



Simple Machines

COOK, BAKER, WELDING, CARPENTRY, PIPE TRADES, AUTOMOTIVE SERVICE TECHNICIAN, HEAVY EQUIPMENT TECHNICIAN, AGRICULTURE EQUIPMENT TECHNICIAN, ELECTRICIAN, WIND TURBINE TECHNICIAN

GRADES	LEARNING OBJECTIVE	CONCEPTS
<ul style="list-style-type: none">• Grade 3• Grade 8• Science 14	Students will gain an understanding of how simple machines are used in everyday trades tools to make work easier.	<ul style="list-style-type: none">• Simple machines• Forces• Structures• Systems and subsystems

Curriculum Connections

GRADE 3 SCIENCE

Guiding question: How can forces relate to changes in movement?

Learning outcome: Students investigate and explain how forces affect movement of objects.

Skills and procedures:

- Explore how simple machines reduce the effort needed to move objects.
- Safely work with tools, materials, and equipment.

GRADE 8 SCIENCE

Unit D: Mechanical Systems

2. Analyze machines by describing the structures and functions of the overall system, the subsystems, and the component parts.
 - Analyze a mechanical device, by:
 - describing the overall function of the device
 - describing the contribution of individual components or subsystems to the overall function of the device
 - identifying components that operate as simple machines



SCIENCE 14

Unit B: Understanding Energy Transfer Technologies

Learning outcome: Describe and compare simple machines as devices that transfer energy and multiply forces or distances.

analyze and describe simple machines as devices that transfer energy (e.g., screws, ramps, hammers, hockey sticks, tennis rackets)

analyze and describe simple machines as either force multipliers or distance multipliers

describe all simple machines as having an input force, an output force and a fulcrum (e.g., pulleys, doorknobs, winches)

explain the functioning of common household machines, in terms of force multipliers and ways in which work is made easier (e.g., can openers, crowbars, car jacks, scissors and hedge clippers)

Description

Students will learn about simple machines and will work with a variety of tools that effectively utilize the featured simple machine(s). Students will also classify and categorize tools based on their knowledge of the tool and simple machines.

Each tool in this kit is a tool used in various industries and is linked to one or more trade. Each tool also features one or more simple machines. Trades professionals complete many of the tasks associated with their job using these tools. Additionally, most of these tools are household items and can be found in a kitchen, garage, or workspace. For more information on the purpose of each tool and how these tools are used on the job, check out our *Simple Machines* video library (see web resources below).



TIME

- 30–45 minutes

MATERIALS

- Printout listing the names of the different simple machines (placemats)
- Trades tools that integrate simple machines (full list under Procedure heading)

Procedure

PREPARATION

- Ensure that 3 of each of the following trade tools are accounted for:
 - Can opener, garlic press, end wrench, claw hammer, pliers, flipper, prybar, ratchet strap, chisel, funnel, screwdriver, retractable measuring tape, tongs, caster wheel, adjustable wrench, corkscrew bottle opener, C-clamp, pipe wrench, multi-shears/scissors, aviation tin snips, pizza cutter, wire stripers, and locking pliers.
- Become familiar with each trade tool, its associated trade, and how the trade tool functions with the different simple machines housed in it. This can be done by examining the tools, watching the corresponding videos and/or referencing the *Classification Guidelines* at the end of this document.

STEPS

Note: You can use this kit to introduce students to the different types of simple machines and their intended purpose and function, or as a review of previously covered material related to the subject matter. Additionally, this activity can be implemented as a whole class or in smaller groups.

WHOLE CLASS INSTRUCTION

1. Present students with the names of the simple machines and the trades tools that utilize simple machines.
2. As a whole class sort the tools into its simple machine category. This is done by matching the tool with the simple machine placemat that best depicts the simple machine within the tool.
 - NOTE 1: Some of the tools have more than one simple machine. For example, the can opener has a wedge, lever and wheel and axle. In cases like this the tool can be places matched with any of those simple machine categories to be correct. As the tools are being classified it would be beneficial to highlight the following:
 - i. The name of the tool.



- ii. The skilled trade that uses the tool and its intended purpose.
 - iii. How the simple machine functions as it pertains to the tool.
- NOTE 2: Some tools display a simple machine that may not be the tools intended purpose. For example, the turner has an incline plane, but is that its purpose? Its intended purpose is a class 1 lever and is used by culinary chefs to turn items such as a pancake or hamburger, not as a ramp.
- 3. If desired, show the corresponding videos to assist in the classifying, sorting, and explanation of the simple machine and how it functions as part of the tool or to check your sorting.

SMALL GROUPS

This activity may be implemented in smaller groups. After students are presented with the names of the simple machines and trade tools, groups could sort the tools into simple machine categories as outlined previously. Once students have sorted the tools into the simple machines categories they could compare their sorting with a different group or as a whole class go over each groups classification. If enough educators are present they could facilitate the small group activities.

Assessment suggestions

OBSERVATION AND QUESTIONING

Watch as students sort the trade tools into the different simple machine categories. Ask students to explain why they put the trade tool in the category they did.

WRITTEN ASSESSMENT

Instead of having students verbalize their sorting reasons, have them write down their reasons in a scribbler or an exit-slip paper.

GROUP DISCUSSION

Have students convince other groups or individuals of their sorting reasons. This can be done in a debate-style discussion.

PERFORMANCE TASK

Students perform a trades-based task with a select number of trade tools. Students explain how the simple machine functions to complete the task.



Extension

- Have students bring a tool or item from home that uses a simple machine and explain a task associated with that tool. For example, a student could bring in a hose clamp that uses a screw to tighten a fitting onto a hose or a nail that acts as a wedge when it enters a block of wood.
- Gather items that pair with each simple machine and put the trade tool to use. For example, bring a canned good to open with the can opener or a piece of tin to cut with the tin snips.

Web resources

- [Simple Machines Kit: Overview](#)
- [Simple Machines Kit: Demonstration](#)
- [Simple Machines Kit: Classification](#)

Contributors

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Classification Guidelines

Teachers can use this sheet to familiarize themselves with the simple machines involved in each tool and how each one is classified. Each tool features one or more types of simple machines. The trades listed are provided as examples of where the tool might be used. Please note that this document is intended as a general guide only and does not include every tool within each simple machine category or every trade where the tool is used.

CLASSIFICATION BY SIMPLE MACHINE

Pulley

- Ratchet strap - Used by trade professionals such as a carpenter to secure a load of lumber.

Wedge

- Chisel - Used by welders to separate a piece of metal or make marks on a piece of metal. Also used by heavy equipment and/or agriculture service technicians to separate a cotter key.

Incline plane

- Funnel - Used by chefs and bakers to add ingredients into a container or by technicians to add liquids into a reservoir.

Screw

- Adjustable wrench - Used by heavy equipment and agriculture technicians to tighten fastening components like nuts and bolts.
- C-clamp - Used by carpenters and welders to secure a piece of material to a table.
- Corkscrew bottle opener - Used by chefs to remove a cork from a glass bottle.
- Pipe wrench - Used by plumbers to tighten or loosen a pipe.

Wheel and axel

- Screwdriver - Used by pipe trade technicians to fasten a hose clamp to a pipe or fitting.
- Measuring tape - Used by a wind turbine technician to measure various components in the nacelle.
- Caster wheel - Used by trade technicians to move toolboxes from one location to another.
- Pizza cutter - Use by chefs to cut pizza.
- Can opener - Used by chefs and bakers to open ingredients contained in cans.



Lever

1st class

- Claw hammer- Used by carpenters to remove a nail from a board.
- Pliers - Used by a heavy equipment technician to remove a cotter key from a chain.
- Pry bar - Used by a plumber to adjust pipe slope.
- Flipper - Used by chefs to turn food.
- Wire strippers - Used by electricians to strip the wire coating from the wire.
- Aviation tin snips – Used by sheet metal workers to cut thin sheets of metal for ductwork.
- Multipurpose shears – Used by many trades people for heavy duty cutting.
- Locking pliers – Used by welders to clamp pieces of metal together for welding.
- End wrench - Used by automotive service technicians to adjust fastener like a bolt or nut.

2nd class

- Garlic press - Use by bakers and chefs to crush garlic.

3rd class

- Tongs - Use by chefs to pick up items.

Some of these tools fall into multiple categories of simple machines. Examples include:

- Multipurpose shears (first class lever, second class lever and wedge)
- Aviation tin snips (first class lever and wedge)
- Pizza cutter (wheel and axle and wedge)
- Locking pliers (first class lever and screw)
- Pipe wrench (screw and second-class lever)
- Can opener (wedge, lever, wheel and axle)
- Wire strippers (wedge, lever)
- Pipe wrench (screw and lever)
- Adjustable wrench (screw and lever)