



Lesson 2: Parts of a Robot and Introduction to Robits

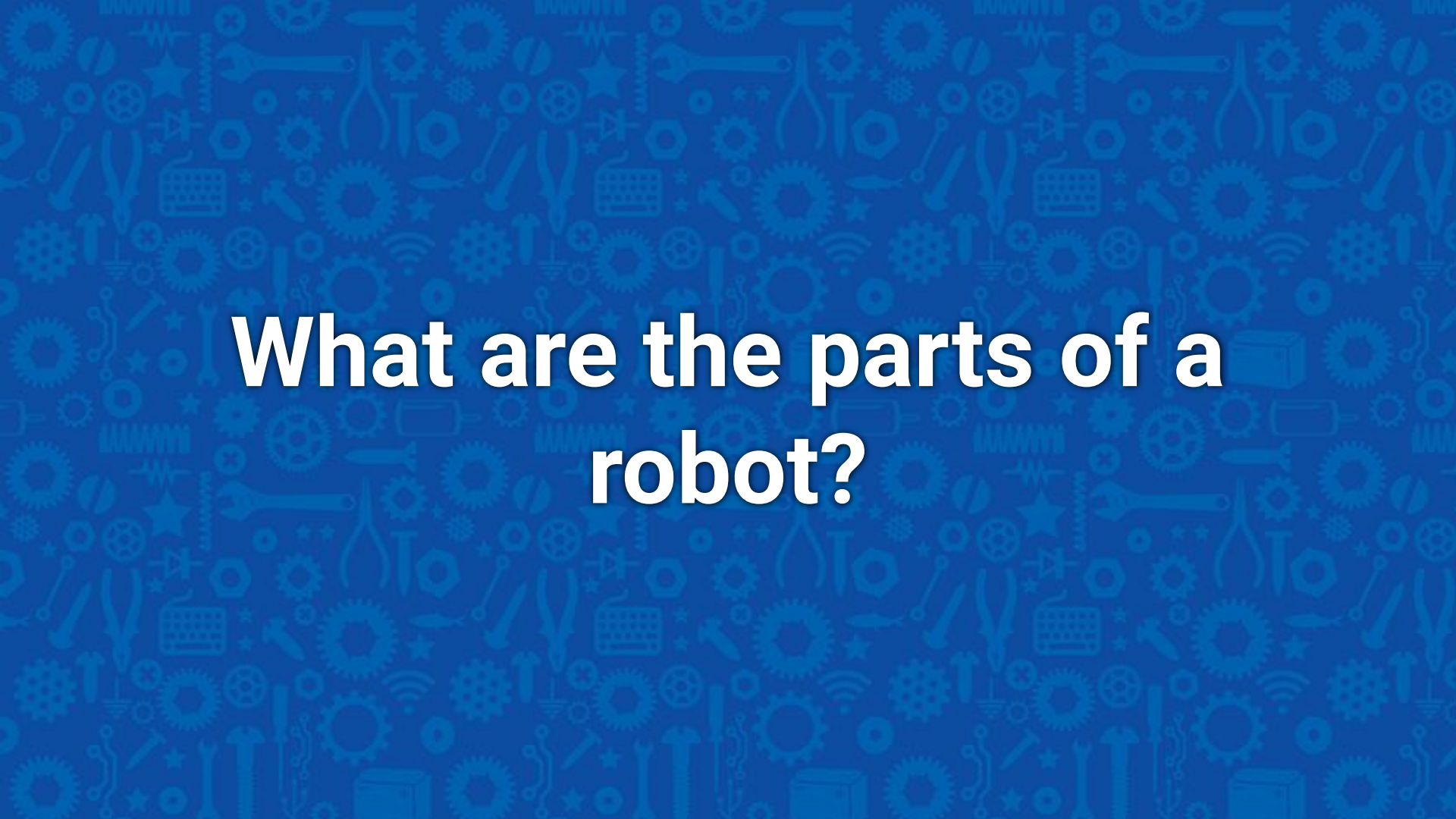
By the end of this lesson, you will be able to:

- Describe the different categories of robot parts.
- Identify the individual parts of a robot.
- Describe the purposes of various robot parts.
- List the most important parts of your Robits kit.



Introduction

In the previous lesson, you learned what a robot is and identified some examples of robots that are used in industry and everyday life. Now it's time to learn what robots are made of. Robots are complicated machines that are composed of numerous individual bits and pieces. Some parts of a robot provide motion, while others provide structure. Every part has a job to do and must seamlessly integrate into the rest of the robot.



**What are the parts of a
robot?**

There are five main categories of robot parts:

Structure - The structure of a robot keeps a robot rigid and gives the robot its form. Parts that give a robot structure are more important than any other part, as all other parts must be securely attached to them.

Electronics - The term, “electronics,” refers to any parts that can manipulate electricity or signals. Electronics and the electronic systems they create when combined allow the subsystems of a robot to function and communicate with each other.

Motion - Parts that belong to the motion category are parts that allow a robot to move, but do not directly power the robot. These parts are used to transfer energy from one part of the robot to another without using electronics.

Hardware - Parts that belong to the hardware category are easily overlooked, but are just as important as the parts in any other category. Hardware includes the small parts that hold a robot together.

Software - The software of a robot is not made of physical parts, rather, it is composed of many lines of code. Software brings a robot to life and a robot wouldn't be able to function without it. We'll discuss software more in Lesson 13.



Structure

Beams

A beam is a basic structural element that is typically a long piece of wood or metal. Beams can be combined to form a vast number of structures in different shapes and sizes. On a robot, beams are incredibly important and can be used to provide structure for a variety of systems.



Steel beams are commonly used to form the structures of buildings and bridges.

Joints

A joint is a basic structural element that strengthens the connection between two or more beams. A joint can be rigid or can allow for motion. There is a wide variety of mechanical joints, including hinge joints, gliding joints, ball joints, and more. On a robot, joints are an important part of the structure and can often be used in robotic arms.



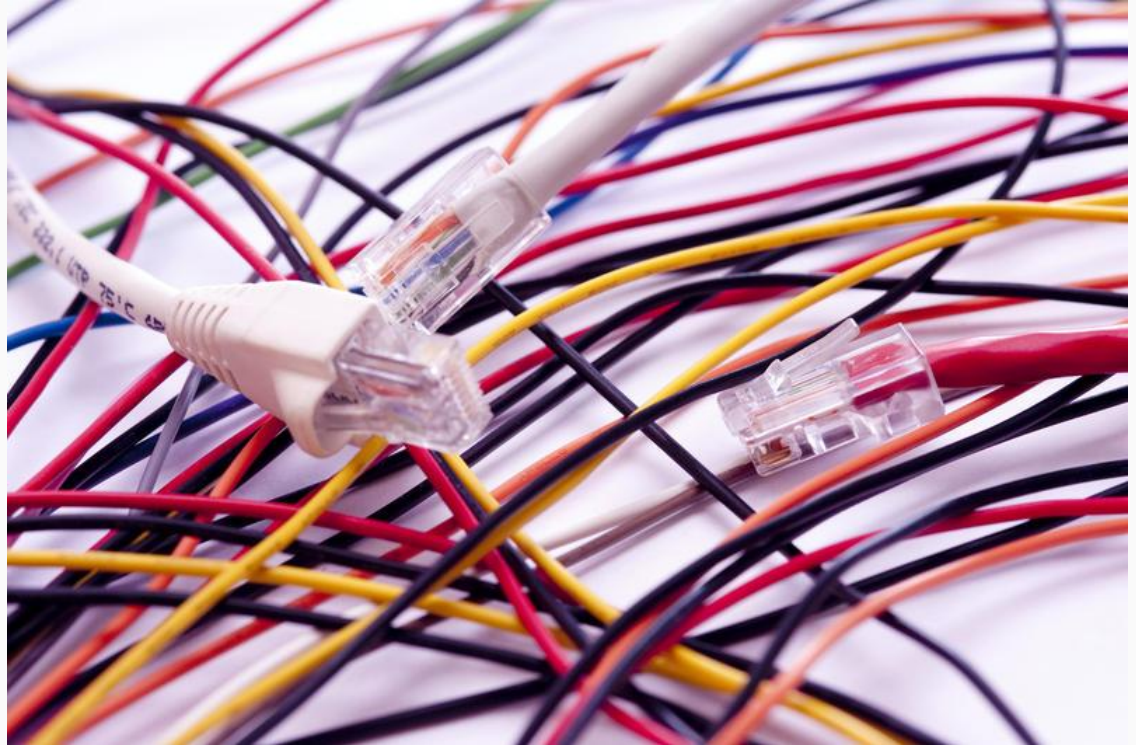
This joint is fairly simple, but other types of joints can be very complex.



Electronics

Wires/Cables

Wires and cables are simple parts that only transport electricity from one point to another. It's almost guaranteed that you see wires or cables every day. Take a look at your phone charger, for example. That's a cable! In a robot or other powered device, wires and cables are incredibly important since they allow both information and power to travel around the device. You will learn more about wires and cables in Lesson 5.



Wires and cables can greatly vary in appearance.

Power Sources

A power source, as the name would suggest, is any device that is capable of delivering power to a system. Batteries and other power sources are used in nearly any device, including robots, where they're one of the most important parts. You will learn more about power sources in Lessons 5.



Double A batteries are just one type of power source.

Motors

A motor is a machine that rotates to generate motion. Motors can be found in a variety of different places and are very versatile. Motors are incredibly important to robots, as they give robots the ability to move. You will learn more about motors in Lesson 5 and Lesson 8.



Motors can be very complex, or they can be simple, like this DC motor.

Sensors

Sensors are devices that detect changes in the physical environment. For example, they can detect changes in temperature, color, or distance. Once a sensor registers a change, it sends out a signal to be acted upon. Sensors are used in robots to help the robots work autonomously, or without human guidance. You will learn more about sensors in Lesson 14.



This sensor, known as an ultrasonic sensor, is just one type of sensor that a robot can use.



Motion

Axles

An axle is a shaft or bar that is typically connected to a motor, bearing, and/or wheels. Axles transmit motion from the motors to wherever it's required. On a robot, axles are usually situated in the drive train, where they link the motors to the wheels, but they often have applications elsewhere.



Axles can come in different sizes depending on what they're used in.

Wheels

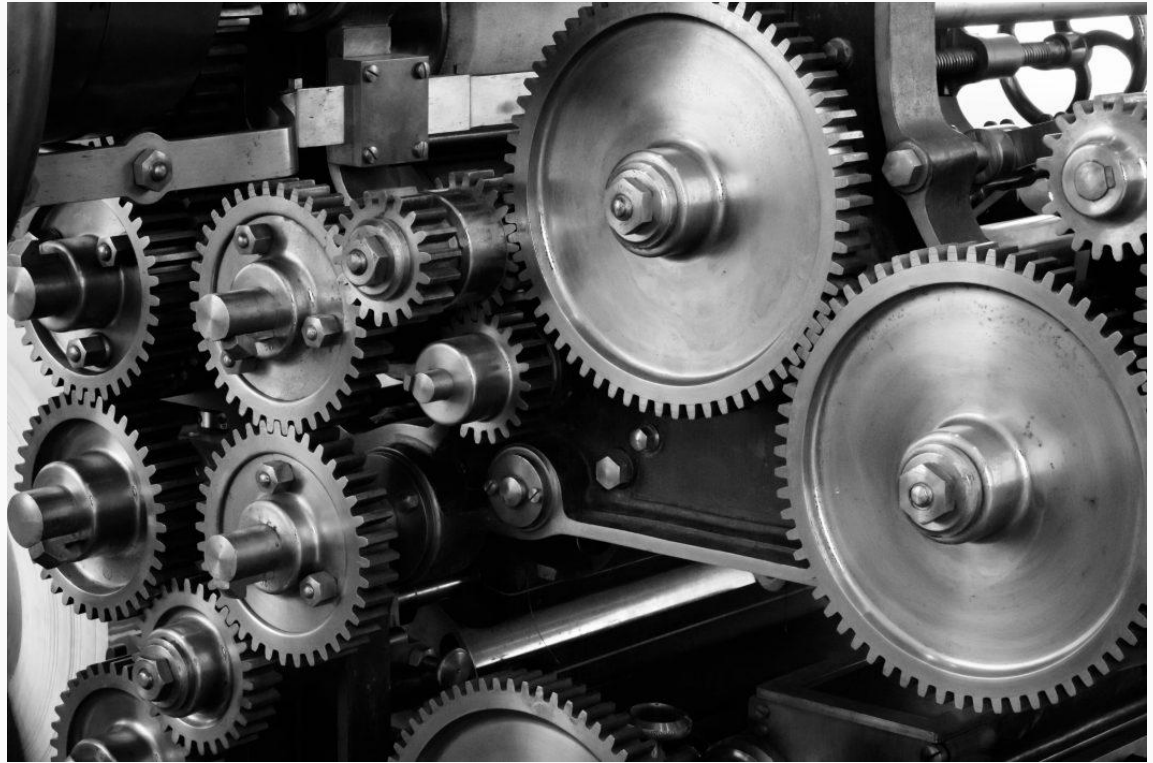
A wheel is a circular piece of material that can be solid, partially solid, compliant, or spoked and is capable of turning on an axle. Wheels are used in a variety of different places, however, they're most commonly used to make things roll, as is the case with robots, although robots can also use wheels for other purposes. You will learn more about wheels in Lesson 6.



Wheels can be very small, or very large, like the wheels on this airplane.

Gears

A gear is a type of wheel that has teeth. Gears can be used in conjunction with other gears to form transmissions that determine mechanical advantage, speed, and torque. A robot that is built using gears is capable of lifting greater weights and reaching higher speeds. You'll learn more about gears in Lesson 7.



Large assemblies of gears, such as these, are known as transmissions.



Hardware

Nuts, Screws, and Bolts

Nuts, screws, and bolts are some of the most common pieces of hardware. They are used to fasten objects together, which is an incredibly important task, especially in robots. You will learn more about using nuts, screws, and bolts in Lesson 3.



There is a wide variety of nuts, screws, and bolts.

Other Hardware

In addition to nuts, screws, and bolts, there are many other pieces of hardware, including string, washers, cable ties, rivets, and much more. These various pieces of hardware also accomplish various different jobs, from fastening to supporting to transferring power.



Washers are another common type of hardware.



Complex Parts

The top of the slide features a dark blue background with a repeating pattern of white mechanical icons. These icons include gears, wrenches, pliers, stars, and other tools, creating a technical or engineering theme.

Complex Parts

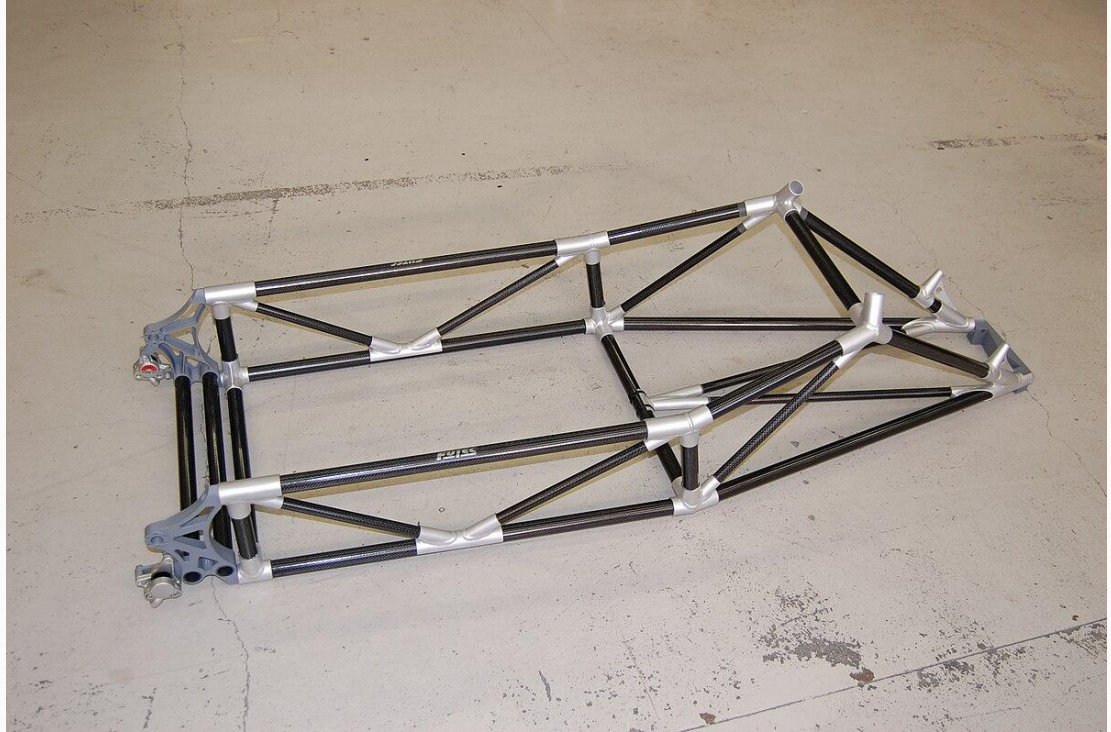
The five main categories of robot parts are often combined to form more complex parts, also known as subsystems. Complex parts are designed to complete a specific task and are typically made from parts that belong to two or more of the basic categories of parts. Let's take a look at some examples of complex parts.



**What are some examples of
complex robot parts?**

Chassis

A chassis is the supporting structure of an a vehicle or robot. For example, both cars and bikes use chassis. In a robot, the chassis makes up almost the entire structure, and is often made of beams, tubes, plates, or other small structural elements. You will learn more about chassis in Lesson 4.



The chassis of a Biomobile is a good example of a chassis.

Grippers

Grippers are mechanisms that combine gears and motors, as well as many other parts into a system that is capable of grabbing or holding onto an object. Grippers must be mounted to another part of the robot in order to achieve their full functionality. You will learn more about grippers in Lesson 10.



The gripper above is a very advanced example of a robotic gripper.

Lifting Mechanisms

Lifting mechanisms are systems that are used to move objects from a lower elevation to a higher elevation or vice versa. They come in many different forms, and often cannot directly interact with objects. Because of this, lifting mechanisms are typically paired with grippers. You will learn more about lifting mechanisms in Lessons 10, 11, and 12



A forklift is an example of a machine that uses a lifting mechanism.



**Now let's apply what you've
learned about robot parts to
a robot kit.**



ROBITS

What is Robits?

Robits is a building system that was designed with accessibility and useability in mind. It is intended to give students like you the ability to effortlessly build and design robots. You will be using this system to build your robots. If you'd like to learn more about Robits, watch the video to the left or visit the Robits webpage.



At this point, it's time to form groups. You will need to be in groups for the remainder of the course, as you'll be working together to build your robots. How you'll form groups is up to your teacher. They'll either allow you to form your own groups, or they'll form groups for you. Make sure there are no more than four students per group.

Once you're in groups, introduce yourselves to your new groupmates, and take five minutes to get to know each other. After you've done that, your teacher will give your group a Robits kit. Each group should have one kit. Once you have your Robits kit, move on to the next part of the lesson.

Activity:

Familiarize yourself with your Robits kit. With your group, work through the checklist or follow along with the presentation.

Robits Tubes

The first thing to look for in your kit is a Robits tube. There should be nine different types of tubes present in your kit. These tubes will be combined to form the chassis of your robots.



Robits Plates

The second thing to look for in your kit is a Robits plate. There should be three different sizes of plates in your kit. These plates can be used in conjunction with the tubes to contribute to the structure of your robot.



Motors

The third thing to look for in your kit is a motor. There should be four DC motors in your kit, as well as two servo motors. As talked about earlier, these motors will allow your robots to move.



Wires/Cables

The fourth thing to look for in your kit is a wire or cable. Your kit should include both power cables and signal wires. The power cables will supply power to the various parts of your robot and the signal wires will transfer commands from the software to the electronics.



Robits Shafts

The fifth thing to look for in your kit is a Robits hex shaft. There should be five different length hex shafts in your kit. These parts will be used to attach the wheels to your robots.



Robits Wheels

The sixth thing to look for in your kit is a Robits wheel. There are three different types of wheels in your kit: Traction wheels, omni wheels*, and compliant wheels. Wheels will allow your robot to move across the ground.

* You may need to assemble your omni wheels before use.



Robits Gears

The seventh thing to look for in your kit is a Robits gear. Your kit should contain four different sized gears. These gears will allow you to build a faster or more powerful robot.



Nuts and Screws

Your kit contains a wide variety of screws as well as several Nylock nuts. These parts will be used to hold your entire robot together.



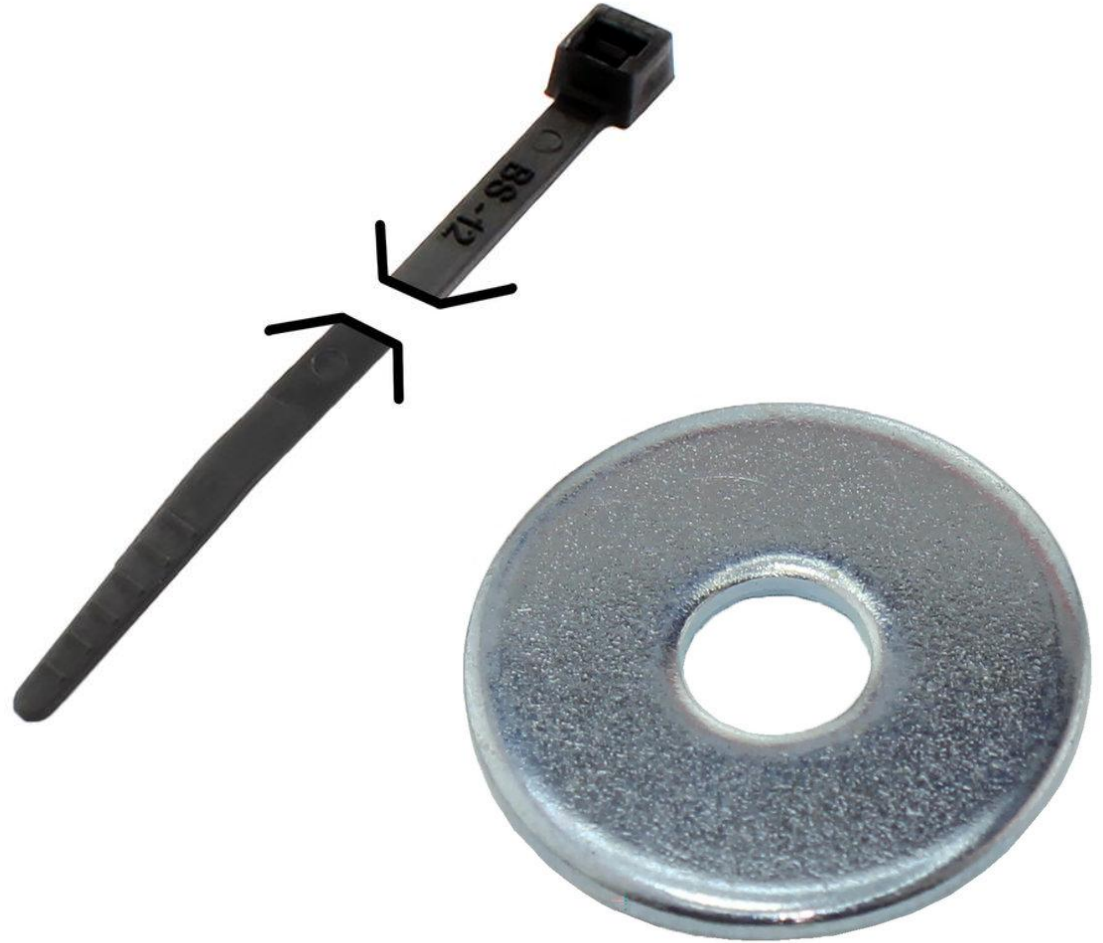
Spacers

Spacers are a type of hardware used to quite literally leave space on a shaft, axle, or screw. There should be six different types of spacers in your kit.



Additional Hardware

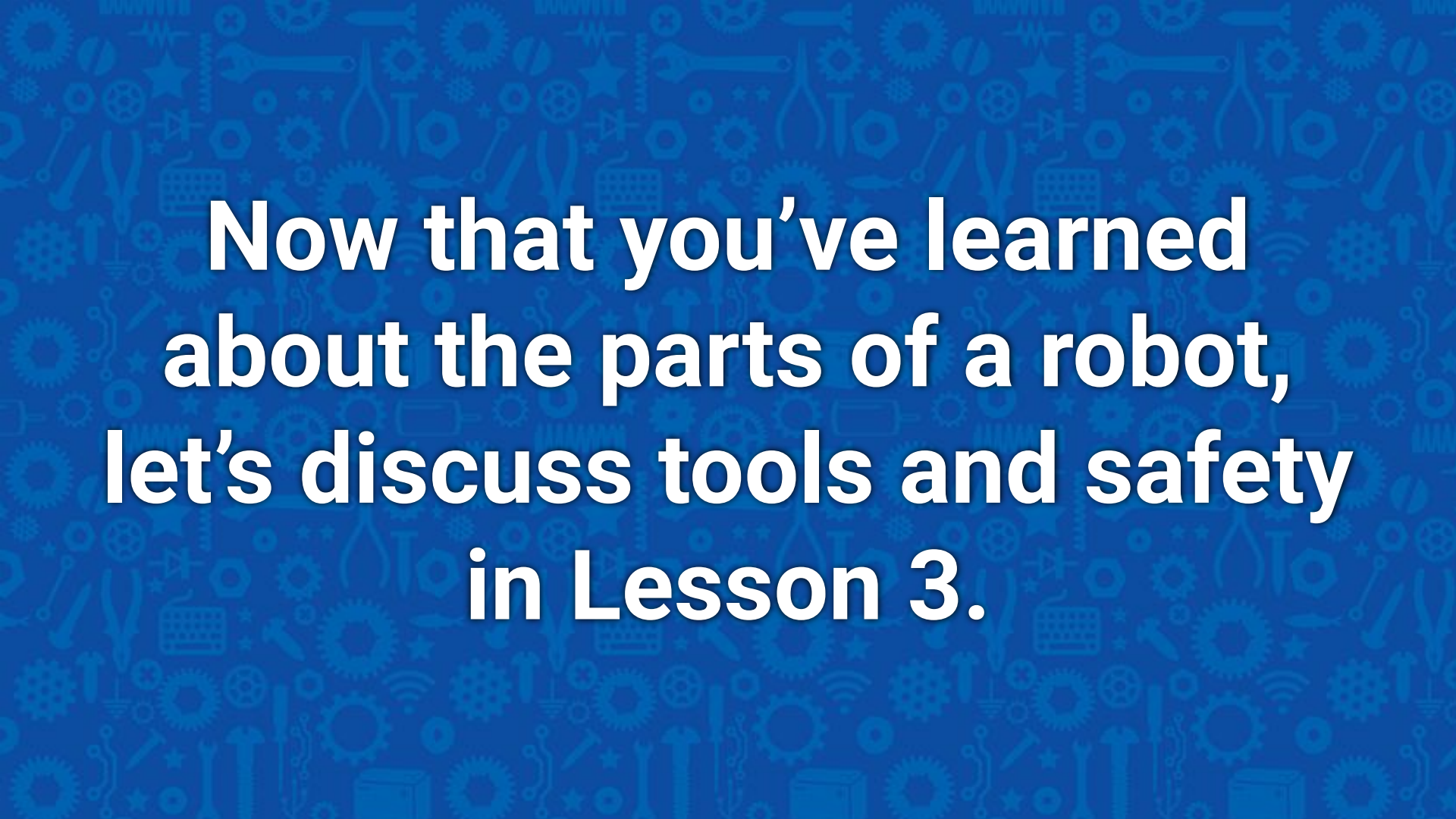
In addition to screws, nuts, and spacers, your kit also includes many other types of hardware. These other types of hardware include cable ties, washers, string, rubber bands, and more. These parts are used for a variety of things, for example cable ties are used to secure cables and wires in place.



Tools

It's important to make sure you have the proper tools in your kit. There should be one allen wrench, one combination wrench, three different hex drivers, and a robits ruler. You'll learn more about tools and how to use them in the next lesson!





**Now that you've learned
about the parts of a robot,
let's discuss tools and safety
in Lesson 3.**

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