Metalwork

Merit Badge Workbook

This workbook can help you but you still need to read the merit badge pamphlet.
This Workbook can help you organize your thoughts as you prepare to meet with your merit badge counselor

Merit Badge Counselors may not require the use of this or any similar workbooks.
You still must satisfy your counselor that you can demonstrate each skill and have learned the information.
You should use the work space provided for each requirement to keep track of which requirements have been completed,
and to make notes for discussing the item with your counselor, not for providing full and complete answers.
If a requirement says that you must take an action using words such as "discuss", "show",
"tell", "explain", "demonstrate", "identify", etc, that is what you must do.
No one may add or subtract from the official requirements found in Scouts BSA Requirements (Pub. + 33216) and/or on Scouting.org.
The requirements were last issued or revised in 2021 • This workbook was updated in November 2023.

Scout's Name:_____ Unit_____Date Started _____

Counselor's Name: _____ Phone No.:_____Email: _____

Please submit errors, omissions, comments or suggestions about this **workbook** to: Workbooks@USScouts.Org
Comments or suggestions for changes to the **requirements** for the **merit badge** should be sent to: Merit.Badge@Scouting.Org

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1. Read the safety rules for metalwork. Discuss how to be safe while working with metal.

Discuss with your counselor the additional safety rules that apply to the metalwork option you choose for requirement 5.

2. Define the terms native metal, malleable, metallurgy, alloy, nonferrous, and ferrous.

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Native Metal	
Malleable,	
Metallurgy,	
Alloy,	
Nonferrous,	
Ferrous.	

Then do the following:

a. Name two nonferrous alloys used by pre-Iron Age metalworkers. Name the metals that are combined to form these alloys.

Alloy		Combination of:	
		and	
		and	

b. Name three ferrous alloys used by modern metalworkers.

1.	
2.	
3.	

c. Describe how to work–harden a metal.

d. Describe how to anneal a non-ferrous and a ferrous metal.

3. Do the following:

☐ a. Work-harden a piece of 26- or 28-gauge sheet brass or sheet copper. Put a 45-degree bend in the metal, then heavily peen the area along the bend line to work-harden it.

Note the amount of effort that is required to overcome the yield point in this unworked piece of metal.

☐ b. Soften the work hardened piece from requirement 3a by annealing it and then try to remove the 45–degree bend. Note the amount of effort that is required to overcome the yield point.

☐ c. Make a temper color index from a flat piece of steel. Using hand tools, make and temper a center punch of medium-carbon or high-carbon steel.

4. Find out about three career opportunities in metalworking.

1.
2.
3.

Pick one and find out the education, training, and experience required for this profession.

Career:	
Education:	
Training:	
Experience:	

Discuss this with your counselor, and explain why this profession might interest you.

5. After completing the first four requirements, complete at least ONE of the options listed below.

☐ a. **Option 1 – Sheet Metal Mechanic / Tinsmith**

1. Name and describe the use of the basic sheet metalworking tools.

2. Create a sketch of two objects to make from sheet metal. Include each component's dimensions on your sketch, which need not be to scale.

3. Make two objects out of 24- or 26–gauge sheet metal. Use patterns either provided by your counselor or made by you and approved by your counselor. Construct these objects using a metal that is appropriate to the object's ultimate purpose, and using cutting, bending, edging, and either soldering or brazing.
   - ☐ a. One object also must include at least one riveted component.
   - ☐ b. If you do not make your objects from zinc-plated sheet steel or tin-plated sheet steel, preserve your work from oxidation.

☐ b. **Option 2 - Silversmith**

1. Name and describe the use of a silversmith's basic tools.

2. Create a sketch of two objects to make from sheet silver. Include each component's dimensions on your sketch, which need not be to scale.

3. Make two objects out of 8- or 20- gauge sheet copper. Use patterns either provided by your counselor or made by you and approved by your counselor. Both objects must include a soldered joint. If you have prior silversmithing experience, you may substitute sterling silver, nickel silver, or lead free pewter.
   - ☐ a. At least one object must include a sawed component you have made yourself.
   - ☐ b. At least one object must include a sunken part you have made yourself.
   - ☐ c. Clean and polish your objects.

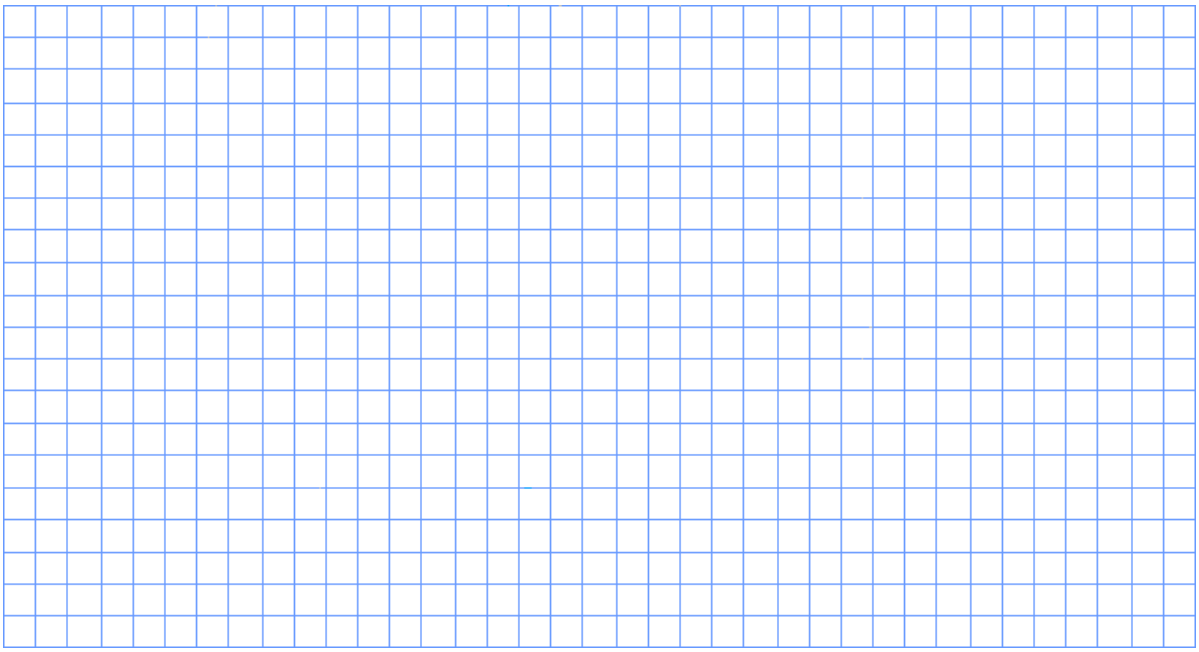
☐ c. **Option 3 – Founder**

1. Name and describe the use of the basic parts of a two–piece mold.

Name at least three different types of molds.

1.
2.
3.

2. Create a sketch of two objects to cast in metal. Include each component's dimensions on your sketch, which need not be to scale.



3. Make two molds, one using a pattern provided by your counselor and another you have made yourself that has been approved by your counselor. Position the pouring gate and vents yourself. Do not use copyrighted materials as patterns.
   - ☐ a. Using lead-free pewter, make a casting using a mold provided by your counselor.
   - ☐ b. Using lead-free pewter, make a casting using the mold that you have made.

☐ d. **Option 4 - Blacksmith**

1. Name and describe the use of a blacksmith's basic tools.

2. Make a sketch of two objects to hot-forge. Include each component's dimensions on your sketch, which need not be to scale.

3. Using low–carbon steel at least ¼ inch thick, perform the following exercises:
   - ☐ a. Draw out by forging a taper.
   - ☐ b. Use the horn of the anvil by forging a U-shaped bend.
   - ☐ c. Form a decorative twist in a piece of square steel.
   - ☐ d. Use the edge of the anvil to bend metal by forging an L–shaped bend.
4. Using low-carbon steel at least ¼ inch thick, make the two objects you sketched that require hot-forging. Be sure you have your counselor's approval before you begin.
   - ☐ a. Include a decorative twist on one object.
   - ☐ b. Include a hammer-riveted joint in one object.
   - ☐ c. Preserve your work from oxidation.

When working on merit badges, Scouts and Scouters should be aware of some vital information in the current edition of the *Guide to Advancement* (BSA publication 33088). Important excerpts from that publication can be downloaded from http://usscouts.org/advance/docs/GTA-Excerpts-meritbadges.pdf.
You can download a complete copy of the *Guide to Advancement* from http://www.scouting.org/filestore/pdf/33088.pdf.