

2010

METALWORK PROGRAM OVERVIEW & WORKBOOK



STUHR MUSEUM

BLACKSMITH SHOP

MERIT BADGE UNIVERSITY

OVERLAND TRAILS COUNCIL

7/31/2010

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(WILL BE COMPLETED DURING CLASS)

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(MUST HAVE UNIT LEADER SIGNATURE PRIOR TO CLASS)



FEBRUARY 2010

Information in this booklet was accurate at the time of publishing.
Boy Scouts Requirements 2010, Copyrighted Boy Scouts of America
Program Overview & Workbook was reviewed by
MBU Staff/Committee.

METALWORK PROGRAM OVERVIEW

COUNSELOR: tba

C/O: Overland Trails Council
PO Box 1361
Grand Island, NE 68802-1361

LOCATION: Stuhr Museum, Blacksmith Shop

TRANSPORTATION: N/A

ADDITIONAL COSTS: None

CLASS SIZE: 10

BRING TO CLASS: Old set of clothes.
Metalwork merit badge pamphlet.
Metalwork merit badge workbook, part one & part two.
Signed "Application for Merit Badge", found at the end of the merit badge workbook. (This will be your only record of work completed on this merit badge.) If your Council requires the official "blue card", you must bring one with you to class.

PRE-REQUISITES: Complete Part One of the workbook before class (requirements 1, 2, & 4).
Complete information on "Application for Merit Badge" including Scoutmasters signature.

CURRICULUM: Requirements 3 & Option 4 will be completed during class (part two of the workbook). Pre-requisites may also be reviewed during class.





PRE-REQUISITE REQUIREMENTS ARE PRINTED IN **ITALICS &**
MUST BE COMPLETED BEFORE CLASS.

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. 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 metal workers**
 - c) **Describe how to work-harden a metal.**
 - d) **Describe how to anneal a nonferrous 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. Pick one and find out the education, training, and experience required for this profession. 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 18- 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

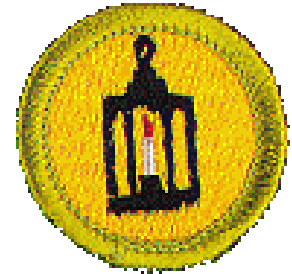
- 1) Name and describe the use of the basic parts of a two-piece mold. Name at least three different types of molds.
- 2) Create a sketch of two objects to cast in metal. Include each component's dimensions on your sketch, which need not be to scale.
- 3) Make two molds, one using a pattern provided by your counselor and another one 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 $\frac{1}{4}$ 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 $\frac{1}{4}$ 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.

METALWORK WORKBOOK

PART ONE, PRE-REQUISITIES



Name _____
 Unit # _____ District _____
 Council _____

Part One of the workbook must be completed before class.

Bring the entire workbook (part one and part two) with you to class.

Also bring the "Application for Merit Badge" signed by your scoutmaster (included at the end of the workbook).

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.

How to be safe while working with metal:

Additional safety rules that apply to the metalwork option:

2. Define the terms native metal, malleable, metallurgy, alloy, nonferrous, and ferrous. Then do the following:

Define the following:

<i>Native metal</i>	
<i>Malleable</i>	
<i>Metallurgy</i>	
<i>Alloy</i>	
<i>Nonferrous</i>	
<i>Ferrous</i>	

Name _____

2. continued

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

Nonferrous alloys used by pre-Iron Age metalworkers

<i>Alloys</i>	<i>Metals that are combined to form these alloys</i>
1	
2	

- b) Name three ferrous alloys used by modern metal workers

Ferrous alloys used by modern metal workers:

1
2
3

- c) Describe how to work-harden a metal.

Work-harden a metal:

- d) Describe how to anneal a nonferrous and a ferrous metal.

Describe how to anneal:

<i>Nonferrous metal</i>	<i>Ferrous metal</i>

Name _____

- 4. Find out about three career opportunities in metalworking. Pick one and find out the education, training, and experience required for this profession. Discuss this with your counselor, and explain why this profession might interest you.

Career opportunities in metalworking:

1.

2.

3.

Pick one career:

Career:

Education:

Training:

Experience:

Why this profession interest's you:



METALWORK WORKBOOK PART TWO, CLASS CURRICULUM

Name _____
Unit # _____ District _____
Council _____

Part Two of the workbook will be completed during class.

- 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.

Work-harden:

Initial: date:

- 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.

Annealing:

Initial: date:

- 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.

Temper color index:

Initial: date:

Name _____

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

OPTION ONE

- a) **Option 1—Sheet Metal Mechanic/Tinsmith**
 - 1) Name and describe the use of the basic sheet metalworking tools.

<i>Sheet metalworking tool</i>	<i>Describe its use</i>

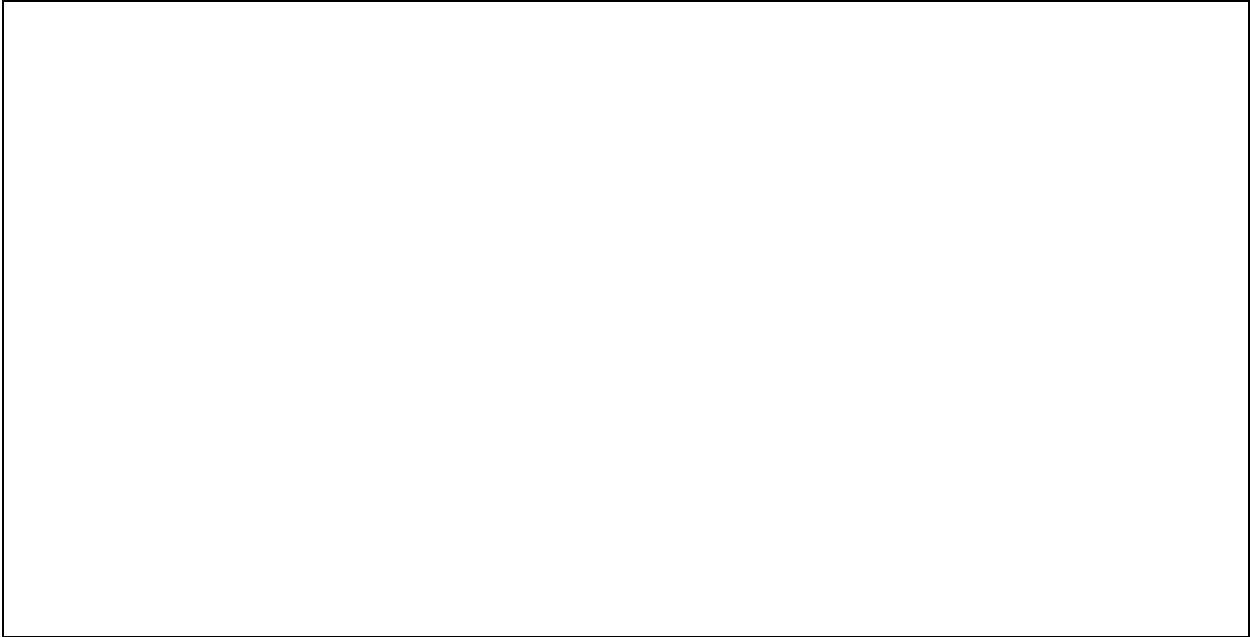


Name _____

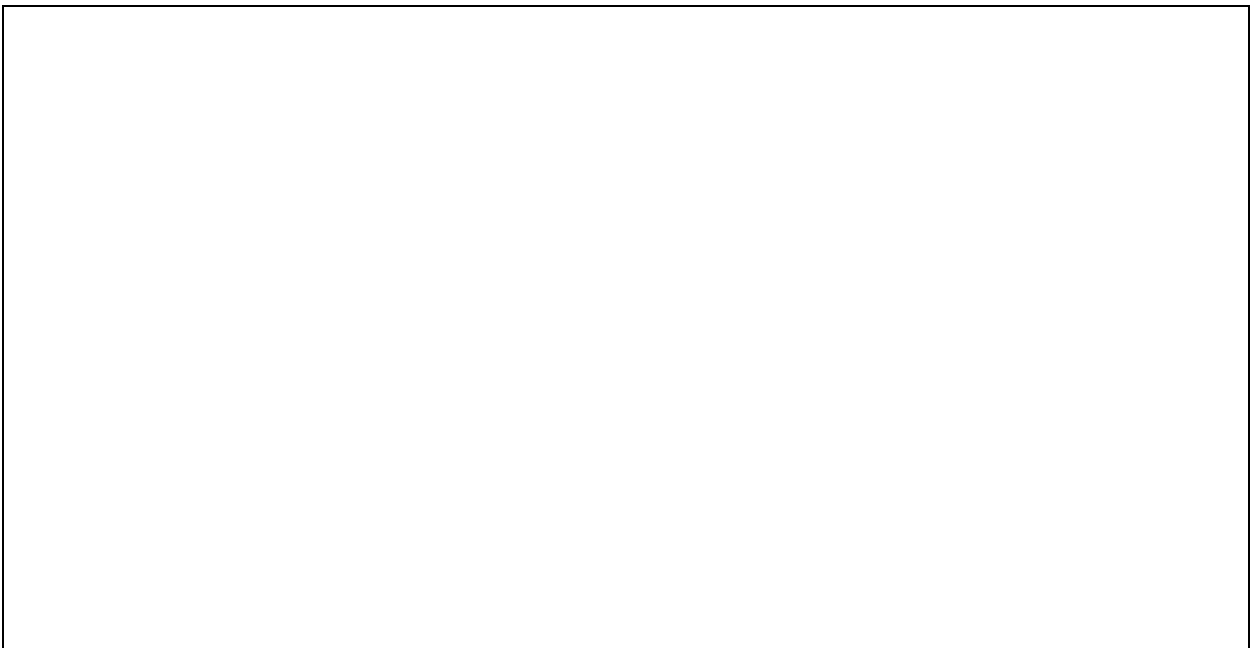
OPTION ONE, continued

- 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.

Sketch one:



Sketch two:



Name _____

OPTION ONE, continued

- 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.

Object one:

	<i>Initial:</i>	<i>date:</i>
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Object two:

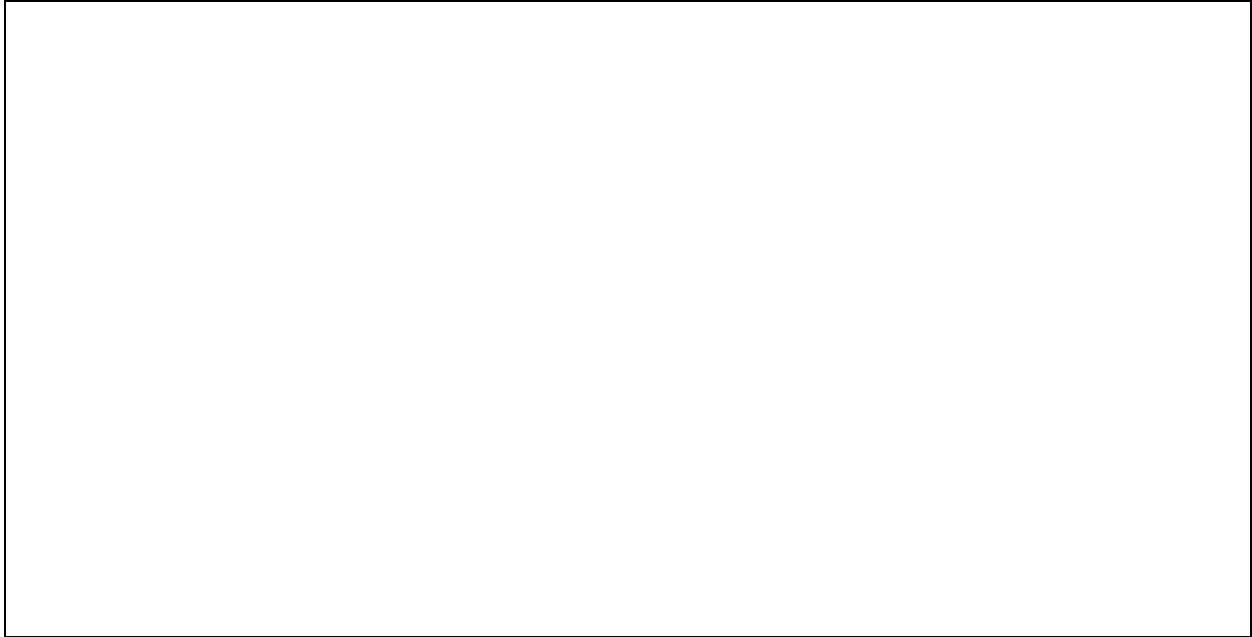
	<i>Initial:</i>	<i>date:</i>
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Name _____

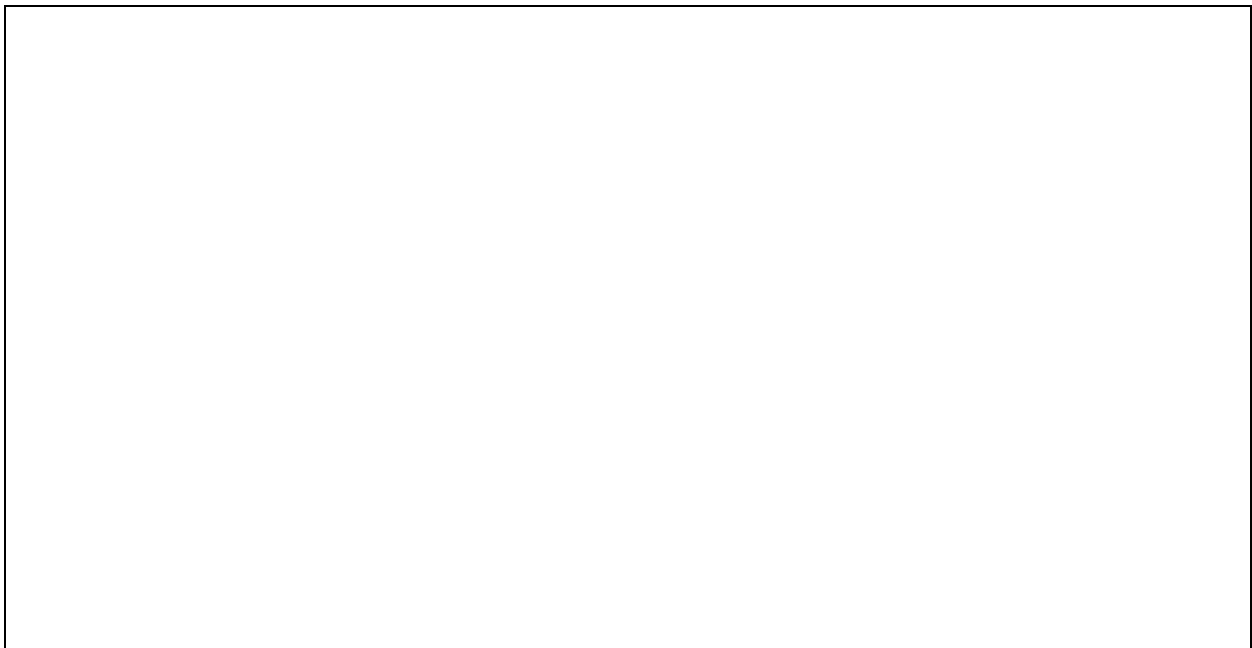
OPTION TWO, continued

- 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.

Sketch one:



Sketch two:



Name _____

OPTION TWO, continued

- 3) Make two objects out of 18- 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

Object one:

	<i>Initial:</i>	<i>date:</i>
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Object two:

	<i>Initial:</i>	<i>date:</i>
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Name _____

OPTION THREE

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.

Name and describe:

<i>Parts of a Mold</i>	<i>Describe their Use</i>

Types of molds:

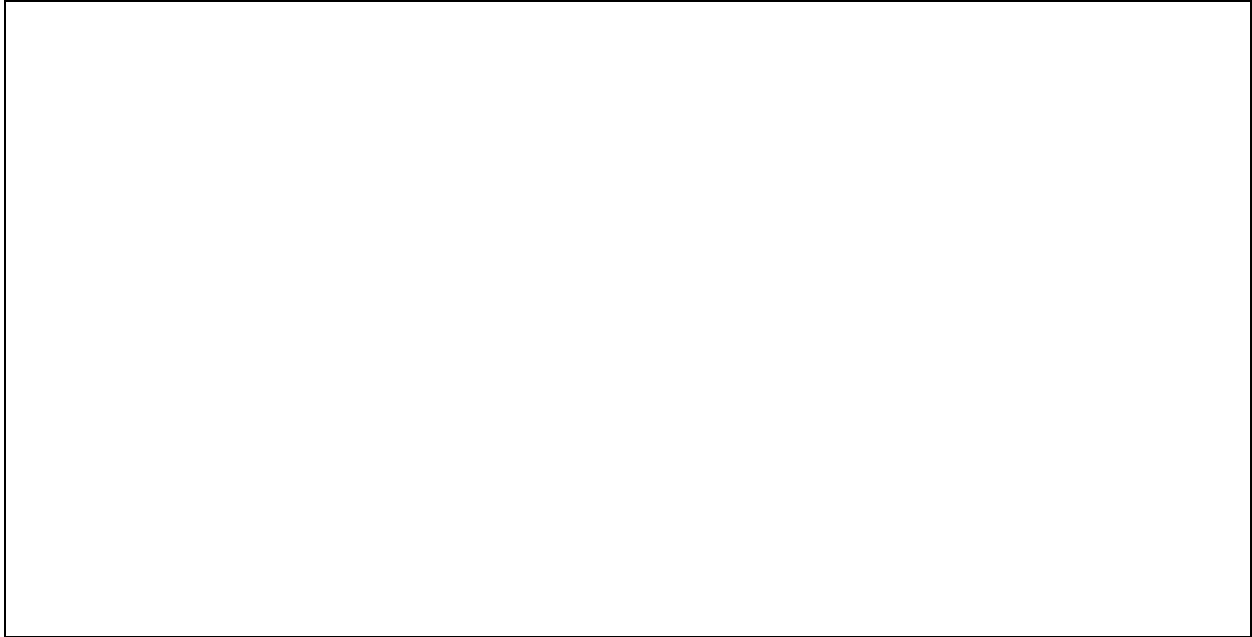
<i>1</i>
<i>2</i>
<i>3</i>

Name _____

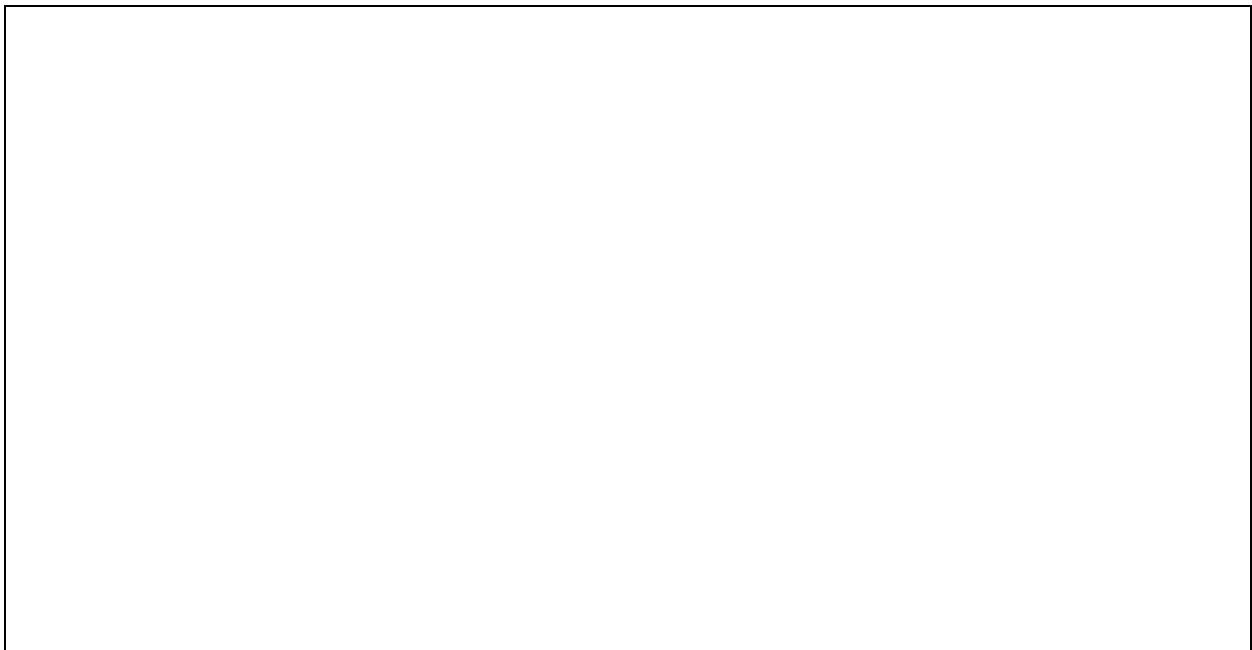
OPTION THREE, continued

- 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.

Sketch one:



Sketch two:



Name _____

OPTION THREE, continued

- 3) Make two molds, one using a pattern provided by your counselor and another one 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.

Mold provided by your counselor:

<i>Initial:</i>	<i>date:</i>
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- b. Using lead-free pewter, make a casting using the mold that you have made.

Mold you made:

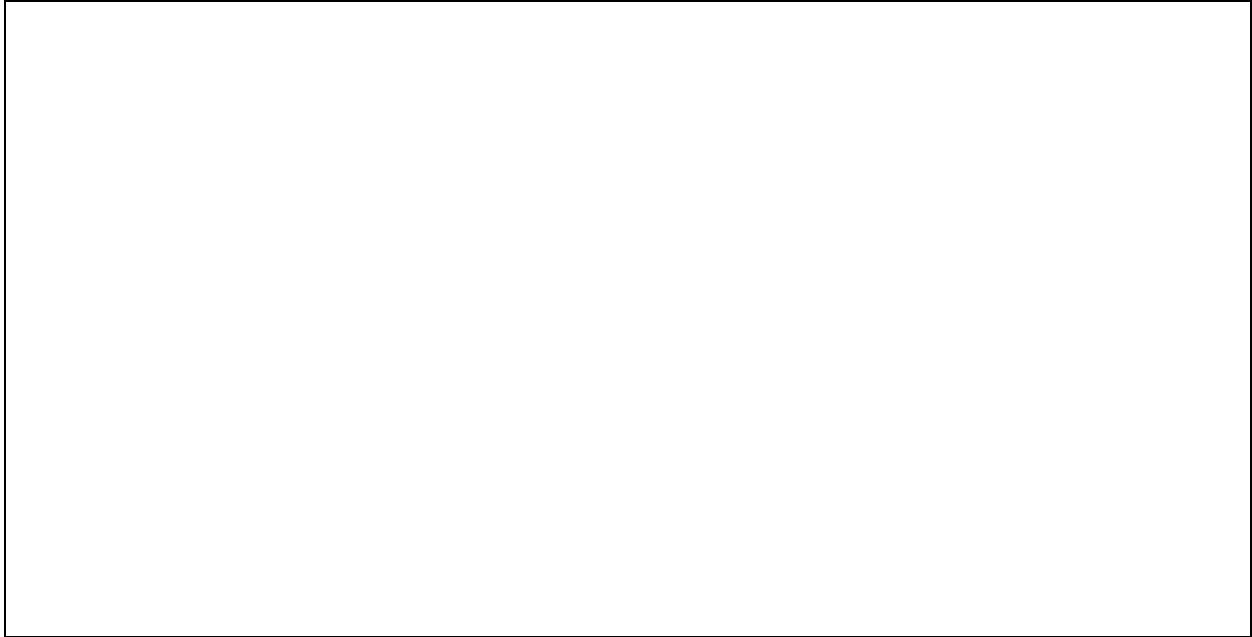
<i>Initial:</i>	<i>date:</i>
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Name _____

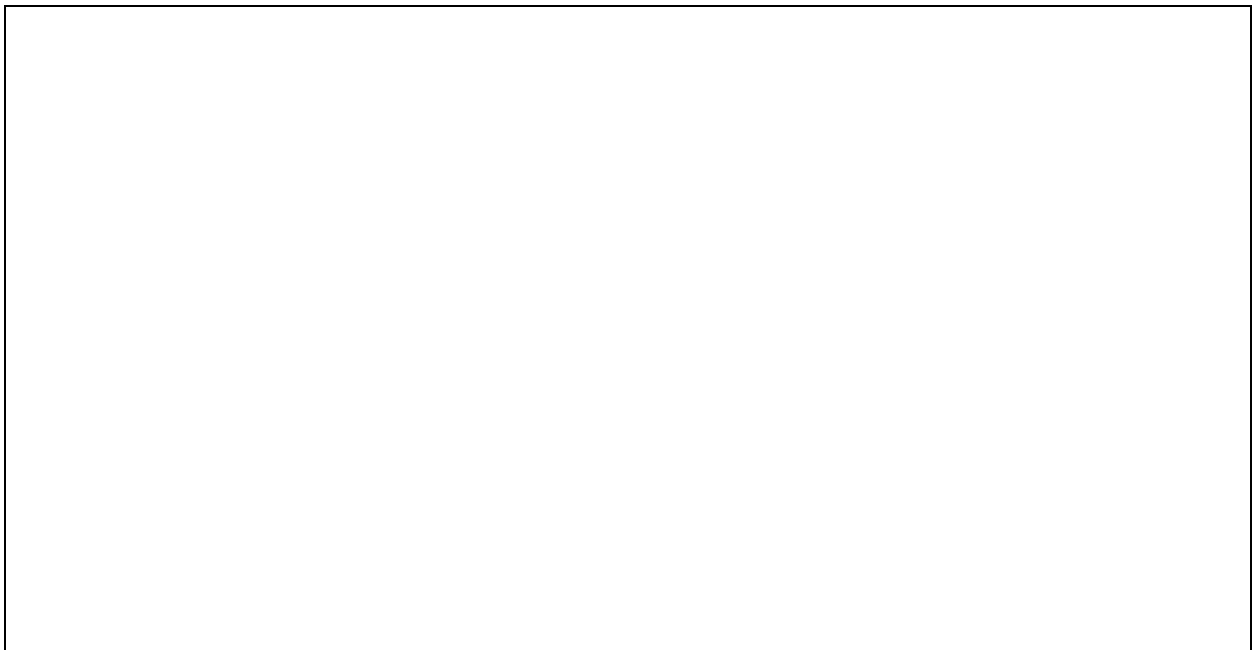
OPTION FOUR, continued

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

Sketch one:



Sketch two:



Name _____

OPTION FOUR, continued

- 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.

Hot-forging object one:

	<i>Initial:</i>	<i>date:</i>
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Hot-forging object two:

	<i>Initial:</i>	<i>date:</i>
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ORGANIZATIONS and WEB SITES

(Whenever you go online, be sure you have your parent's permission first.)

Artist-Blacksmith's Association of North America

<http://www.abana.org>

The ArtMetal Resources to Metalworking

<http://www.artmetal.com>

National Ornamental metal Museum

<http://www.metalmuseum.org>

Society of American Silversmiths

<http://www.silversmithing.com>

METALWORK WORKBOOK

Notes



APPLICATION FOR MERIT BADGE

Name: _____

Address: _____

City: _____

State: _____

Is a registered _____ Boy Scout,
 _____ Varsity Scout,
 _____ Venturer,

of _____ No. _____
Troop, team, crew, ship

District: _____

Council: _____

MERIT BADGE UNIVERISTY

Merit Badge: **Metalwork**

Counselor: _____

Address: Overland Trails Council

PO Box 1361

2808 O'Flannagan

Grand Island, NE 68802-1361

Phone: 308-382-3717

email: mbuotc@yahoo.com

and is qualified to begin working for this merit badge and has completed the following pre-requisite requirements:

SECTION A PRE-REQUISITE REQUIREMENTS

Requirement No. and letter	Date of Approval	Counselor Initial	Requirement No. and letter	Date of Approval	Counselor Initial
1					
2					
4					

The applicant has personally appeared before me and demonstrated to my satisfaction that he has met all pre-requisites requirements for the above stated merit badge and is ready to attend his assigned MBU class.

Signature of Unit Leader _____ Date _____

SECTION B APPLICANTS RECORD

Requirement No. and letter	Date of Approval	Counselor Initial	Requirement No. and letter	Date of Approval	Counselor Initial
3					
(Option 4) 1					
(Option 4) 2					
(Option 4) 3					
(Option 4) 4					

The applicant has personally appeared before me and demonstrated to my satisfaction that he has completed all requirements in **SECTION B** above for the

Merit Badge: **Metalwork**

Name of Counselor: _____

Signature of Counselor _____ Date _____

SCOUT INSTRUCTIONS

- Complete your name, address, city, unit type & number, district, & council on the Application for Merit Badge.
- Your unit leader must sign the Application for Merit Badge before attending class.
- All other information is already printed on the Application for Merit Badge; please make sure all information is correct.
- The merit badge counselor is registered & approved for this merit badge and is on the MBU Counselor's List.
- Read the merit badge pamphlet.
- Attend the merit badge class.
- Always meet with your counselor along with a buddy (a Scout, friend, or parent)
- Have your merit badge worksheet with you when you attend class.
- **If the merit badge pre-requisites are not completed before class, you will not be able to complete the merit badge during this weekend event, you will have to follow up with your Unit's Advancement Chair when you return home**
- **PLEASE BE AWARE THAT SOME COUNSELORS WILL NOT ALLOW YOU TO ATTEND THEIR CLASS WITHOUT PRE-REQUISITES COMPLETED—CLASS CURRICULUM IS DEPENDENT ON PRE-REQUISITE WORK BEING COMPLETED!**

COUNSELOR INSTRUCTIONS

- Never meet alone with a Scout.
- Verify all information & merit badge name on Application for Merit Badge is correct.
- Sign your name on the line at the bottom of **"SECTION B APPLICANTS RECORD"**.