

# Make a Mini Shield and Letter Opener

## Description

Metal fabrication involves the use of a basic set of skills—cutting, bending, and assembling processes—to create something from raw material. In this activity plan, students will put all the various stages of fabrication to work as they fabricate their own mini shield and letter opener. Teachers will demonstrate equipment and process and the students will follow up by building their own mini shield and letter opener.

## Lesson Objectives

The student will be able to:

- Identify common metals
- Demonstrate appropriate shop behaviour
- Demonstrate safe and appropriate use of hand tools and equipment
- Use appropriate layout tools
- Place and rivet components in the correct location
- Demonstrate proficient riveting

## Assumptions

The student:

- Has demonstrated previous metallurgical knowledge
- Understands basic layout techniques
- Can perform basic measurement
- Demonstrates safe tool and equipment use

## Terminology

**Hilt:** handle of a tool or sword.

**Hilt topper:** top section of the handle that separates your hand from the blade.

## Estimated Time

5–10 hours

The time for this activity will depend on the familiarity of students with tools and the amount of equipment available.



## Recommended Number of Students

20, based on *BC Technology Educators' Best Practices Guide*

## Facilities

Secondary school metal shop or equivalently equipped technology education shop

## Equipment/Machinery

- Bench grinder
- Drill press
- Foot shear
- Slip roller

## Tools

- Aviation snips
- Ball peen hammer
- Beverly shear
- Whitney punch
- Centre punch
- Scribe
- Permanent marker
- Square
- Steel scale
- File
- Emery cloth

## Materials

Item	# of pieces	Material	Thickness	Width	Length
Shield body	1	22 ga sheet metal	22 ga	6"	6"
Shield dome	1	22 ga sheet metal	22 ga	3"	3"
Shield back plate	1	22 ga sheet metal	22 ga	½"	3"
Letter opener	1	½" band iron	⅛"	½"	9"
Hilt topper	1	½" band iron	⅛"	½"	3"

5 – ⅛" aluminum pop rivets

## Resources

### How to use a Beverly shear

<https://www.youtube.com/watch?v=1vKgqse-40k>

### How to use a foot shear

[https://www.youtube.com/watch?v=w8d3n\\_kvlyM](https://www.youtube.com/watch?v=w8d3n_kvlyM)

### How to rivet

<https://www.youtube.com/watch?v=xv2RBLPYikY>

### How to use a slip roller

<https://www.youtube.com/watch?v=bmt5ixgpKTY>

## Teacher-led Activity

Lead the class through the following steps to fabricate a mini shield and letter opener.

### Shield body

1. Obtain a piece of 22 ga aluminum sheet metal.
2. Teacher demonstrates layout and foot shear safety. Use aviation snips if a foot shear is unavailable.
3. Lay out and cut a 6" × 6" square of sheet metal.
4. Trace template and cut along layout lines with aviation snips.
5. File shield to uniform shape and remove sharp edges.
6. Teacher demonstrates slip roller to students. You can leave the shield flat if a slip roller is unavailable.
7. Roll shield through slip roller to give shield a slightly convex shape.
8. Using emery cloth, sand entire surface of shield.
9. Using your thumb over the emery cloth, twist emery cloth to create swirls over the entire surface of the shield.

### Shield back plate

1. Obtain a piece of ½" sheet metal strip. Measure 3" and cut.
2. Use emery cloth to smooth any burrs around edges.

### Shield dome

1. Cut a piece of aluminum sheet metal 3" × 3" square.
2. Clamp a 2" diameter pipe vertically into a vise.

3. Centre sheet metal over pipe. Begin peening the centre of sheet metal starting from the centre and moving out towards the edges in circular patterns, to create a dome shape.
4. Trace and cut a 3" diameter circle around the dome to leave a ½" lip around the dome.
5. File edges of the circle uniform and smooth.
6. Mark out 4 evenly spaced holes around dome.
7. Teacher demonstrates Whitney punch. Use ⅛" drill bit in hand drill or drill press, if Whitney punch is unavailable.
8. Using the Whitney punch with a ⅛" die, punch out 4 marks.
9. Place the dome on the shield and transfer 4 Whitney punch marks with scribe.

**Assembly of shield**

1. Use the Whitney punch to punch holes in shield.
2. Lay out shield back plate behind two horizontal holes on shield and transfer marks with scribe.
3. Use the Whitney punch to punch holes in the backing plate.
4. Place a rivet through the dome, shield, and backing plate.
5. Place the rivet in a suitable recess of the rivet set and flatten the rivet with a ball peen hammer.
6. Rivet the other side of the backing plate.

**Small sword letter opener**

1. Obtain a piece of ⅛" × ½" flat bar and cut to 9".
2. File one end of flat bar to ½" diameter and the other end to a ⅛" diameter taper, as per plans.
3. File 90° notches that are ⅛" deep into flat bar, as per plans, to create the hilt.
4. File edges of letter opener blade to a mild chamfer.
5. Obtain a piece of ½" flat bar and cut to 3" long to create hilt topper.
6. Lay out radius lines on hilt topper as per plans.
7. File to lines to create shape on hilt topper.
8. Centre punch middle of hilt topper and drill with ⅛" drill bit.
9. Lay out centre punch mark on sword handle as per plans and drill with ⅛" drill bit.

10. Countersink hole with  $\frac{3}{8}$ " drill bit on one side.
11. File both pieces to remove any burrs after drilling.

**Assembly of letter opener**

1. Place a rivet set in the vise.
2. Place a  $\frac{1}{8}$ " rivet through the hilt topper and letter opener.
3. Position the rivet head into the corresponding hole on the rivet set anvil.
4. Use a ball peen hammer to mushroom the rivet.
5. Hammer the rivet flat against the letter opener back.
6. File any excess material from the rivet to make it smooth against the hilt.

**Finishing**

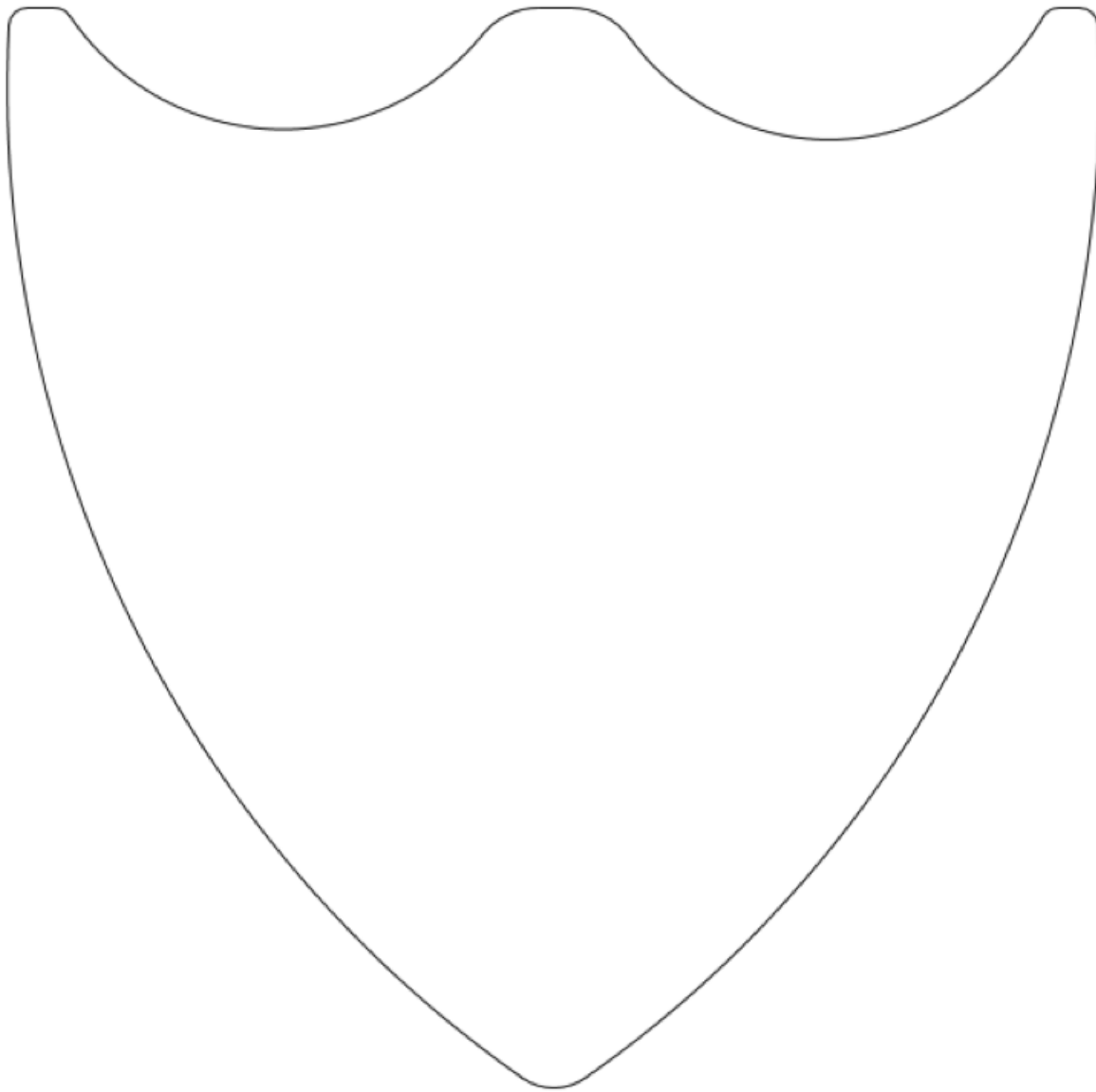
1. Clean any grease, dirt, or scratches in the metal using emery cloth.
2. Choose an appropriate method of finishing (painting, powder coating, etc.).

**Assessment**

Consider co-creating the assessment criteria with your students at the beginning of the activity/project. You may want to include the following:

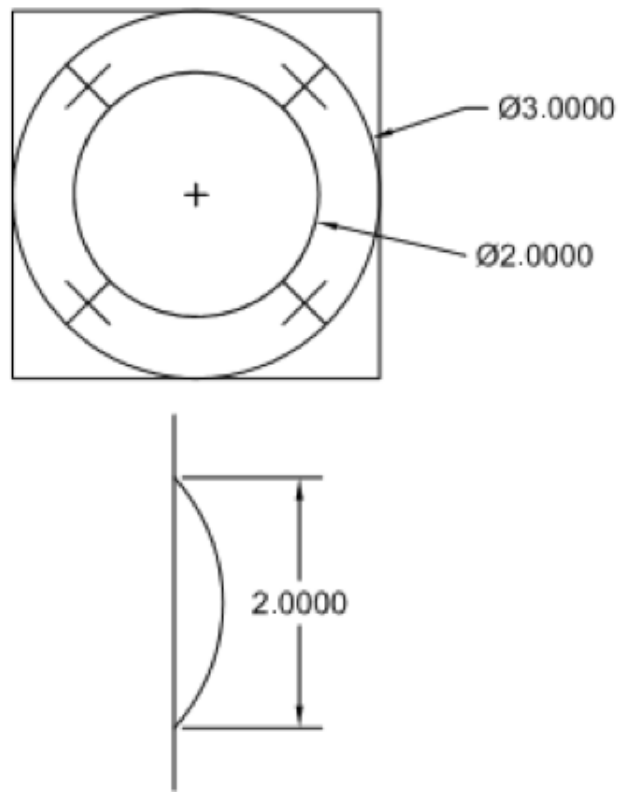
- Shield size is within  $\frac{1}{16}$ " to  $\frac{1}{8}$ " of the template size overall
- Dome is evenly hammered out
- Outside edge of dome is within  $\frac{1}{16}$ " of a 3" circle
- Shield riveting is flat and smooth
- Letter opener length is within  $\frac{1}{16}$ "
- Handle riveting is flat and smooth to handle
- Hilt is within  $\frac{1}{16}$ " of length
- Finishing: all edges are smooth

## Shield Template – full size

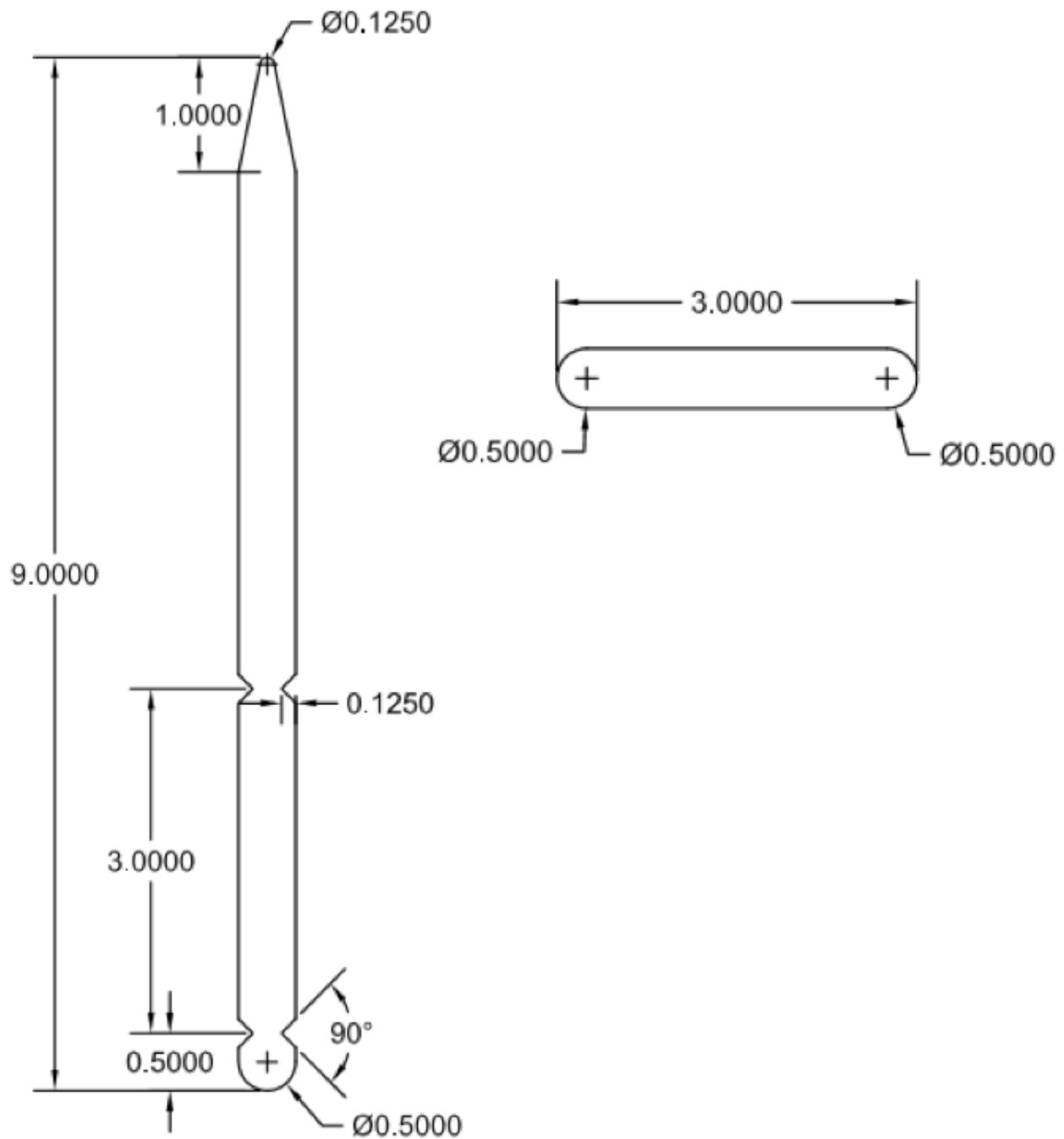


Shield template

## Dome Specifications



Dome specifications

**Letter Opener / Hilt Topper Specifications**

Letter opener/Hilt topper specifications



## Completed Projects

