**Fabricate a Cookie Sheet**

**Description**

The purpose of this Activity Plan is to introduce students to the metal shop through a practical activity. This activity is an introduction to sheet metal fabrication and basic hand tools used in working with sheet metal.

## Lesson Objectives

The student will be able to:

* Break out and lay out stock
* Cut sheet metal
* Form sheet metal
* Spot weld sheet metal
* Finish sheet metal

## Assumptions

The teacher will:

* Be a certified technology education/industrial education teacher
* Be familiar with the metal shop where this Activity Plan is conducted
* Have experience with all aspects of the given metal shop, including machines, tools and processes

The student will:

* Be attentive and participatory
* Recognize that appropriate attitudes are the best insurance for safety
* Cut, form and join sheet metal material to create the desired project
* Safely work in the metal shop
* Demonstrate safe and appropriate use of hand tools and equipment
* Use appropriate layout tools
* Demonstrate appropriate finishing techniques

## Terminology

**Aviation snips**: a hand tool designed to cut sheet metal into intricate designs. Can be used to cut compound curves. Red = left cutting; Green = right cutting; Yellow = universal, able to cut in any direction.



This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License unless otherwise indicated.

**Box and pan brake**: a sheet metal machine that is used to create bends, hems and boxes in sheet metal.

**Breaking**: bending the sheet metal along a line.

**Combination square**: a ruled blade with both 45° and 90° heads. Used to lay out right angles and 45° angles.

**Emery cloth**: an abrasive cloth used to remove material and smooth surfaces.

**File**: a hand tool designed to shape and smooth metal. Available in a variety of shapes and sizes to fit different projects. Made of hardened steel with varying textures to remove large or very minimal amounts of material.

**Finishing**: the process of using sanding, polishing, sandblasting or painting to create a desirable end product appearance.

**Layout**: the process of transferring a pattern from paper to the material using pens, scribes, centre punches, squares and scales.

**Letter and number stamps**: hardened steel bars with letters and numbers. Used to permanently label metal projects.

**Pattern**: a model or design used as a guide.

**Roper Whitney punch**: a hand tool used to punch holes in sheet metal stock.

**Ruler**: a precision measurement tool that is a length of steel with marks at regular intervals.

**Scribe**: a long pointed piece of hardened steel that is used to mark layout lines on metal.

**Sheet metal**: a term used to describe a variety of thin rolled metal sheet stock.

**Spot weld**: a resistance welding technique.

**Squaring foot shear**: a foot-controlled machine used to cut sheet metal stock.

## Estimated Time

2–4 hours

## Recommended Number of Students

20, based on the *BC Technology Educators’ Best Practices Guide*

## Facilities

Metal shop facility with all necessary equipment

## Tools

* + Aviation snips
  + Bar folder
  + Box and pan brake
* Combination square
* Emery cloth
* Coarse and smooth files
* Hammer
* Letter stamps
* 24" ruler
* Scribe
* Spot welder
* Squaring foot shear
* Whitney punch with a ⅛" die

## Materials

1 – 13½" × 19½" 18 ga. stainless steel metal

## Resources

**Box and pan brake**  [http://www.bing.com/videos/search?q=how+to+use+a+box+and+pan+brake&view=detail&mid=0](http://www.bing.com/videos/search?q=how%2Bto%2Buse%2Ba%2Bbox%2Band%2Bpan%2Bbrake&amp;view=detail&amp;mid=0) B5F895025F7C74515AE0B5F895025F7C74515AE&FORM=VIRE

**Roper Whitney punch**  [http://www.bing.com/videos/search?q=how+to+use+a+whiney+punch&&view=detail&mid=94426](http://www.bing.com/videos/search?q=how%2Bto%2Buse%2Ba%2Bwhiney%2Bpunch&amp;&amp;view=detail&amp;mid=94426) 538A09825CF06DD94426538A09825CF06DD&FORM=VRDGAR

### Aviation snips

https://[www.youtube.com/watch?v=5Nrc2xvLmC0](http://www.youtube.com/watch?v=5Nrc2xvLmC0)

### “HEADS UP! for Safety” handbook

https://[www.bced.gov.bc.ca/irp/resdocs/headsup.pdf](http://www.bced.gov.bc.ca/irp/resdocs/headsup.pdf)

### BC Technology Education Association Best Practices Guide

<http://www.bctea.org/best-practice-guide/>

*Modern Metalworking*, textbook by John R. Walker, copyright 2004, Goodheart-Wilcox Company Inc.

# Student Activity

1. Gather materials and all layout tools.
2. Handling your material carefully, lay your sheet metal flat on your work table and use the letter stamps and a hammer to stamp your name or initials into the centre of your material.
3. With emery cloth or a smooth cut file, gently file all edges of your material on both sides to remove any burrs or sharp edges.

### Note: Sheet metal is very sharp and can cut skin easily.

1. Using a ruler and scribe, measure and scribe a line ¼" from the top and both side edges of your material.
2. Measure and scribe a line ½" from the previously drawn line. (It will be ¾" from the outside edge.)

Have your teacher check your lines before proceeding to the next step.

1. Turn your material over and lay it flat on your work table again. Measure and scribe a line ¼" from the bottom edge only.
2. Measure and scribe a line ½" from the previously scribed line across the bottom edge. (It will be ¾" from the outside edge.)

Have your teacher check your lines before proceeding to the next step.

1. Using the box and pan brake, fold the ¼" hem on the bottom edge of your material. Make sure the hem is smooth and flat.
2. Using the brake, fold the second hem at the ½" line to create a double hem. This will make the edge of your cookie sheet firm and durable.

Have your teacher check your folds before proceeding to the next step.

1. Turn your material over so the bottom edge hem is on the underside of your project. Using the Roper Whitney punch and a ⅛" die, punch a hole in the corner where the ½" lines of the sides and top edge intersect (¾" in from the top and side edges).
2. Make sure there is no burr or sharp edge by smoothing with a smooth cut file or emery cloth.
3. Return to the box and pan brake and fold a hem at the ¼" line of both of your sides. Make sure the hem is smooth and flat. This hem gets folded toward the centre of the top side of your cookie sheet.

Have your teacher check your folds before proceeding to the next step.

1. Now fold the ¼" hem on the top edge. Make sure it is smooth and flat.
2. At your work table, use aviation snips to cut from the top edge down to meet the ⅛" hole you punched in step 10. This will create a tab at either end of your sides.
3. Using the box and pan brake, fold the top edge to 90°. This creates a lip edge. As you are folding the top edge, you will also be folding the tabs to 90° at the same time. Make sure you are lining up your fold lines to be square with the edge of the box and pan brake. (The ¼" hem will be on the inside of the cookie sheet.)
4. Adjust the keys on the box and pan brake, and from the ½" line fold the side edges to 90°. Make sure the tabs fold to the inside of your top edge.
5. Repeat step 16 for the second side.
6. File any rough edges or burrs on your corners.

Have your teacher check your cookie sheet before proceeding to the next step.

1. Using all appropriate safety gear, spot weld your tabs to the top edge of your cookie sheet. You may have to spot weld twice in each corner to ensure they are secure.
2. Once the spot welds are cool, remove any rough or sharp spots using emery cloth. Wipe down your cookie sheet with a damp cloth to ensure no particulate is left on it.
3. Hand in your project for marking.

**Assessment**

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

* Safe working procedures at all times
* Personal and project management: good use of time, attitude, effort
* Accurate measurements and layout
* Appropriate tools use
* All hems and folds are clean, straight and uniform
* All burrs and sharp edges are smooth
* Instructions were followed throughout the activity
* Name stamp is easy to read, letters are evenly spaced and uniform

0.5000

0.2500

0.2500

0.5000

18.0000

0.2500

0.5000

**Fabricate a Cookie Sheet**

Cookie Sheet Dimension Layout

x

Cut line for top edge

Cookie sheet dimension layout

12.0000

0.5000

Youth Explore Trades Skills

0.2500

Cut line for top edge

x

**Metal Work – Fabrication**

Remove 1/4" square (indicated with

the X on both sides using aviation snips

**6**