

## Unit Overview:

In this unit, students will explore how mechanisms and machines can be used to create and convert motion, increase speed, increase torque, and create mechanical advantage.

### Recommended Grade Level:

6 - 8

### Kid Spark STEM Lab:

STEM Pathways

## Alignment to STEM Standards:

The table below highlights how this unit is aligned to the Next Generation Science Standards (NGSS) and the International Society for Technology in Education Standards (ISTE).

- ⚙️ NGSS Disciplinary Core Ideas (DCI) are standards related to content knowledge.
- ⚙️ NGSS Science and Engineering Practices (SEP) and Crosscutting Concepts (CCC) provide a foundation for all scientific and engineering disciplines and are particularly important to develop in young students.
- ⚙️ ISTE standards are designed to prepare students to thrive in a constantly evolving technological landscape. [Click here](#) to view ISTE standards.

Lessons & Assessment	NGSS DCI	NGSS SEP	NGSS CCC	ISTE
<b>Lesson 1: The Spark:bit - Motor Override Mode (120 Min.)</b> In this lesson, students will learn how to use the Motor Override Mode on the Spark:bit to control Motor Modules and Light Modules. This lesson does not require any computers or programming.	Engineering design	Developing & using models	Structure & function	Innovative designer, Creative communicator
<b>Lesson 2: Creating &amp; Converting Motion (120 Min.)</b> In this lesson, students will learn how to create and convert different types of motion using Kid Spark engineering materials. Then, students work as a team to create a custom design that converts motion.	Engineering design	Asking questions & defining problems	Cause & effect; mechanism & explanation	Innovative designer, Creative communicator
<b>Lesson 3: Links &amp; Linkages (120 Min.)</b> In this lesson, students will learn how different types of linkages can be used to redirect or convert motion. Students will build a series of mechanisms and then work as a team to create a custom design that includes a linkage.	Engineering design	Developing & using models	Systems & system models	Innovative designer, Creative communicator
<b>Lesson 4: Gears &amp; Gear Trains (120 Min.)</b> In this lesson, students will learn how gears can be used to increase torque or speed. Students will build, modify, and analyze a simple gear train and then work as a team to create a custom design.	Engineering design	Using mathematics	Scale, proportion, & quantity	Innovative designer, Creative communicator
<b>Lesson 5: Compound Machines (120 Min.)</b> In this lesson, students will build a compound machine and determine its total mechanical advantage. Then, students will work as a team to design and create a custom compound machine.	Engineering design	Constructing explanations & designing solutions	Systems & system models	Innovative designer, Creative communicator

### Unit Assessment: Compound Machines

In this performance-based assessment, students will complete a series of tasks as they demonstrate their understanding of the core ideas and concepts that were covered throughout this unit.

## Target Vocabulary

The following key terms will be used throughout this unit. It may be helpful to explain these terms as they show up in lessons and challenges.

Dimensions	Innovation	Mechanical advantage	Robot
Force	Invention	Mechanism	Rotary
Gear	Linear	Motion	Speed
Gear Ratio	Linkages	Oscillating	Torque
Gear Train	Links	Power	
Infrared	Machine	Reciprocating	

## Teaching Lessons Over Multiple Class Periods

Each lesson in this unit follows Kid Spark's convergent to divergent lesson format. Lessons can easily be taught over the course of two class periods.

### Class Period 1 - Convergent Learning Activity

Students building the same models, learning the same content.

### Class Period 2 - Divergent Learning Activity

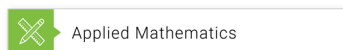
Students applying their knowledge through open-ended design challenges.



## Prerequisite Kid Spark Units

We highly recommend students complete the following Kid Spark units prior to starting this unit.

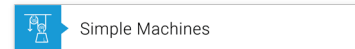
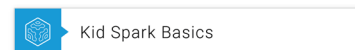
### Elementary Program Units



Students should demonstrate an understanding of the following concepts:

- Metric Measurement
- Dimensions
- Ratios
- Proportions

### Middle School Program Units



Students should demonstrate an understanding of the following concepts:

- Simple Machines
- Mechanical Advantage