



Metalwork

Scouts BSA · Trades

Name

Started

Completed

Metalwork is about shaping metal into useful and beautiful things. You'll learn how metal behaves when you bend, heat, and cool it, then make a project of your own. It's real craftsmanship that blends science and skill.

Requirements

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

- ☐ **1** Read the metalwork safety rules and discuss how to work safely with metal, plus the extra safety rules for the option you pick in requirement 5

Tip: Learn the safety rules for heat, sharp edges, and tools, and wear eye protection every time. Work with a trained adult nearby.

Example: Show your safety setup: safety glasses, leather gloves for hot work, cotton clothes instead of synthetic, long hair tied back, no loose sleeves, a bucket of water and fire extinguisher nearby, and tongs for anything hot.

- ☐ **2** Explain these terms: native metal, malleable, metallurgy, alloy, ferrous, and nonferrous. Then do 2a–2d

Tip: Bend a paper clip back and forth to feel work-hardening happen, then talk about what's going on inside the metal.

Example: Explain terms with things you can hold: brass is an alloy of copper and zinc; steel is iron with carbon; a soda can is aluminum. Work-hardening makes metal stiffer when you bend it, and annealing softens it again with heat.

- ☐ **2a** Name two nonferrous alloys that metalworkers used before the Iron Age, and the metals mixed to make each

- ☐ **2b** Name three ferrous alloys modern metalworkers use

- ☐ **2c** Describe how to work-harden a metal

- ☐ **2d** Describe how to anneal both a nonferrous and a ferrous metal

3 **Hardening, annealing, and tempering**

Tips for this section: Do these steps with your counselor or a skilled adult supervising the heat, and compare how each sample bends before and after.

Example for this section: With your counselor supervising, bend a copper strip 45 degrees and peen along the bend to work-harden it, then anneal that same strip and feel how much easier it is to straighten. Next, make a temper color index on a flat piece of steel, then shape and temper a center punch.

- ☐ **3a** Using 26- or 28-gauge brass or copper sheet, bend a piece 45 degrees and peen heavily along the bend to work-harden it. Note the effort needed to get past the yield point of the unworked metal

- ☐ **3b** Anneal the work-hardened piece from 3a to soften it, then try to straighten the 45-degree bend, noting how much effort it takes to pass the yield point

- ☐ **3c** From a flat steel piece, make a temper color index. Then shape a center punch by hand from medium- or high-carbon steel and temper it

4 Careers or hobbies: Choose 1 of 2

Tips for this section: Visit a welding shop, blacksmith, or jeweler and ask how they learned their trade.

Example for this section: Compare three jobs: a welder who joins steel on a construction site, a machinist who cuts precise parts on a lathe, and a jeweler who shapes silver. Find out the training each needs and what a day looks like.

- ☐ **4a** Name three careers that use metalworking skills. Pick one and research its training, education, certification, experience, costs, job outlook, starting pay, and advancement. Talk over your findings with your counselor, including whether you'd want this career

- ☐ **4b** Identify how metalworking skills could become a personal hobby. Research the extra training, costs, and organizations that could help you get the most from it, then share your findings and your short- and long-term goals with your counselor

5 Metalwork option (after requirements 1–4): Choose 1 of 4

Tips for this section: Choose the project option that excites you most, sketch your plan first, and take your time on each step.

Example for this section: If you choose blacksmithing, you might forge a simple S-hook: heat a steel rod, draw out a taper, scroll the ends, and quench it. Sketch it first and keep notes on each heat.

5a Option A: sheet metal mechanic/tinsmith

- ☐ **5a1** Name the basic sheet metalworking tools and describe how each is used

- ☐ **5a2** Sketch two objects to make from sheet metal, marking each part's dimensions (the sketch doesn't need to be to scale)

- ☐ **5a3** Make the two objects from 24- or 26-gauge sheet metal, using patterns your counselor provides or approves and a metal suited to each object's final use. Shape and join them by cutting, edging, and bending, then soldering or brazing

- ☐ **5a3a** Include at least one riveted part in one of the objects

- ☐ **5a3b** Unless you used zinc-plated or tin-plated sheet steel, protect your work from oxidation

5b Option B: silversmith

- ☐ **5b1** Name a silversmith's basic tools and describe how each is used

- ☐ **5b2** Sketch two objects to make from sheet silver, marking each part's dimensions (not necessarily to scale)

- ☐ **5b3** Make two objects from 18- or 20-gauge sheet copper, using patterns your counselor provides or approves, each with a soldered joint. If you've done silversmithing before, you may use nickel silver, sterling silver, or lead-free pewter instead

- ☐ **5b3a** Include a sawed part you made yourself in at least one object

- ☐ **5b3b** Include a sunken part you made yourself in at least one object

- ☐ **5b3c** Clean and polish both objects

5c Option C: founder

- ☐ **5c1** Describe what each basic part of a two-piece mold does, and name at least three kinds of molds

- ☐ **5c2** Sketch two objects to cast in metal, marking each part's dimensions (not necessarily to scale)

- ☐ **5c3** Make two molds, one from a pattern your counselor provides and one from your own counselor-approved pattern (no copyrighted designs), placing the pouring gate and vents yourself

- ☐ **5c3a** Cast lead-free pewter in a mold your counselor provides

- ☐ **5c3b** Cast lead-free pewter in the mold you made yourself

5d Option D: blacksmith

- ☐ **5d1** Name a blacksmith's basic tools and describe how each is used

- ☐ **5d2** Sketch two objects to hot-forge, marking each part's dimensions (not necessarily to scale)

5d3 Forging exercises (low-carbon steel, 1/4 in. or thicker)

- ☐ **5d3a** With low-carbon steel 1/4 inch or thicker, forge a taper by drawing out the metal

- ☐ **5d3b** With low-carbon steel 1/4 inch or thicker, forge a U-shaped bend over the horn of the anvil

- ☐ **5d3c** With square low-carbon steel 1/4 inch or thicker, form a decorative twist

- ☐ **5d3d** With low-carbon steel 1/4 inch or thicker, forge an L-shaped bend over the edge of the anvil

- ☐ **5d4** With your counselor's approval first, hot-forge the two objects you sketched from low-carbon steel 1/4 inch or thicker

- ☐ **5d4a** Give one object a decorative twist

- ☐ **5d4b** Give one object a hammer-riveted joint

- ☐ **5d4c** Protect your work from oxidation