HANDS DOWN EDUCATION · 6-WEEK UNIT STUDY PLANNER

Trains unit study

Turn a train obsession into a homeschool curriculum — engineering, industrial history, geography and math built around railroads, for K-12.

GRADE BANDS K-2 · 3-5 · 6-8 · 9-12
FULL GUIDE https://handsdowneducation.com/homeschool/trains

How to use this planner

The six weeks below are the guide's authored scope and sequence: one focus, one key activity and one portfolio output per week. Run the activity at the level your child is at (the grade band notes tell you how), keep the output, and by week six you have a portfolio that shows the unit end to end.

Pace is yours. A week here is three to five working sessions; a topic that is going well can take two calendar weeks, and one that has run dry can be closed early. Tick the box when a week's output is in the portfolio.

Six-week scope and sequence

Wk	Focus	Key activity	Portfolio output	Done
1	**How a train moves**	Steam and pinwheel demonstration, friction comparisons and a cutaway diagram traced from fire to wheel; older students compute kinetic energy.	A numbered sequence or annotated diagram explaining how a locomotive converts energy to motion.	☐
2	**Grades, curves and routes**	Track experiments with hills; map a real rail line on a topographic map and mark tunnels, bridges and grades.	An annotated route map with a written explanation of why the line goes where it goes.	☐
3	**The transcontinental railroad**	Read the story of 1869; write diary entries from two perspectives; older students read primary sources from the Chinese crews.	Two contrasting first-person accounts, or a documented essay for high school.	☐
4	**Timetables and networks**	Speed-distance-time problems from real schedules; build a timetable for three trains on one line; draw a distance-time graph.	A working timetable with calculations and a distance-time graph.	☐
5	**Railroads and the towns they made**	Case study of one town's rise or decline with census data; the economics of freight versus passenger rail.	A short case study with a population graph and a written explanation.	☐
6	**Trains today and tomorrow**	High-speed rail comparison, a vintage-style travel poster for a real route, and a final project or model-railroad build.	A poster or proposal plus a final presentation of the unit's work.	☐

Running it at your child's level

Grades K-2: sequence, sort and build

The wooden train set is genuine early engineering, and a K-2 train unit uses it as such: layouts are plans, cars are units to count, and the order of a train is a sequence. Add real trains through picture books and, if you can, one ride or one visit to a station, and the vocabulary takes care of itself.

- Build a track with one loop and one branch, then draw a map of it from above. Compare the drawing with the track, fix the differences, and try again. This is the first map a child makes of something they built.
- Make up trains from a set of cars and count them, then sort: which cars carry people, which carry cargo, which carry the engine crew. Line them up longest to shortest and count the wheels.
- Build a hill on the track with books and find out how steep it can be before the train stops climbing. Move one book at a time and talk about why heavier trains need gentler hills.

- Learn the parts of a steam engine from a labeled picture (boiler, cab, wheels, tender, smokestack) and build a version out of blocks or cardboard boxes with each part labeled on a sticky note.

  Reading: Freight Train by Donald Crews, a picture-book classic that teaches colors, car types and motion in a few pages, and Locomotive by Brian Floca, a Caldecott winner that follows one 1869 crossing with wonderful detail.

Grades 3-5: how trains work and where they go

Third to fifth graders can move from playing with trains to explaining them: what pushes a locomotive, why steel wheels on steel rails need so little energy, and how the first railroads changed the map. Timetable math — speed, distance and time — arrives naturally, and history enters through the transcontinental railroad.

- Demonstrate steam power with a kettle and a pinwheel, then look at a cutaway diagram of a steam locomotive and trace the path from fire to wheel. Write the sequence in numbered steps.
- Compare friction: pull a book across carpet, tile and a row of pencils with a rubber band and measure how far the band stretches each time. Explain why rails and wheels are made of steel and what that has to do with how much a train can pull.
- Solve real timetable problems from a printed schedule: if a train leaves at 9:15 and arrives 140 miles away at 11:35, how fast was it going on average? Make up three more and swap them with a sibling.
- Read about the transcontinental railroad and write two short diary entries for the same day in 1869 — one from a Central Pacific worker, one from a passenger on the first through train.

  Reading: Ten Mile Day by Mary Ann Fraser, the story of the record-setting day of track laying in 1869, with accurate detail on the Chinese and Irish crews who did it.

Grades 6-8: physics, networks and the industrial revolution

Middle schoolers can take on the physics of forces and energy with trains as the case study, the scheduling math of a real network, and the industrial and social history that railroads drove. The writing shifts to explanation and argument, and a model railroad or a mapping project becomes a real engineering exercise.

- Calculate the kinetic energy of a freight train (mass around 10,000 tonnes, speed 25 meters per second) and compare it with a car; then explain from the numbers why a train needs more than a mile to stop and why crossings are dangerous.
- Build a timetable for three trains sharing one single-track line with two passing sidings, working out speeds and meeting points so that no two trains occupy the same section. Present it as a distance-time graph, the way real dispatchers once did.
- Map one real rail line on a topographic map and mark every tunnel, bridge and long grade. Explain why the route was chosen over the straight line and what each detour cost or saved.
- Research how one town on a rail line grew or died — a division point, a bypassed county seat, a stop that became a city — using census figures, and write a short case study with a population graph.

  Reading: Trains: The Definitive Visual History (DK) for the technology and its eras, and the American Experience documentary Transcontinental Railroad from PBS for the history strand.

Grades 9-12: railroads as engineering, economics and history

At high-school depth railroads become an interdisciplinary case study: the engineering of traction and high-speed lines, the economics of freight and passenger networks, and the labor, immigration and political history that railroads shaped. The work is quantitative analysis, primary-source reading and structured argument.

- Analyze the energy efficiency of freight rail versus trucking using published tonne-miles per gallon figures, build a comparison table, and write an evidence-based evaluation of when each mode makes sense.
- Read primary sources on Chinese railroad workers — the Stanford Chinese Railroad Workers in North America Project publishes them — and write a documented essay on their working conditions, pay and the record they left behind.
- Study why high-speed rail succeeded in Japan and France and stalled in the United States: geography, population density, land costs and policy. Write a comparative analysis with data on ridership and cost per mile.
- Design a commuter timetable for a real corridor near you using actual distances and station stops, computing

headways and rolling-stock requirements, and present it as a proposal with costs estimated from published figures.

Reading: Nothing Like It in the World by Stephen Ambrose for the transcontinental story, paired with chapters of Railroaded by Richard White for a critical view of the same era — reading both teaches how historians disagree.

A sample week, subject by subject

Reading & Writing

Read about the golden spike at Promontory Summit, then write two short accounts of the same day — one from a railroad executive, one from a Chinese laborer who laid the track.

Math

Build a working timetable for three trains sharing one line, calculating speeds and headways so none arrive at the same siding at once.

Science

Demonstrate steam power with a kettle and pinwheel, then explain how a piston converts that push into rotation — and why diesel-electric replaced it.

Social Studies

Map how one rail line changed the towns along it: which grew, which were bypassed and died, and why the route went where it did.

Art

Design a vintage travel poster for a real rail route, studying how mid-century poster art sold the romance of the journey.

Books, sites and kits

- Freight Train by Donald Crews (Book (K-1)) — A Caldecott Honor picture book that teaches car types, colors and motion in a handful of pages.
- Locomotive by Brian Floca (Book (K-3)) — The Caldecott Medal winner following one family's 1869 journey; accurate, beautiful and dense with detail.
- Ten Mile Day by Mary Ann Fraser (Book (3-5)) — The record-setting day of track laying on the Central Pacific, with the workers at the center.
- Trains: The Definitive Visual History (DK) (Book (5-12)) — An illustrated survey of railroad technology from the first steam engines to high-speed rail.
- Nothing Like It in the World by Stephen Ambrose (Book (9-12)) — A narrative history of the transcontinental railroad; pair with Richard White's Railroaded for the critical view.
- American Experience: Transcontinental Railroad (PBS) (Video) — A documentary covering the politics, engineering and labor of the 1860s line.
- Chinese Railroad Workers in North America Project (Stanford) (Website) — Primary sources, research and teaching materials on the workers who built the Central Pacific.
- California State Railroad Museum (Museum / website) — One of the best railroad collections in the country, with online resources for families who cannot visit Sacramento.

Standards this unit covers

- K-2-ETS1-1 (NGSS) — Ask questions, make observations and gather information about a situation people want to change to define a simple problem that can be solved through a new or improved tool — the hill and layout experiments.
- 3-PS2-1 (NGSS) — Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object — the friction and grade tests.
- 4-PS3-4 (NGSS) — Apply scientific ideas to design, test and refine a device that converts energy from one form to another — the steam demonstration and energy chain.

- MS-PS3-1 (NGSS) — Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
- CCSS.MATH.CONTENT.6.RP.A.3.B (CCSS Math) — Solve unit rate problems including those involving unit pricing and constant speed — the timetable and speed-distance-time work.
- CCSS.ELA-LITERACY.RH.6-8.6 (CCSS ELA) — Identify aspects of a text that reveal an author's point of view or purpose — the paired transcontinental accounts and competing histories.

Common questions

Do we need a model railroad?

No. Maps, timetables and video cover the curriculum; a model set is a rewarding build project if the interest deepens, not a starting requirement.

Is this mostly history?

History is the richest vein, but the physics of traction and braking, the math of scheduling, and the geography of grades and tunnels carry real science and math content.

My child only likes Thomas the Tank Engine.

Perfect starting point for K-2 — the characters carry vocabulary and narrative, and real locomotives become the natural next step when curiosity outgrows the stories.

What does a train unit study cover?

A train unit study runs on four tracks: how trains work (forces, energy, steam, diesel-electric, braking), the history of railroads (the industrial revolution, the transcontinental line and the people who built it, the shift to highways and the return of high-speed rail), the geography of routes (grades, tunnels, why a line goes where it goes and what it does to the towns along it), and the math of running a network (speed, distance, time, timetables and headways). The six-week scope and sequence above gives each track a week or more and ends with a project.

How do I use a model railroad or wooden train set in homeschool?

Treat it as an engineering lab rather than a toy. A wooden set teaches sequencing, spatial planning and the physics of grades — build a hill and see where the train stalls. A model railroad adds scale (HO scale is 1:87; measure a real boxcar and check), wiring and electrical circuits, timetable operation with two trains sharing a track, and scenery that becomes a geography project. Set a constraint for each session and the play becomes the lesson.

Is there a train curriculum that works for high school?

Yes, and the material is richer at this level than most parents expect. High-school students can study the physics of traction and braking quantitatively, the economics of freight versus passenger rail, the history of railroad labor and immigration with primary sources, and the engineering of high-speed lines. Presented as a history elective or an applied-physics unit with written work, it belongs on a transcript.

Turn this into a full, standards-aligned curriculum

Generate a complete plan around trains for your child's grade and pace — free to try, no account required.

https://handsdowneducation.com/curriculum/generate