2)
4. If you had to design a track system to hold something even heavier than a train, what changes might you make? (Bloom's: Create | DOK: 3)

Extension Activities

1. Build a Model Track System: Provide students with craft sticks, straws, or plastic rulers to represent rails, and popsicle sticks for ties. Have them arrange materials to create a stable track structure. Then place toy cars or blocks on top to test whether the design can hold weight without tipping. This hands-on experience demonstrates why two parallel rails are better than one.
2. Balance and Stability Investigation: Create a simple experiment where students place a ruler (representing a train) across two pencils (representing rails) versus one pencil. Have them gently push or add weight to see which setup is more stable. They can record observations with drawings and discuss why the two-rail system works better.
3. Design a Playground Path: Challenge students to design a safe pathway through the classroom or playground using "rails" made from tape. They must consider how to keep people moving in the right direction without falling, similar to how railroad tracks guide trains. Have them explain their design choices to classmates.

NGSS Connections

Performance Expectation:

3-PS2-1: Plan and conduct an investigation to provide evidence that balanced and unbalanced forces on an object change its shape and/or the speed or direction of its motion.

Disciplinary Core Ideas:

- 3-PS2.A Forces and Motion
- 3-PS2.B Types of Interactions

Crosscutting Concepts:

- Stability and Change
- Structure and Function

Science Vocabulary

- * Rails: Long metal bars that form the path a train travels on.
- * Ties (or sleepers): Wooden beams laid across the rails that help hold them in place and spread the train's weight.
- * Ballast: Small stones or gravel placed under and around the ties to keep them from moving and to drain water.
- * Parallel: Two lines or rails that run next to each other and never cross or meet.
- * Stability: The quality of being steady and balanced, not tipping over easily.
- * Steel: A very strong metal made from iron that is used to make train rails.

External Resources

Children's Books:

- The Little Engine That Could by Watty Piper (Classic story about a train that teaches perseverance and problem-solving)
- Trains by Gail Gibbons (Informational picture book with clear diagrams of train parts and how tracks work)
- Click, Clack, Moo: Cows That Type by Doreen Cronin (Humorous story featuring a train, great for engagement)

YouTube Videos:

- "How Do Train Tracks Work?" by National Geographic Kids — A 3-minute animated explanation of track design, rail stability, and train physics. https://www.youtube.com/results?search_query=how+do+train+tracks+work+national+geographic+kids
- "Building Railroad Tracks" by CTC Math — A documentary-style video (5 minutes) showing real railroad construction, workers placing ties and rails, and ballast application, perfect for visual learners. https://www.youtube.com/results?search_query=building+railroad+tracks+how+it+works