



Lesson 3: Tools & Safety

By the end of this lesson, you will be able to:

- List several important safety rules.
- Identify the difference between hand tools and power tools.
- Give examples of different tools and explain how they're used.
- Use tools to put together Robits parts.



Introduction

In the previous lesson, you learned about a variety of parts that are used to build robots and became familiar with your Robits kit. In this lesson, you'll learn how to put those parts together using a variety of different tools. You'll learn the difference between hand tools and power tools, and you'll discuss examples of each. Additionally, you'll learn important safety rules that are to be used at all times. It is especially important to keep safety in mind when working on robots.



Safety

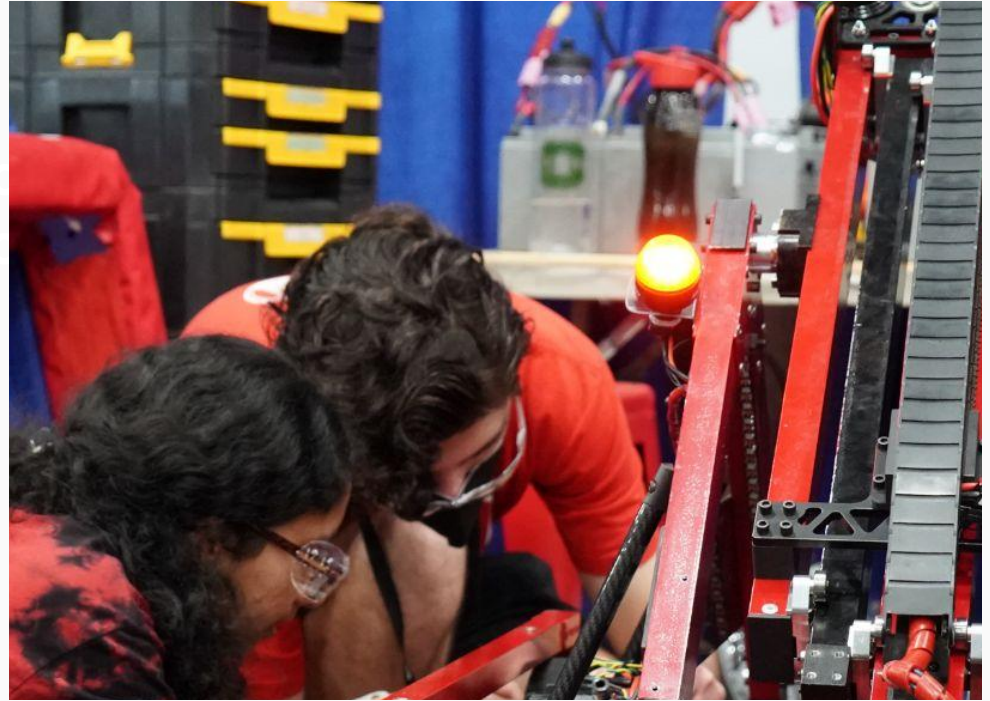


Discussion:

With your group, come up with a list of three common safety rules that you think are important to know.

Safety

Safety is the number one priority in any classroom, but is even more important in an engineering classroom, where tools and heavy machines are at play. The goal of safety is to prevent harm from befalling a single student. Everyone in your classroom must work together to maintain a safe learning environment. In this lesson, we'll go over some general safety rules as well as some robot-specific safety rules.



Two students wearing safety glasses while working on their robot



General Safety

General Safety Rules

- Be aware of your surroundings at all times.
- Stay focused and don't mess around.
- Report hazards, unsafe work conditions, and injuries **immediately**.
- Use tools only as they're intended to be used and treat them with respect.
- Wear the right clothing and any protective gear you might need.
- Keep your workspace clean and organized.



Robot Safety

While Building The Robot

- Communicate with your team regarding every change that is made.
- **Never** work on the robot when it is on.
- Prioritize making the robot safe over making a “quick fix.”

Always let your team know when you are using a tool in the same space they are working in and respect each person's work time.

While Testing The Robot

- Announce to your team or anyone working close to the robot that it will be turned on and testing will begin.
- Leave space between your team and the robot.
- **Always** put the robot in a safe location for testing.
 - Don't activate the robot on a table.
 - Make sure there are no food or beverages nearby.

Always let your team know when you are testing something, and warn them when the robot is about to be powered on.

Electronics Safety Rules

- **Never** work on any electronics while the robot is on.
- Inspect any electronics for signs of damage
 - Alert your teacher if any parts are broken or are getting worn out
- Do not run the robot for too long. It needs to take a break just like you!
- If part of the robot gets hot, shut it off immediately and let it cool down.

If you notice any smoke, sparks, or bad smells coming from your robot, have one team member immediately turn the robot off while another team member alerts your teacher.

Workspace Safety Rules

- Know all the safety procedures for your school and classroom including fire evacuation routes.
- Listen to all instructions provided by your teacher before starting work.
- Always be prepared to work.

When in doubt, always double check rules and instructions. The most important part of participating in robotics is safety.



Tools



Discussion:

What are some tools you use in your everyday life? How are they used and what do you use them for?



Tools

In the following sections, we will discuss a variety of different tools. Each tool can be classified as either a hand tool or a power tool, so we will also go over the differences between those categories. Pay special attention to the tools included in your Robits kit as you will be using them extensively.



Hand Tools

Hand Tools

A hand tool is a tool that is powered by no source other than a human. Hand tools are incredibly reliable, since a person has complete control over the tool they are using. There are many different kinds of hand tools, and they can be used to complete nearly any task. Examples of hand tools include screwdrivers, hammers, wrenches, and pliers.





Hand Tools Found in Your Robits Kit

Allen Keys, Hex Drivers, and Screwdrivers

Allen keys, hex drivers, and screw drivers are used to drive screws and nuts together. You will use these tools more often than any other tool in your kit since all parts of your robot require screws to hold them together.

When using an allen key, hex driver, or screwdriver, make sure to:

- **Only tighten something the correct amount.** If a screw feels tight, then be careful not to overtighten it or else you could wear out the threads.
- Check that your tools are not damaged or worn out. If a tool is damaged or worn out, bring it to your teacher's attention.



Wrenches

Wrenches can be used in two different ways. In the first way, a wrench is used to hold a nut in place while another tool provides the motion to connect a screw to the nut. In the second way, a wrench is used to apply force to a nut that has already been connected to a screw in order to tighten it.

When using a wrench, make sure to:

- **Only tighten something the correct amount.** If a nut feels tight, then be careful not to overtighten it or else you could wear out the threads.
- Check that the your hardware is undamaged. If there is damage, do not try to make the hardware work. Instead, bring it to your teacher's attention.





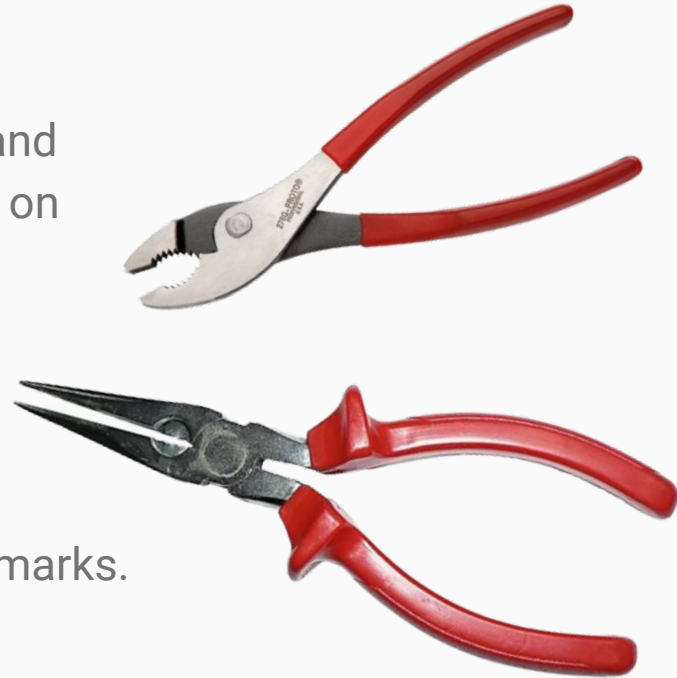
Additional Hand Tools

Pliers

Pliers are used to hold things in place, typically while fastening items together. They are very versatile tools and can be paired with objects of different sizes depending on what is needed to complete a given job.

When using pliers, make sure to:

- Watch between the handles to avoid pinching.
- Avoid crushing items between pliers or tweezers.
- Remember grabbing an object too hard can leave marks.



Scissors and Snips

Scissors are a very common tool, and snips are very similar. Both tools are used to cut things, however, snips are a shorter and *sharper* version of scissors that are made to cut wiring and thick plastic. Change which tool you use based on how “tough” of a material you are using.

When using scissors or snips, make sure to:

- Watch between the handles to avoid pinching.
- Keep your fingers away from the blades.
- Check that nothing besides the material you are trying to cut is in the way of the blades.



Hammers

A hammer is a tool that is composed of a heavy head on a handle that is used for pounding. Hammers are most often used to drive nails into material, but they can also be used to apply a large amount of force to a small area. **If you do not have a hammer, do not use another tool in its place.**

When using a hammer, make sure to:

- Use the right hammer for the job. There are many types of hammers and they all have their own purposes.
- Keep your fingers away from the area being struck by the hammer.





Power Tools

Power Tools

A power tool is any tool that is powered by something other than a human. All the tools reviewed in the previous sections of this lesson were not power tools, since they require the aid of a person to be able to complete a task. Power tools are more dangerous than hand tools because they are faster, stronger, and often more complex than hand tools. This means we must exercise caution whenever using a power tool.



Power Tool Safety

When using power tools, make sure to:

- Wear safety goggles at all times and a mask if you are creating dust.
- Keep any long hair, clothing, or jewelry away from your tool. You don't want to get caught on something.
- Have the material you are working with secured in place. **Don't only use your hands.** Clamps work very well.
- Never lose control of your tool or your material and always remain focused and aware.



Examples of Power Tools

Drills and Drivers

Drills and drivers are power tools that are capable of producing a high amount of torque. Drills are used to put holes into a variety of materials, whereas drivers drive screws into holes, similarly to screwdrivers, just with much more power. They are typically used in place of hand tools to help make jobs go quicker.



Saws

Saws are sharp, toothed blades that are used to cut a variety of materials. They can be powered or unpowered, but both can be dangerous since they are capable of cutting through nearly any material. Different saws are used depending on the material, size, and shape of the cut. Some common examples of saws are hacksaws, circular saws, and miter saws.



Shop Machines

Shop machines are power tools that are typically used within a machine shop. They **require additional safety measures** compared to regular power tools due to the fact that they're usually larger and more dangerous. Shop machines are used to manufacture large quantities of parts or individual specialized parts, since they can complete the job quickly and accurately. Some examples of shop machines that you might find in your workspace are lathes, drill presses, mills, and routers. This course does not require you to use shop machines, but we still want you to have an awareness of these powerful machines and how to stay safe around them.



Activity:

Alone or with your group, fasten together two or more Robits parts using the tools found in your Robits kit and your newfound knowledge of tools. Make sure you use the right tools for the job.



**Let's use tools to build a
chassis in Lesson 4!**

Sources:

- "Allen key." *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/dictionary/Allen%20key>. Accessed 10 Apr. 2024.
- "Basic Safety Rules." *University of Idaho*, U Idaho, www.uidaho.edu/dfa/division-operations/ehs/tips/basic-safety-rules. Accessed 10 Apr. 2024.
- "Drill." *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/dictionary/drill>. Accessed 10 Apr. 2024.
- DRILL AND IMPACT DRIVER KIT*. *ULINE*, www.uline.com/BL_1723/Drill-and-Impact-Driver-Kit. Accessed 10 Apr. 2024.
- FELCO 310 SLENDER PICKING & TRIMMING SNIPPERS*. 2024. *Amberg's*, 2024, amberg.com/shop/felco-310-picking-trimming-snippers/?highlight=pruners. Accessed 10 Apr. 2024.
- Fiskars® Scissors For Kids, Grades K-5, 5", Pointed*. *Office Depot & Office Max*, Office Depot & Office Max, www.officedepot.com/a/products/502369/Fiskars-Scissors-For-Kids-Grades-K/. Accessed 10 Apr. 2024.
- Global Industrial™ Bench Top Drill Press, 120V, 3/4 HP*. *Global Industrial*, www.globalindustrial.com/p/bench-top-drill-press-120v-3-4-hp. Accessed 10 Apr. 2024.

Sources (contd.):

"Hammer." *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/dictionary/hammer>. Accessed 10 Apr. 2024.

Hunter, Mark. *Disc cutter hand-held power tool with diamond blade disc attached*. Openverse, openverse.org/image/90304aa0-ef6e-4295-bf44-11ffd8c6825b?q=power%20tool. Accessed 10 Apr. 2024.

Ivo, Baron. *Needle-nose pliers*. *Encyclopædia Britannica*, www.britannica.com/technology/pliers/images-videos#/media/1/464805/119523. Accessed 10 Apr. 2024.

Koya79. *Hand saw isolated stock photo*. 27 May 2014. *iStock*, Getty Images, 27 May 2014, www.istockphoto.com/photo/hand-saw-isolated-gm494239615-40595442. Accessed 10 Apr. 2024.

McGeough, Joseph A. and Hartenberg, Richard S.. "hand tool." *Encyclopedia Britannica*, 20 Sep. 2023, <https://www.britannica.com/technology/hand-tool>. Accessed 10 April 2024.

MOTORHEAD Tools Team. "WHAT ARE POWER TOOLS?" *MOTORHEAD Tools*, 25 Mar. 2021, motorheadtools.com/blogs/motorhead-tools/what-are-power-tools. Accessed 10 Apr. 2024.

Sources (contd.):

"Pliers." *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/dictionary/pliers>. Accessed 10 Apr. 2024.

Proto 8-1/16" Combination Slip Joint Pliers. Tacoma Screw, www.tacomascREW.com/Product/436-202. Accessed 10 Apr. 2024.

"Robits Core Kit." *AndyMark*, 2024, www.andymark.com/products/robits-core-kit.

Rolson 16oz Claw Hammer Fibreglass Shaft 10372. Desert Cart,

www.desertcart.com.om/products/66604811-rolson-10372-16-oz-claw-hammer. Accessed 10 Apr. 2024.

"Safety." *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/dictionary/safety>. Accessed 10 Apr.

2024.

"Saw." *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/dictionary/saw>. Accessed 10 Apr. 2024.

"Scissors." *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/dictionary/scissors>. Accessed 10 Apr.

2024.

"Screwdriver." *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/dictionary/screwdriver>. Accessed

10 Apr. 2024.

Sources (contd.):

seven assorted hand tools with yellow tape measure bottom. PickPik,

www.pickpik.com/tools-work-repair-hammer-screwdriver-chisel-95247. Accessed 10 Apr. 2024.

7.25" 14Amp 5500RPM Circular Saw w/ Integrated Dust Blower PS4015. Powersmart,

powersmartusa.com/products/circular-saw-with-integrated-dust-blower-ps4015. Accessed 10 Apr. 2024.

"Snips." *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/dictionary/snips>. Accessed 10 Apr. 2024.

"Tool." *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/dictionary/tool>. Accessed 10 Apr. 2024.

"Tool." *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/dictionary/tool>. Accessed 10 Apr. 2024.

Trees.com Staff. "33 Different Types of Saws with Pictures." *Trees.com*, 22 Dec. 2022,

www.trees.com/gardening-and-landscaping/types-of-saws. Accessed 10 Apr. 2024.

"Tweezers." *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/dictionary/tweezers>. Accessed 10 Apr. 2024.

"What is a Machine Shop?" *Kosmo Machine*, 8 Dec. 2016, kosmomachine.com/2016/12/what-is-a-machine-shop/. Accessed 10 Apr. 2024.

Sources (contd.):

"Wrench." *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/dictionary/wrench>. Accessed 10 Apr. 2024.