



Engineering

Scouts BSA · STEM

Name

Started

Completed

Engineering is about solving problems by designing and building things that work. You'll take something apart, try hands-on experiments, and design something of your own. Along the way you'll meet engineers and see how many different kinds there are.

Requirements

Every official requirement, in plain language. Check the official wording when you sign off (scouting.org/merit-badges/engineering/). Tips and examples are ideas, not extra requirements.

- ☐ **1** Pick a manufactured item at home, like a toy or appliance, and with adult supervision and your counselor's approval, investigate how and why it works and what engineering went into making it; then talk with your counselor about what you found and where you found it

Tip: Choose an old item headed for the trash, like a toy or a small appliance, and take it apart with an adult's OK. Notice why each part is shaped the way it is.

Example: Take apart an old remote control or flashlight. Notice why the case snaps together instead of using screws (cheaper to assemble), why the buttons are rubber (feel and durability), and what each part is made of.

- ☐ **2** Pick an engineering achievement that has greatly affected society; using sources like books, magazines, and the internet (with a parent or guardian's permission), learn about the engineers behind it, the obstacles they overcame, and its influence today; share what you learned with your counselor

Tip: Pick an achievement that excites you, like a famous bridge, a dam, or a space mission, and find out what problem it solved.

Example: Research the Golden Gate Bridge: why a suspension bridge fit the deep, windy strait, how workers stayed safe, and how it changed travel around San Francisco Bay. Or pick a dam, the Apollo program, or the interstate highway system.

- ☐ **3** Explain what six types of engineers do; choose two of them and explain how their work relates to engineering

Tip: Look up engineers in different fields, such as civil, mechanical, electrical, chemical, and computer, and find one cool thing each one builds.

Example: Six types with something each one builds: civil (bridges and water systems), mechanical (engines and machines), electrical (power grids), chemical (fuels and medicines), computer (chips and software), and biomedical (artificial joints).

4 Visit with an engineer

Tips for this section: Ask family friends or your counselor to help you find an engineer. Bring questions about what a normal day looks like.

- ☐ **4a** Meet with an engineer (your counselor, parent, or guardian may count) and discuss the work they do and the tools they use

- ☐ **4b** Discuss a current project with the engineer and the role they play in it

- ☐ **4c** Find out how the engineer does the work and gets results

- ☐ **4d** Ask to see reports the engineer has written about the project

- ☐ **4e** Discuss with your counselor what the visit taught you about engineering

- ☐ **5** Design an original item of patrol gear, a toy, or a useful device for a home, office, or garage, following the systems engineering approach

Tip: Start with a real problem you've noticed, then work through each step of the process and write down what you learn as you go.

Example: Design a better backpack hook for your patrol's camp kitchen: define the need, sketch three ideas, pick one with a simple scoring chart, build a prototype, test how much weight it holds, and write what you'd change.

6 Hands-on engineering: Choose 2 of 7

Tips for this section: Pick two you can build and test, like a model that uses levers or gears, or a test of how wood, metal, and plastic hold up, and measure the results.

Example for this section: Test materials: hang weights from same-size strips of wood, metal, and plastic to see which bends first, then set each in warm water and feel which one carries heat fastest. Or build a model with gears and a lever from a construction set and name a real product that works the same way.

- ☐ **6a** Transforming motion: build a simple model from common materials or a construction set that demonstrates motion, explain how it uses simple mechanical elements such as inclined planes and levers, and describe a real product that uses this mechanism

- ☐ **6b** Using electricity: list 10 electrical appliances at home and about how much electricity each uses per month; learn how to find the amount and cost of electricity your home uses at times of heavy and light use; name five ways to save electricity

- ☐ **6c** Understanding electronics: use a device like a smartphone or tablet to learn how text, images, sound, or video get from one place to another, and explain how the device was designed for usability, function, and durability

- ☐ **6d** Using materials: experiment to show how wood, metal, and plastic differ in strength and in heat conductivity, and discuss what you learned with your counselor

- ☐ **6e** Converting energy: do an experiment showing how energy (mechanical, heat, chemical, solar, and/or electrical) can change from one type to another; explain your results, and tell your counselor what energy is and how it gets converted and used around you

- ☐ **6f** Moving people: learn the ways people in your community commute; study traffic flow (vehicle counts and relative speeds) at heavy and light times; discuss with your counselor improvements that could help people get around more easily

- ☐ **6g** Building an engineering project: put a project into a science fair, engineering fair, or similar contest (serving on an engineering competition team counts); discuss with your counselor what your project shows, what visitors asked, and how well you answered

- ☐ **7** Explain what being a registered Professional Engineer (P.E.) means and the kinds of engineering work where registration matters most

Tip: Find out what it takes to become a licensed Professional Engineer and why licensing matters for public safety.

- ☐ **8** Study the Engineer's Code of Ethics and explain how it compares to the Scout Oath and Scout Law

Tip: Read the code side by side with the Scout Oath and Law and note which ideas match.

Example: Line them up side by side: engineers put public safety first (helpful, and the Scout slogan to Do a Good Turn), report results honestly even when they are bad news (trustworthy), and take on only work they are qualified to do (doing your best, and being honest about what you know).

- ☐ **9** Research an engineering career: education and training, costs, job outlook, pay, duties, and advancement (by searching, interviewing a professional, or visiting a workplace, with a parent or guardian's permission); discuss your findings with your counselor and what makes the career appealing

Tip: Ask the engineer you visit how they chose their field and what classes helped most.