

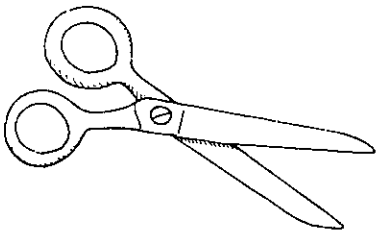
# Simple Machines

A **simple machine** is one that requires only the force of a human to perform work. There are six types. From these types, the elements of all other machines are composed. Use the terms in the word box to label the illustrations. Some terms are used more than once.

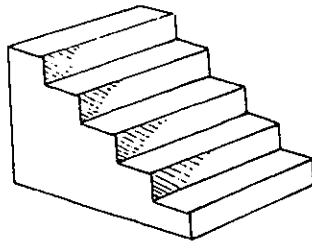
lever  
inclined plane

wheel and axle  
wedge

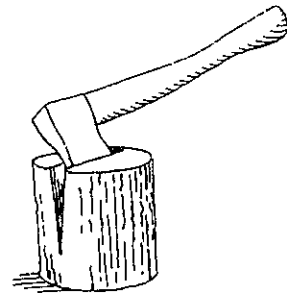
pulley  
screw



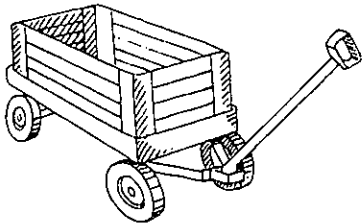
1 \_\_\_\_\_



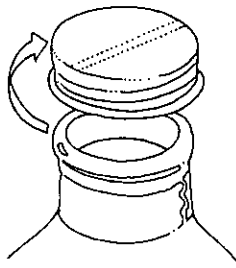
2 \_\_\_\_\_



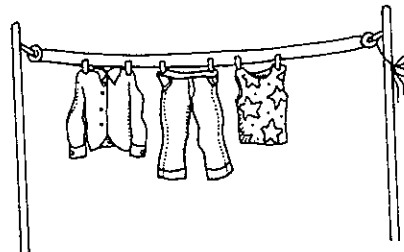
3 \_\_\_\_\_



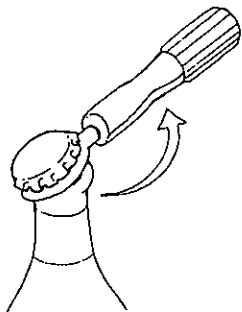
4 \_\_\_\_\_



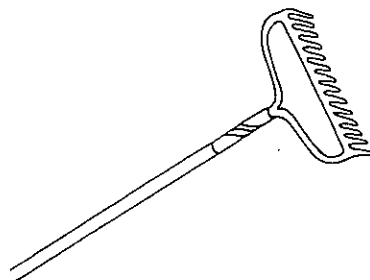
5 \_\_\_\_\_



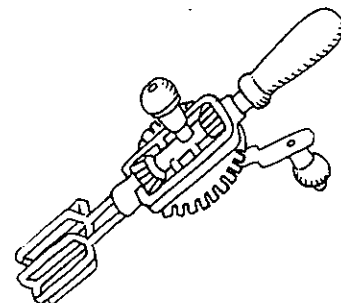
6 \_\_\_\_\_



7 \_\_\_\_\_



8 \_\_\_\_\_



9 \_\_\_\_\_

# Functions of Simple Machines

Simple machines are simple tools used to make work easier. Match each term in the word box to its description.

force	work	distance	lever	inclined plane
wedge	pulley	screw	gear	wheel and axle

- 1 \_\_\_\_\_ This is the product of the force or effort needed to move a load multiplied by the distance it was moved.
- 2 \_\_\_\_\_ This is a simple inclined-plane type machine that consists of a spirally threaded cylindrical rod that engages with a similarly threaded hole.
- 3 \_\_\_\_\_ This is a small wheel with a grooved rim through which a rope or chains run. It changes the direction of a pulling force and combinations of these simple machines increase the force applied for lifting an object.
- 4 \_\_\_\_\_ This is a toothed wheel that engages another toothed mechanism in order to change the speed or direction of transmitted motion.
- 5 \_\_\_\_\_ This is the gap or measurement between two locations.
- 6 \_\_\_\_\_ This is a class of rotating machines or devices in which effort applied to one part produces a useful movement at another part. They are used for moving or lifting loads.
- 7 \_\_\_\_\_ This is an influence that produces a change in an object.
- 8 \_\_\_\_\_ This simple machine is a rigid bar that pivots on a fulcrum to move or lift a load.
- 9 \_\_\_\_\_ This is a combination of two inclined planes that is itself moved with force to cut apart or separate an object.
- 10 \_\_\_\_\_ This simple machine is a slope or ramp that is used to lift a load. It trades distance for force.

# Three Classes of Levers

Levers come in three basic classes. They each have a **fulcrum** or pivot point. Each lever has a **force** put into the lever called an **effort** or input force. Each lever also has a force, called the **load**, which is the object being moved. The type of lever is determined by where the effort and load are placed in relation to the fulcrum. Use the terms in the word box to label each class of lever and the diagrams. Some terms are used more than once.

first class fulcrum	second class load	third class effort
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Type of Lever: \_\_\_\_\_

The effort and load are on the same side of the fulcrum, but the effort is closer in.

Type of Lever: \_\_\_\_\_

The fulcrum is between the effort and the load.

Type of Lever: \_\_\_\_\_

The effort and load are on the same side of the fulcrum, but the effort is farther out.



# Mechanical Advantage of Inclined Planes and Levers

**Mechanical advantage** is the advantage created by a machine that enables people to do work while using less force. Use the example diagram to identify resistant force and effort force. Then use the formula to calculate the mechanical advantage for each diagram.

mechanical advantage = effort distance ÷ resistance distance

$$MA = \frac{F_E}{F_R}$$

① \_\_\_\_\_

② \_\_\_\_\_

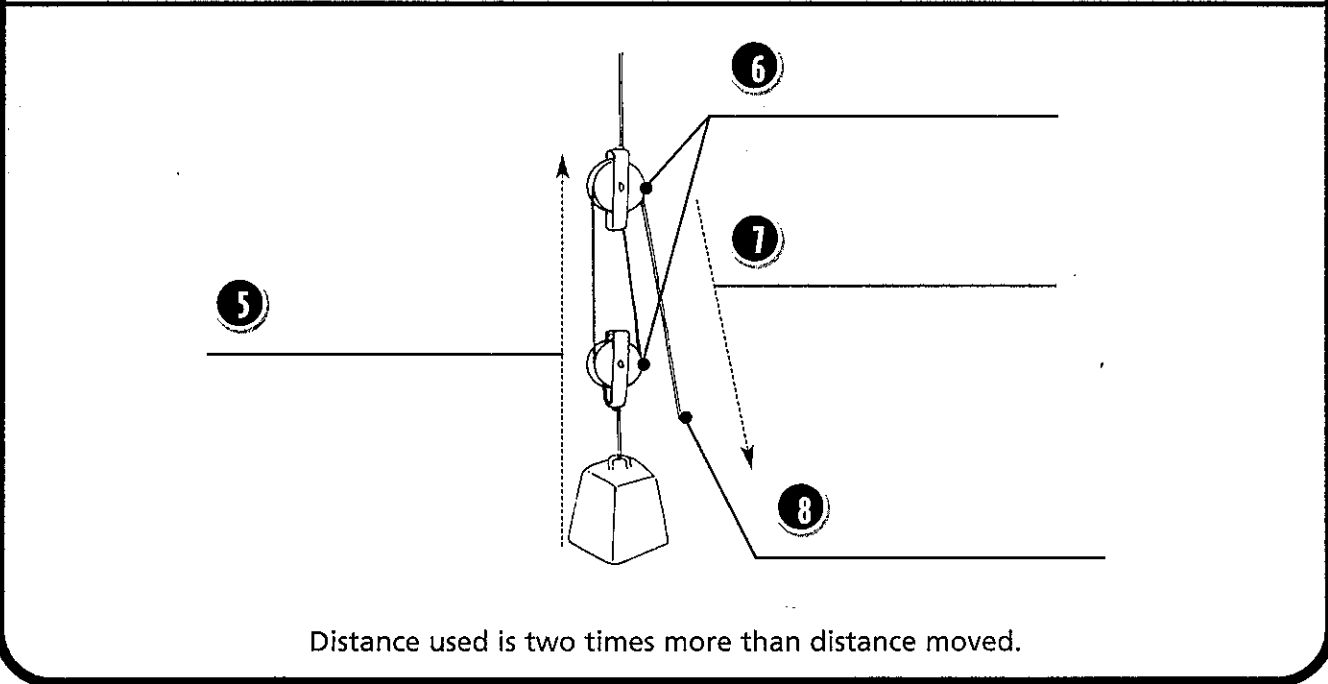
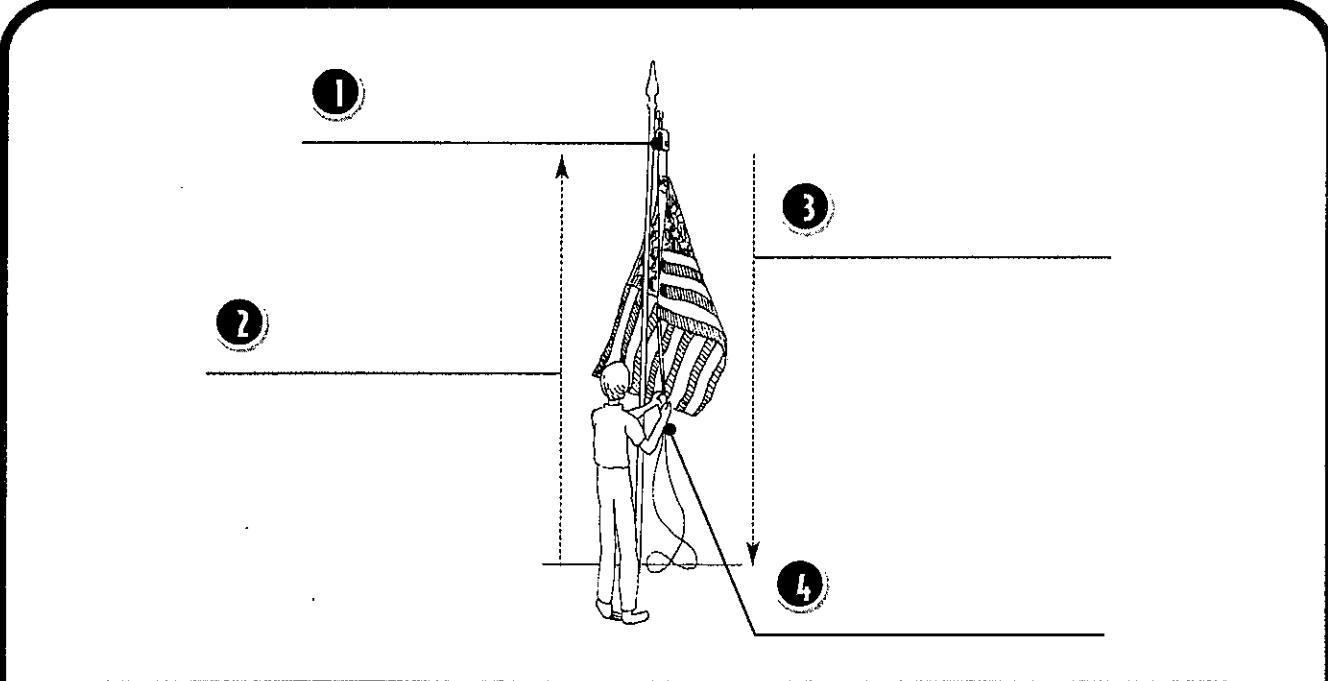
③ \_\_\_\_\_

④ \_\_\_\_\_

# Pulleys

A **pulley** is a small wheel with a grooved rim that holds a rope or chain. Pulleys can be fixed or movable. Each pulley or wrap of the line allows you to trade distance for force. Use the terms in the word box to label the illustrations.

distance to move load      length of rope pulled      force      pulley



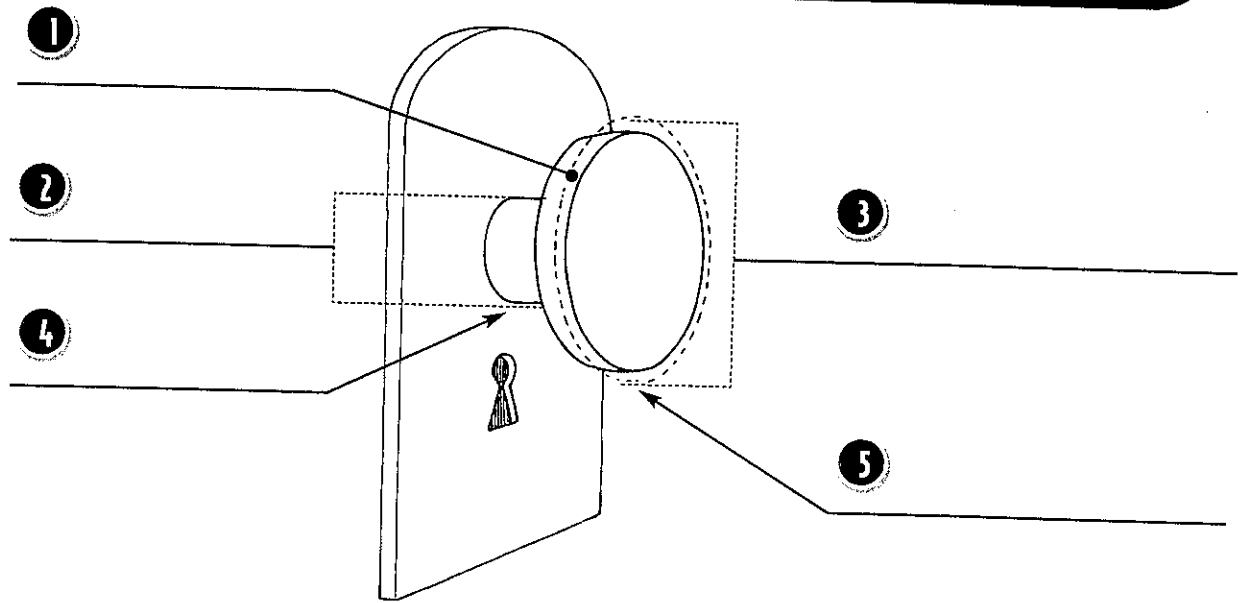
# Wheels and Axles

We see wheels on things every day. However, these kinds of wheels do not always do the same kind of work as the simple machine called the wheel and axle. The purpose of some wheels is to reduce friction by allowing an object to roll instead of drag. The simple machine is made up of a small wheel attached to a larger wheel. The small wheel is the axle. It is usually a rod that turns as a larger wheel turns. Use the terms in the word box to label the diagram.

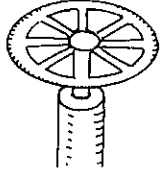
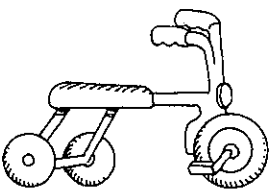

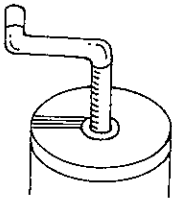
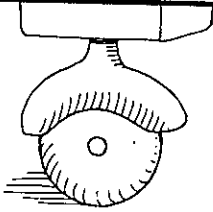
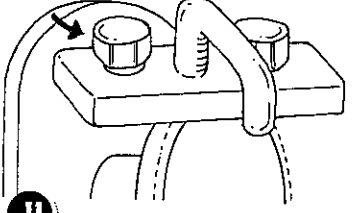
distance axle uses  
large wheel makes turning easier

force  
small wheel is difficult to turn

distance you use



Write **wheel and axle** if it operates like a simple machine to increase force.  
Write **reduce friction** if that is the purpose of the object in the diagram.

 <b>6</b> _____	 <b>7</b> _____	 <b>8</b> _____
 <b>9</b> _____	 <b>10</b> _____	 <b>11</b> _____

# Wedges

A **wedge** is made up of two inclined planes. Unlike an inclined plane which does not move, the wedge moves to do work. Wedges can be used to lift things, separate things, or tighten and attach things in place. Use the terms in the word box to label each use of a wedge.

lift                      separate                      tighten                      attach

- 1 \_\_\_\_\_ A nail is a wedge. Drive the nail into a block of wood.
- 2 \_\_\_\_\_ A doorstop is a wedge. Prop a door open with a doorstop.
- 3 \_\_\_\_\_ The blades of a pruner are wedges. Cut a branch with the pruners.
- 4 \_\_\_\_\_ The blades on a pair of scissors are wedges. Use the scissors to cut paper.
- 5 \_\_\_\_\_ A piece of wood can be a wedge. A man slips a wedge under a heavy box.
- 6 \_\_\_\_\_ A chisel is a wedge. An artist uses a chisel to carve a statue.
- 7 \_\_\_\_\_ Paper staples are wedges. Use staples to hold pages together.
- 8 \_\_\_\_\_ An axe is a wedge. Use an axe to split a log.
- 9 \_\_\_\_\_ Little wedges of wood can tighten a loose chair leg. Hammer the wedges into the space where the chair leg is attached to the seat.
- 10 \_\_\_\_\_ Wedges of metal can secure the head of an axe. Pound the wedges into the wood where the handle joins the axe head.
- 11 \_\_\_\_\_ The edge of a snow shovel is a wedge. Use the shovel to push snow off your driveway.
- 12 \_\_\_\_\_ The blade of a knife is a wedge. Be careful as you slice a piece of cheese for a hamburger with the wedge.



# Screws

Screws are a simple machine that is a combination of other simple machines. Match each word in the word box to its description.

inclined plane	threads	turned
wheel and axle	handle	axle
wedge	force	distance
drill	jackscrew	

- 1 \_\_\_\_\_ This is a variation of a screw that is designed to make holes in wood or other materials.
- 2 \_\_\_\_\_ A screw is one of these wrapped around a cylinder.
- 3 \_\_\_\_\_ With the use of a screwdriver, this is done to the screw as it enters the wood or other material.
- 4 \_\_\_\_\_ When you are moving the screw with a screwdriver, you are really moving it with this simple machine.
- 5 \_\_\_\_\_ Without the threads, a screw is basically a nail, which is an example of this.
- 6 \_\_\_\_\_ When driving a nail, it takes a lot of this to push apart the wood as the nail enters it.
- 7 \_\_\_\_\_ On a screw, the inclined plane forms these ridges in a spiral along the cylinder.
- 8 \_\_\_\_\_ When turning a screw, it takes less force but you use more of this as the screw enters the wood.
- 9 \_\_\_\_\_ This tool is a variation of a screw that allows a platform to raise and lower extremely heavy objects.
- 10 \_\_\_\_\_ This part of the screwdriver acts as a wheel to do the work.
- 11 \_\_\_\_\_ The shaft of the screwdriver and the screw itself act as one of these to do the work.

# Uses for Simple Machines

Match the simple machines in the word box to the descriptions of the work that needs to be done. Some terms are used more than once

lever  
wedge

pulley  
screw

wheel and axle  
inclined plane

- 1 \_\_\_\_\_ A piano needs to be moved up to a third floor apartment.
- 2 \_\_\_\_\_ Your sister wants to fasten a towel bar in the bathroom. You suggest one of these.
- 3 \_\_\_\_\_ A large boulder is in your yard. You need to move it over about 3 feet.
- 4 \_\_\_\_\_ You need to block a door to keep it open while you bring in groceries from the car.
- 5 \_\_\_\_\_ Dad needs to take your older dog to the vet. The dog can no longer jump into the car on his own and he is too heavy to lift.
- 6 \_\_\_\_\_ Every morning the flag needs to be raised to the top of the flagpole.
- 7 \_\_\_\_\_ You remember to put the lid back on the jar of mayonnaise.
- 8 \_\_\_\_\_ The trees have lost their leaves and you have a lot of them to collect.
- 9 \_\_\_\_\_ Your little sister's treehouse is 6 feet off the ground and her friends need an easier way to get up to it.
- 10 \_\_\_\_\_ You turn off the water to the sprinkler hose for your mom.
- 11 \_\_\_\_\_ Your older brother chops some firewood because it's going to be a cold night.
- 12 \_\_\_\_\_ While visiting an old farm, you need to draw a bucket of water up from the well.