



# Metalwork

## Merit Badge Workbook

This workbook can help you but you still need to read the merit badge pamphlet.

The work space provided for each requirement should be used by the Scout to make notes for discussing the item with his counselor, not for providing the full and complete answers. Each Scout must do each requirement.

No one may add or subtract from the official requirements found in **Boy Scout Requirements** (Pub. 33216 – SKU 34765).

The requirements were last issued or revised in 2008 • This workbook was updated in June 2012.

Scout's Name: \_\_\_\_\_ Unit: \_\_\_\_\_

Counselor's Name: \_\_\_\_\_ Counselor's Phone No.: \_\_\_\_\_

<http://www.USScouts.Org> • <http://www.MeritBadge.Org>

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

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.

malleable, \_\_\_\_\_

metallurgy, \_\_\_\_\_

alloy, \_\_\_\_\_

nonferrous, \_\_\_\_\_

and 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.

\_\_\_\_\_  
\_\_\_\_\_

b. Name three ferrous alloys used by modern metalworkers.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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.

\_\_\_\_\_

\_\_\_\_\_

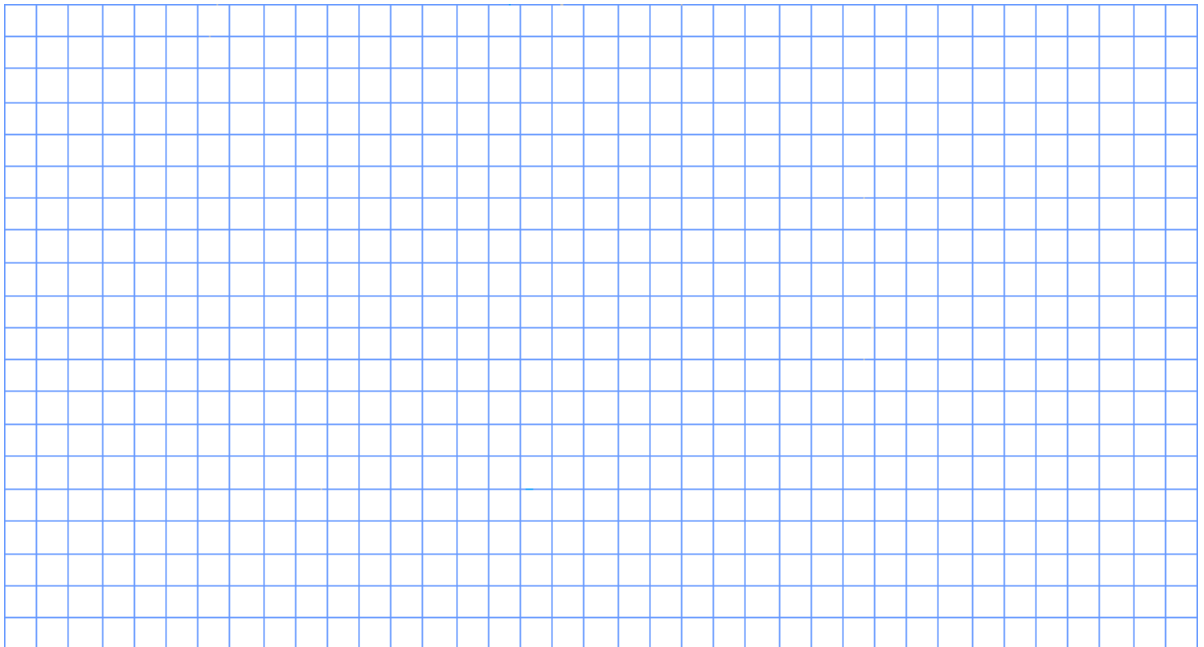
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5. After completing the first four requirements, complete at least ONE of the options listed below.

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.



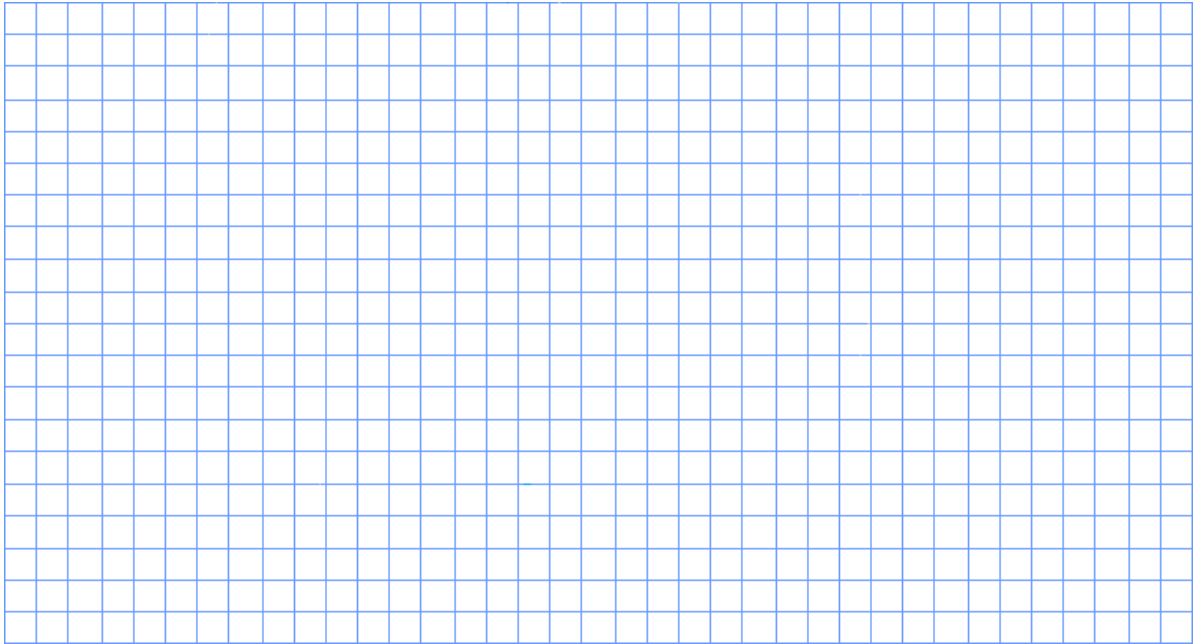
3. Make two objects out of 24- or 26-gauge sheet metal. Use patterns either provided by your counselor or made by you and approved by your counselor. Construct these objects using a metal that is appropriate to the object's ultimate purpose, and using cutting, bending, edging, and either soldering or 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.

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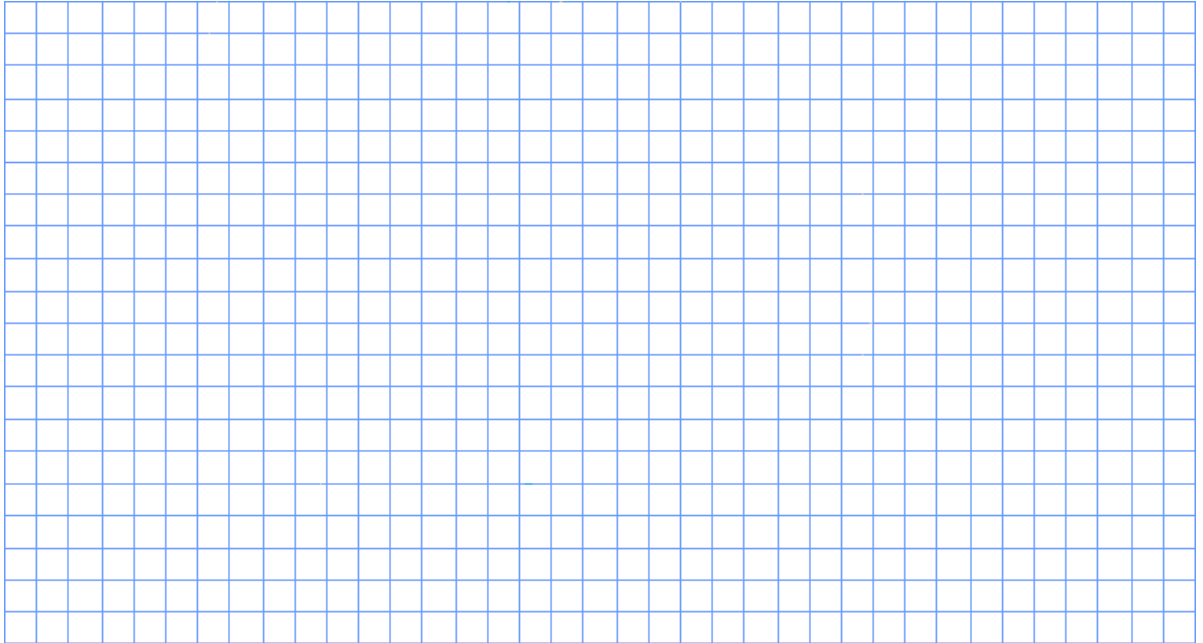
Name at least three different types of molds.

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- 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.

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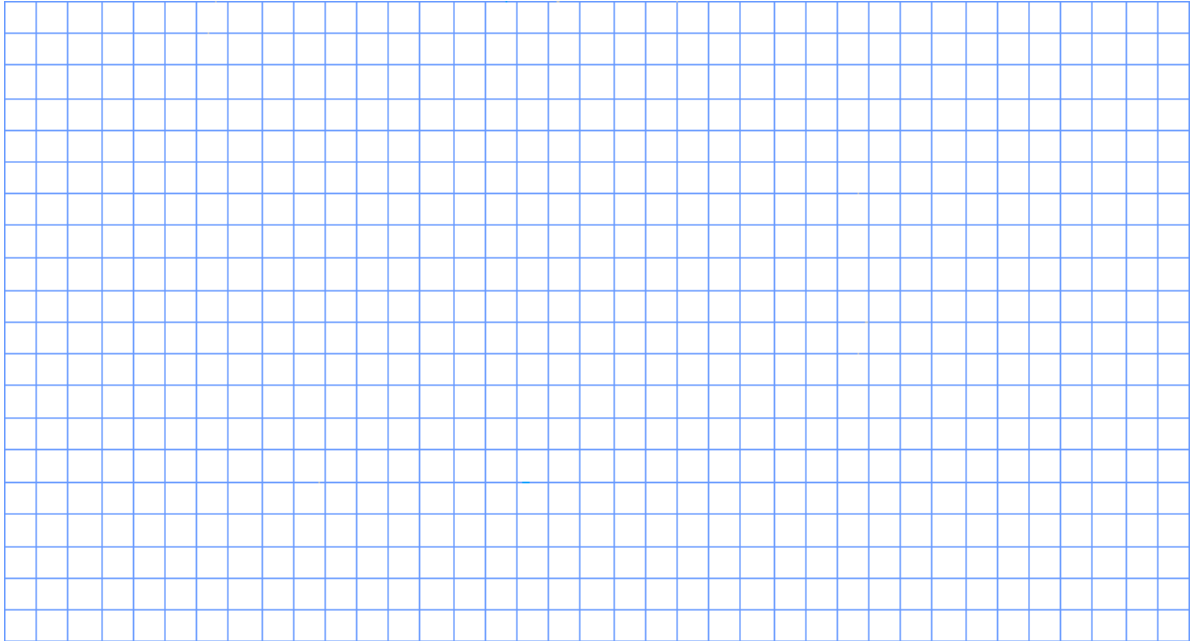
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2. Make a sketch of two objects to hot-forge. Include each component's dimensions on your sketch, which need not be to scale.



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.

**Requirement resources can be found here:**  
[http://www.meritbadge.org/wiki/index.php/Metalwork#Requirement\\_resources](http://www.meritbadge.org/wiki/index.php/Metalwork#Requirement_resources)

## Important excerpts from the [‘Guide To Advancement’](#), No. 33088:

Effective January 1, 2012, the ‘Guide to Advancement’ (which replaced the publication ‘Advancement Committee Policies and Procedures’) is now the official Boy Scouts of America source on advancement policies and procedures.

- **[ Inside front cover, and 5.0.1.4 ] — Unauthorized Changes to Advancement Program**  
**No council, committee, district, unit, or individual has the authority to add to, or subtract from, advancement requirements.**  
(There are limited exceptions relating only to youth members with disabilities. For details see section 10, “Advancement for Members With Special Needs”.)
- **[ Inside front cover, and 7.0.1.1 ] — The [‘Guide to Safe Scouting’](#) Applies**  
Policies and procedures outlined in the ‘Guide to Safe Scouting’, No. 34416, apply to all BSA activities, including those related to advancement and Eagle Scout service projects. [Note: Always reference the online version, which is updated quarterly.]
- **[ 7.0.3.1 ] — The Buddy System and Certifying Completion**  
Youth members must not meet one-on-one with adults. Sessions with counselors must take place where others can view the interaction, or the Scout must have a buddy: a friend, parent, guardian, brother, sister, or other relative—or better yet, another Scout working on the same badge—along with him attending the session. When the Scout meets with the counselor, he should bring any required projects. If these cannot be transported, he should present evidence, such as photographs or adult certification. His unit leader, for example, might state that a satisfactory bridge or tower has been built for the Pioneering merit badge, or that meals were prepared for Cooking. If there are questions that requirements were met, a counselor may confirm with adults involved. Once satisfied, the counselor signs the blue card using the date upon which the Scout completed the requirements, or in the case of partials, initials the individual requirements passed.
- **[ 7.0.3.2 ] — Group Instruction**  
It is acceptable—and sometimes desirable—for merit badges to be taught in group settings. This often occurs at camp and merit badge midways or similar events. Interactive group discussions can support learning. The method can also be attractive to “guest experts” assisting registered and approved counselors. Slide shows, skits, demonstrations, panels, and various other techniques can also be employed, but as any teacher can attest, not everyone will learn all the material.

There must be attention to each individual’s projects and his fulfillment of *all* requirements. We must know that every Scout—actually and *personally*—completed them. If, for example, a requirement uses words like “show,” “demonstrate,” or “discuss,” then every Scout must do that. It is unacceptable to award badges on the basis of sitting in classrooms *watching* demonstrations, or remaining silent during discussions. Because of the importance of individual attention in the merit badge plan, group instruction should be limited to those scenarios where the benefits are compelling.

- **[ 7.0.3.3 ] — Partial Completions**  
Scouts need not pass all requirements with one counselor. The Application for Merit Badge has a place to record what has been finished—a “partial.” In the center section on the reverse of the blue card, the counselor initials for each requirement passed. In the case of a partial completion, he or she does not retain the counselor’s portion of the card. A subsequent counselor may choose not to accept partial work, but this should be rare. A Scout, if he believes he is being treated unfairly, may work with his Scoutmaster to find another counselor. An example for the use of a signed partial would be to take it to camp as proof of prerequisites. Partials have no expiration except the 18th birthday.