

# Module One: Non-Powered Hand Tools



## What is included in this module

- Why are we learning this?
- Safety rules
- Right tool for the right job
- Identity of Tools
- Hands on time
- Quiz



## Why are we here?

Basic knowledge of tools and fabrication will help any engineer. From communicating with machinists, knowing which tool does what job, and being competent on how to use them, will help in everyday engineering design.

This class will help you gain basic knowledge of non-powered hand tools, powered hand tools, fasteners, basic design, mills and lathes.

This first module covers Non-Powered Hand Tools.



- Safety is the most important part of any tool using or shop time
- Safety glasses must be worn the entire time you are in Shiley 110
- NEVER** work alone in any lab ever.
- Please **think** before using tools
- Do not cut things or saw things towards yourself or other people
- When using any tool, have a plan and know what you are working to complete
- If you have questions, **ASK!**
- Call Public Safety if injured or experiencing a medical emergency. Dial 4444



## *What you need today!*

- Toolkit
- Hands On Paperwork
- Wood for project
- Safety Glasses



Pre – Quiz!

What kind of screw driver is pictured below?

[Phillips Head](#)

[Flat Head](#)

[Torx](#)



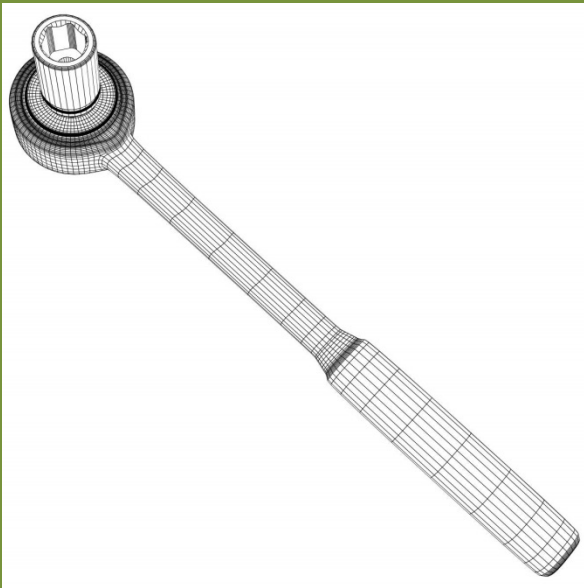
# CORRECT!

A torx (pronounced “Torcs”) screw driver is just one of the many types of drivers we will discuss. A torx screwdriver is characterized by the 6 point star pattern on the head. Of course, it works to drive screws with the same pattern. Torx Screw Driver resist something called “CAM-OUT” better than their more common counterparts, the Phillips and the Flat Head screw driver. “CAM-OUT” is when the screwdriver slips out of the screw head when the torque applied to drive the screw exceeds a certain value. Meaning, the screws are less resistant to high torque motions provided by the driver.





What picture depicts a ratcheting socket wrench?



CORRECT!



A ratcheting Socket wrench is a special tool we will discuss in detail later on. Wrenches are used to secure bolts in any number of manufacturing practices. Socket wrenches are interchangeable, meaning you can change of the bit head size to fit different bolt sizes. A ratcheting system allows easier motion by loading and unloading in one direction at a time.


What type of pliers would you use to grip and lock the piece you are working with?



## CORRECT!

The object to the right is called a vice grip plier or locking plier. It can grab and move items or hold items in place like any other set of pliers, but what makes the vice grips unique is that they have a locking mechanism that can be set by the operator. Once it is set, the grips will lock in place and won't move until they are released by the operator. This helps keep objects in place when working with them.





The next few slides describe the various non powered hand tools you will encounter in regular shop usage. Included in the red toolbox with you are a collection of these tools. Please, as you read about these tools, pull the corresponding item out to investigate.

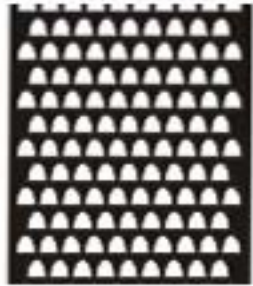
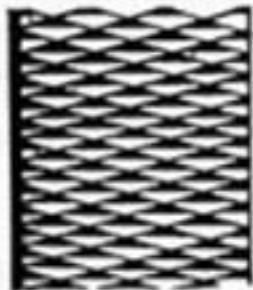
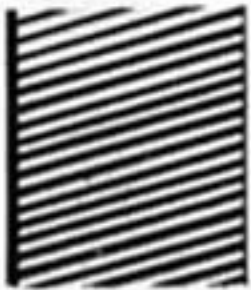
Files are used to remove a small amount of material from a work face surface. Files can be used in Wood working, metal working and with plastics to create clean edges, remove burs and other imperfections, smooth sharp edges and remove excess material in small amounts. Files come in numerous sizes and roughness to work with different materials.

# Files



# Files

**File Blades**



**Rasps and Rifflers**

Files have different types of rasps and rifflers, or “patterns” on their surface. These are used for better gripping on a material or for causing a courser or finer grind on the material you are working.

Files are best used in long strokes, downward from the piece you are working. They are an easy tool to use an master. Please find the files in the toolbox provided to explore with.

# Wrenches

A wrench is a tool that uses torque to tighten fasteners, in most cases nuts and bolts. The wrench is a widely used tool that comes in many different varieties and sizes. In the next few slides we will touch on the main wrench types and their basic uses. At the end of this section, you can explore with the wrenches provided in the toolbox for this module.





# Wrenches



**LUG WRENCH:** These can come in multiple sizes and are often times seen in cars to help remove bolts from tires as they are easy to grip. Often times used for “breaking” a bolt.



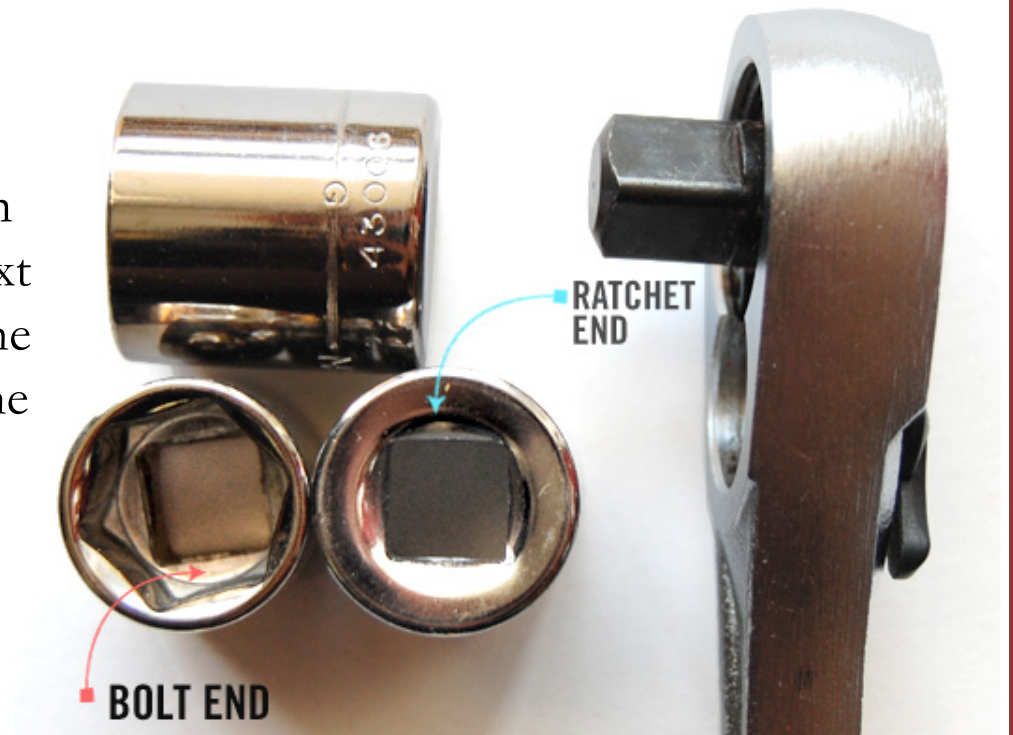
**PIPE WRENCH:** This type of wrench is adjustable to fit on multiple sized bolts. Often times, these wrenches are large to grasp bolts or connectors, especially in plumbing. This wrench is variable, meaning it can be used on more than one types of fastener. Not generally a good fit for smaller areas or fasteners.

# Wrench

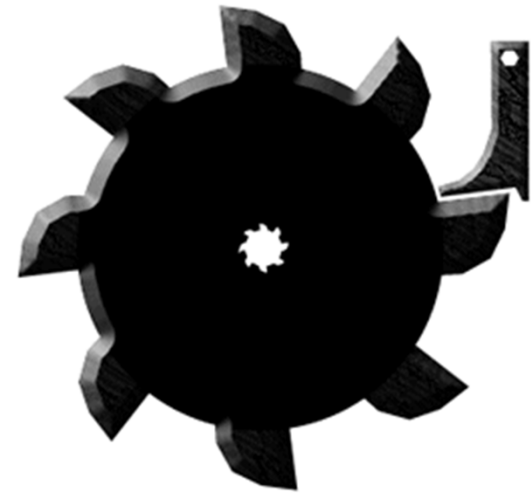
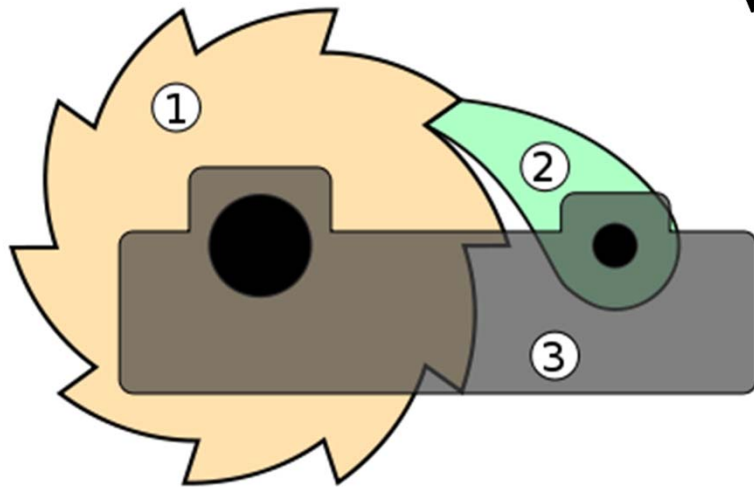


Ratcheting Socket Wrench: There are two parts to this type of wrench. One is the socket part. A socket wrench involves a whole collection of different bits to different sized bolts. They can be interchanged on the wrench easily.

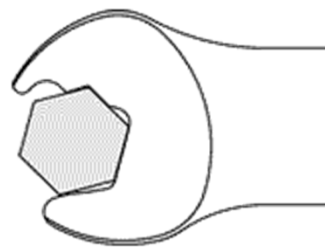
The ratcheting part of the wrench makes it easier to and faster to tighten and loosen nuts and bolts. On the next slide, there are gif's explaining how the ratcheting system works to improve the job.



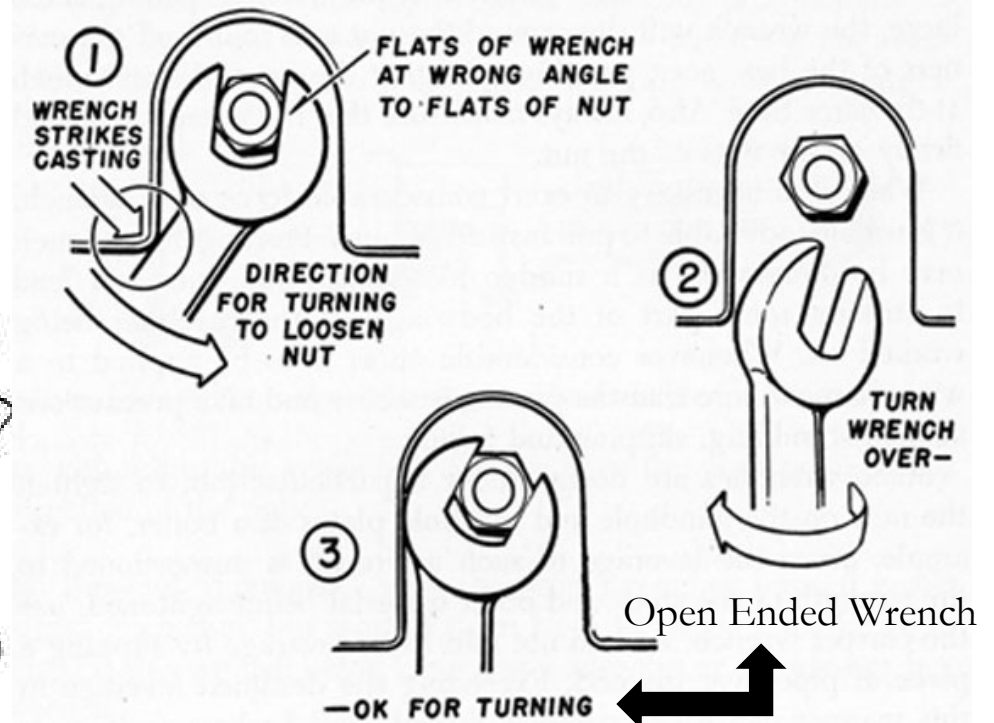
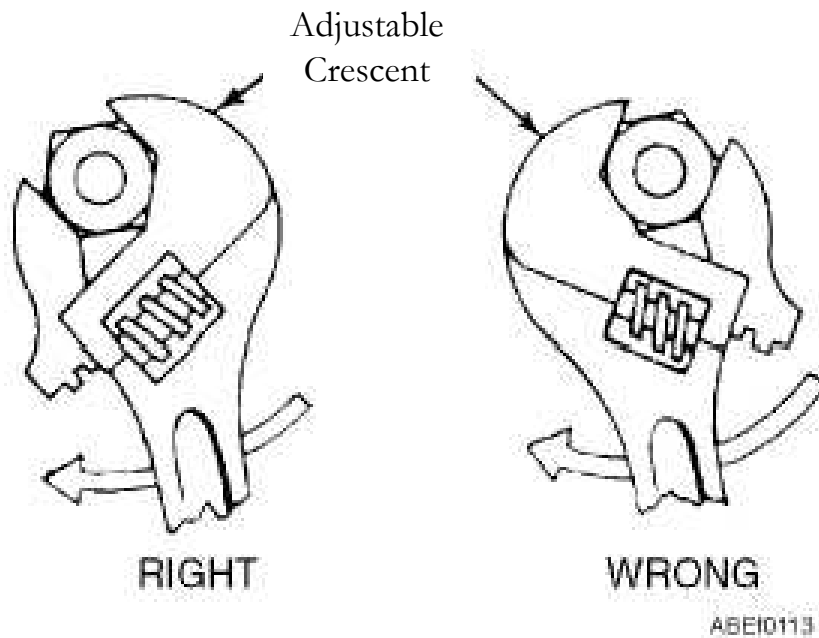
# Wrench



The picture in the top left is of the inside of the ratchet. It works one way to tighten, and in the other direction, does not loosen the nut. In the bottom, you can see how the process works on a non socket wrench.

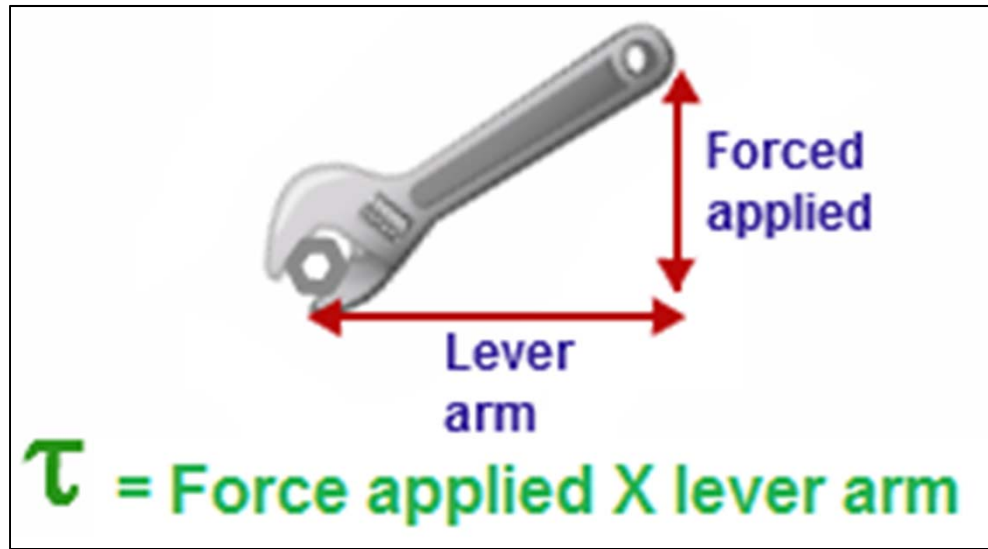


# Wrench



Above are some examples of correct usage for wrenches. Remember that using a tool correctly will keep you safe and help the project go smoothly. Keeping your wrench perpendicular from the bolt you are working with will create easier flow during your project.

# Wrench



Torque is equal to the force we are applying times the length of the lever arm. To increase torque, increase either the length of your lever arm or the force. An easy way to extend the length of a lever arm is to slip a pipe over the wrench end.

Please find the wrenches in the toolbox to explore. There will be some tasks at the end to complete using these tools.

# Clamps



A vice is a device used for work holding, or holding a part in place while working with it. The vice in this picture is a table vice. It is bolted to a work table for general use. A vice is a very useful, common tool that can be used for a variety of projects. In the next few slides, we touch on a few different types of vices and clamping methods.

# Clamps



All of these pictures dictate various C clamps. These come in small sizes and large sizes to be placed on all sorts of projects. Whether your holding pieces together while gluing or painting or nailing, clamps and vices can get the job done.

# Clamps



Provided in your toolkit are a few C Clamps, feel free to use them to hold pieces in place as you work with more tools.



# Pliers

## → COMMON TYPES OF PLIERS



EXTRA LONG,  
SPRING LEVER  
NEEDLENOSE



NEEDLENOSE



SLIP-JOINT



TONGUE & GROOVE  
ARC-JOINT  
("CHANNELLOCK") ("VISE GRIP")

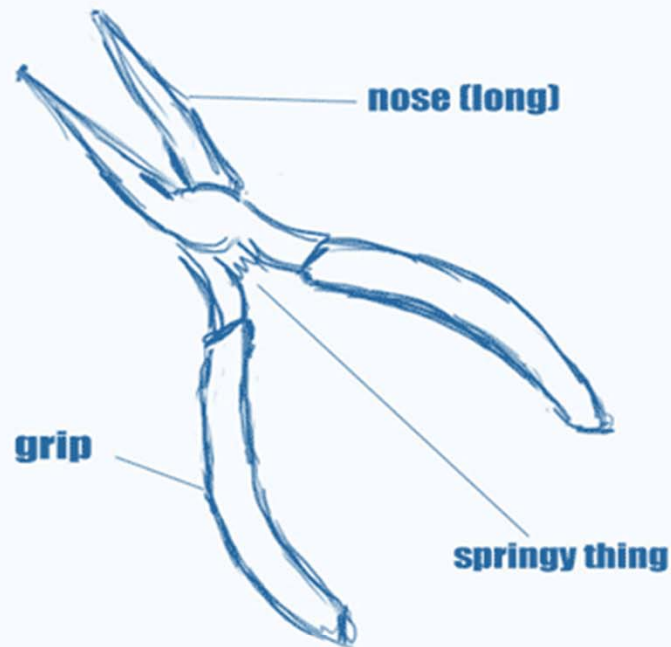


Pliers are a tool used to hold objects firmly in place while working with them. They also can be used to compress or bend material and work pieces. Pliers come in a variety of sizes and shapes, a few of which we will cover.

*"Channellock" and "Vise Grip" are trademarks.*

# Pliers

## Long Nose Pliers:



[cableorganizer.com](http://cableorganizer.com)

Probably the most well know and most widely used type of plier, long nose pliers are used for a variety of actions. Long nose pliers generally are thinner at the top than other pliers, and can reach into smaller spaces. Most include wire cutters just above the fulcrum.

# Pliers

Flat nose pliers are usually stouter and able to grip larger items. They come in numerous sizes and often have ridges on the inside for easier gripping. The inside are often times round in the center to grab onto bolts, round items and other fasteners. Often times, they include cutters on inside, toward the fulcrum.



# Pliers

To the right are three types of pliers, all with cutters integrated. The top tool is just a cutter, used for wire cutting, and snipping other items. The needle nose pliers also include cutters down toward the fulcrum. The same goes for the flat nose pliers.



# Pliers



The pliers to the left are known as tongue and groove or channel lock pliers. These are variable and can be used to grab oddly sized or shaped items. They are reminiscent of variable wrenches.

The pliers to the right are vice locking pliers. They can be locked in place so you no longer have to hold them in place to work with an item.

PLEASE, pull the pliers out of the toolkit to explore with.



# Hammers

Though Hammers all look similar and can perform similar tasks, using the right hammer for your project will make all the difference.



## TYPES OF HAMMERS



BALL-PEEN  
HAMMER



MASONRY  
HAMMER



MALLET



FRAMING  
HAMMER



SLEDGE  
HAMMER

# Hammers



Ball peen hammers were generally used in metal working, often to harden the surface by impact. Now they are used for chisels and flattening work pieces, as well as rounding off rivets. Sometimes referred to as the “Machinists hammer”.



A framing hammer, or claw hammer, is the most commonly used and recognized hammer. Used for numerous tasks, this hammer is most known for driving nails and removing nails with the back, crowbar like attachment.

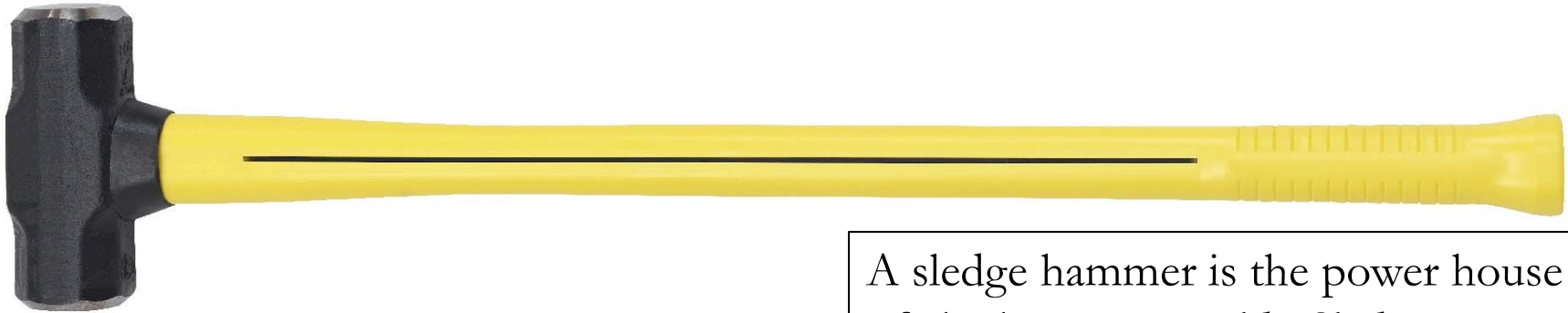
# Hammers



A rubber mallet is a hammer that has a rubber head instead of the regular metal head. Mallets are used for a variety of tasks, but are often used in place of metal hammers when working with a material that could be easily damaged by impacting it with metal. They are often used in metal work, upholstery work and sliding plaster and sheetrock into place.



# Hammers



A sledge hammer is the power house of the hammer world. Sledge Hammers tend to be extremely heavy on the metal striking end, and generally have a much longer handle to apply more force to the striking surface. Sledge hammers come in a variety of sizes for working and for crushing or breaking things.



# Hammers



Like all tools, hammers can be used correctly and incorrectly. In the picture to the left, we see a framing hammer being used to drive a nail. The flat end of your hammer need to be parallel with your striking surface to drive the nail properly and not bend the nail.

To the right, we see a ball peen hammer being used. The photo demonstrates a correct and incorrect way to use the hammer for driving. This can be applied to any type of hammer.

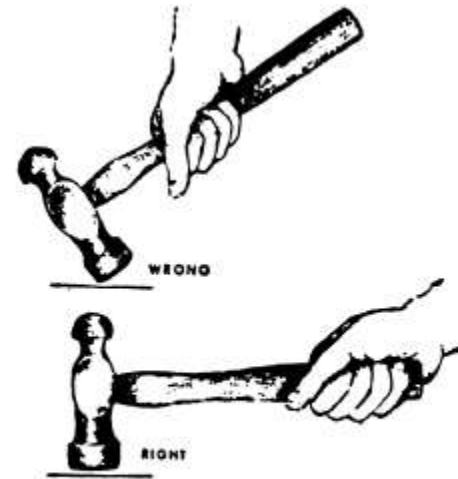
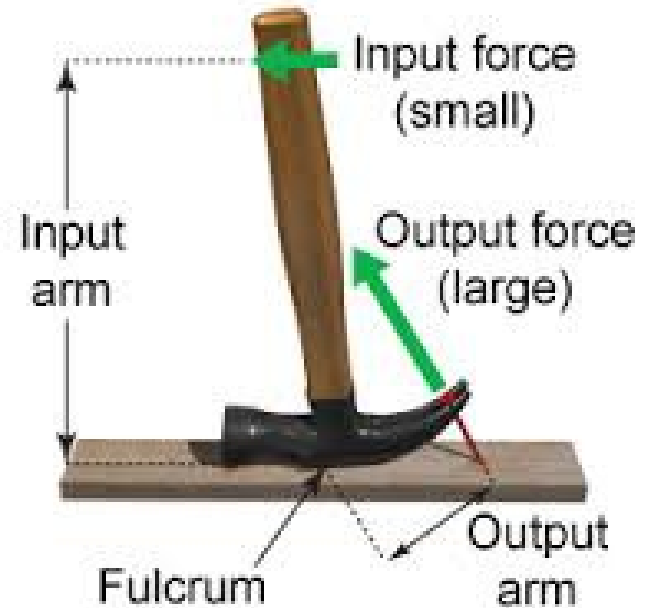


Figure 1-3.—Right and wrong way to use a ball-peen hammer.

# Hammers



Framing hammers can also be used to remove nails. The back of the hammer, or the claw part of the hammer, can be used like a crowbar, while you use the top head of the hammer as your fulcrum. In the picture to the left, a block of wood is used to lift the hammer away from the work surface while removing the nail. This helps prevent the hammer from deforming the work piece any further.

# Hammers

**SAFETY**

**SAFETY FIRST**

**SAFETY LAST**

**SAFETY ALWAYS**

**SAFETY**

Please use this time to take the hammers out of the toolbox to explore with. We are not going to drive any nails just yet.

# Screw Drivers

As you can see, there are a variety of screw drivers! Lets explore the main varieties used!



# Screw Drivers

Screw drivers all perform the same basic tasks of driving a screws into material. Choosing the correct screw driver depends on the type of screw you are working with. As seen in the photo below, there are many types of screws.



# Screw Drivers

Screw drivers require torque and pressure to drive nails and to remove them. It is also best practice to screw or unscrew fasteners with keeping the screwdriver as straight as possible. This will provide the most surface contact with the screw for better tightening and removing.

Please pull out the different types of screw drivers and determine what kind of screw drivers they are. We will use these later to drive and remove screws.



# Saws

Saws, again, all perform the same basic tasks, cutting. Which saw we use is the important thing. Also, how we use them.



## HAND SAWS

Crosscut Saw



Keyhole Saw



Coping Saw



Back Saw



Hack Saw



# Saws

The hack saw is used for all sorts of cutting. From metal slugs and sheets, to small amounts of wood. Hack saws work well for basic projects, but are not always the most accurate. Hack Saws work in one direction, the forward motion. Also, it is a good idea to use long strong strokes.



# Saws



To the left is a coping saw. A coping saw is used to cut intricate, small patterns in wood working, especially interior cuts. The blades are flexible for turning, but are still thin and small and can break easily. Coping saw blades can be removed easily to slide the blade into tight spaces.

A keyhole saw is picture to the right. This type of saw is used especially in sheetrock work, as it can pierce straight through and cutout the shapes you need.



# Saws



A back saw works in one direction, back. So as you drive the saw toward yourself, it cuts the material. Back saws are used for cutting larger items, not intricate shapes. Usually they are used to cut wood, but can be used for metal working if need be.

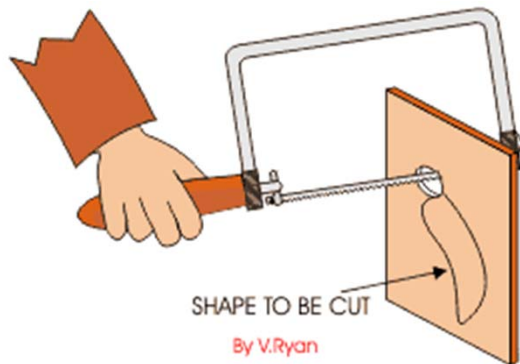
# Saws



A crosscut saw is the type of that loggers use. It is generally big and meant for two people, or sometimes, like the picture above, is made for one person to use with a handle on the other end. This is because the saws are generally long and incredibly flexible, making them hard to handle. But they are effective at their jobs of cutting large things, especially wood.

# Saws

*SAW PROJECT.* We definitely want you to get a feeling for using saws, but as saws are generally dangerous, we are only providing you with a coping saw. Please remember to cut away from yourself and others.



# Hand Drill



Hand Drills are used to drill holes into wood before placing a screw in them. They were used before we had electric drills and drill presses to do the same work. They are still a handy tool to know how to use. In our project later, you will get a chance to use one to drill pilot holes. (Pilot holes are holes you pre drill so you easier insert a screw of fastener.

# Hand Drill

Hand drills use gears to turn a rotor at the front to turn a drill. Many hand drill feature a way to interchange the drill size. Many of them look like the one pictured below, with a handle for stability and another for turning the drill. Hand drills require force, and it is best to use them with your shoulder directly above the hole you are drilling.



## What is next?

We have gone through the basic hand tools used in general shops. Now, we need to get some hands on experience. Please refer to the rest of this powerpoint and the documents provided to complete the basic tasks assigned to you. When that is over, there is a short quiz going over basic tools.





By now you should have explored the tools provided in your tool kit. Now we will have you complete a few tasks to demonstrate what you've learned and to also let you get a feel for how to use them. Please refer to the document titled "Module One Hands on Tools" for instructions on what projects to complete.

After you've completed the tasks, Please follow the link below to complete a short quiz!

<https://www.surveymonkey.com/s/KP86DP9>