LEAP

Science is Fun!

LEARN EXPLORE AND PLAY

Activity Kit

Simple Machines

Materials

Simple Machines Components

- 7 Base Plates (color may vary)
- 4 Large Pillars
- 2 Small Pillars
- 2 5g Blocks and Hooks
- 2 10g Blocks and Hooks
- 8 Large Pulley Wheels
- 4 Small Pulley Wheels
- 1 Incline
- 2 Axle Holders
- 6 Eye Axles
- 3 Bolts
- 3 Nuts
- 1 Insert Piece
- 1 Wedge
- 9 Connector Axles
- 8 Rubber Bands
- 20 Activity Cards

Binder

- About This Kit
- Simple Machines Components
- Simple Machines Box Diagram
- Glossary
- Assembly Instructions & Information

Book

- ***The Kids' Book of Simple Machines: Cool Projects & Activities That Make Science Fun*** by Kelly Doudna

Recommended for Grades 5 and Up

Choking Hazard

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What to Know About This Kit. . .

Simple machines, an important part of everyday life, simplify work tasks such as lifting, pulling, and pushing objects. Simple machines allow a person to exert less energy and effort to accomplish a task. For example, lifting a heavy box into a truck requires much more force and effort than pushing the box up an inclined. Simple machines can also reduce the amount of force needed to move an object or change the direction or distance of force required.

This kit includes sixty-three components to build five basic simple machines: pulley, inclined plane, wedge, lever, and wheel and axle. Each machine is designed to decrease force and effort in its own way. Also included is a set of Activity Cards designed to support the study of simple machines. Use these Activity Cards to help identify real-world examples and perform tests that demonstrate mechanical advantage.

For further exploration, try some of the experiments from the book ***The Kids' Book of Simple Machines: Cool Projects & Activities That Make Science Fun*** that is included in this kit.

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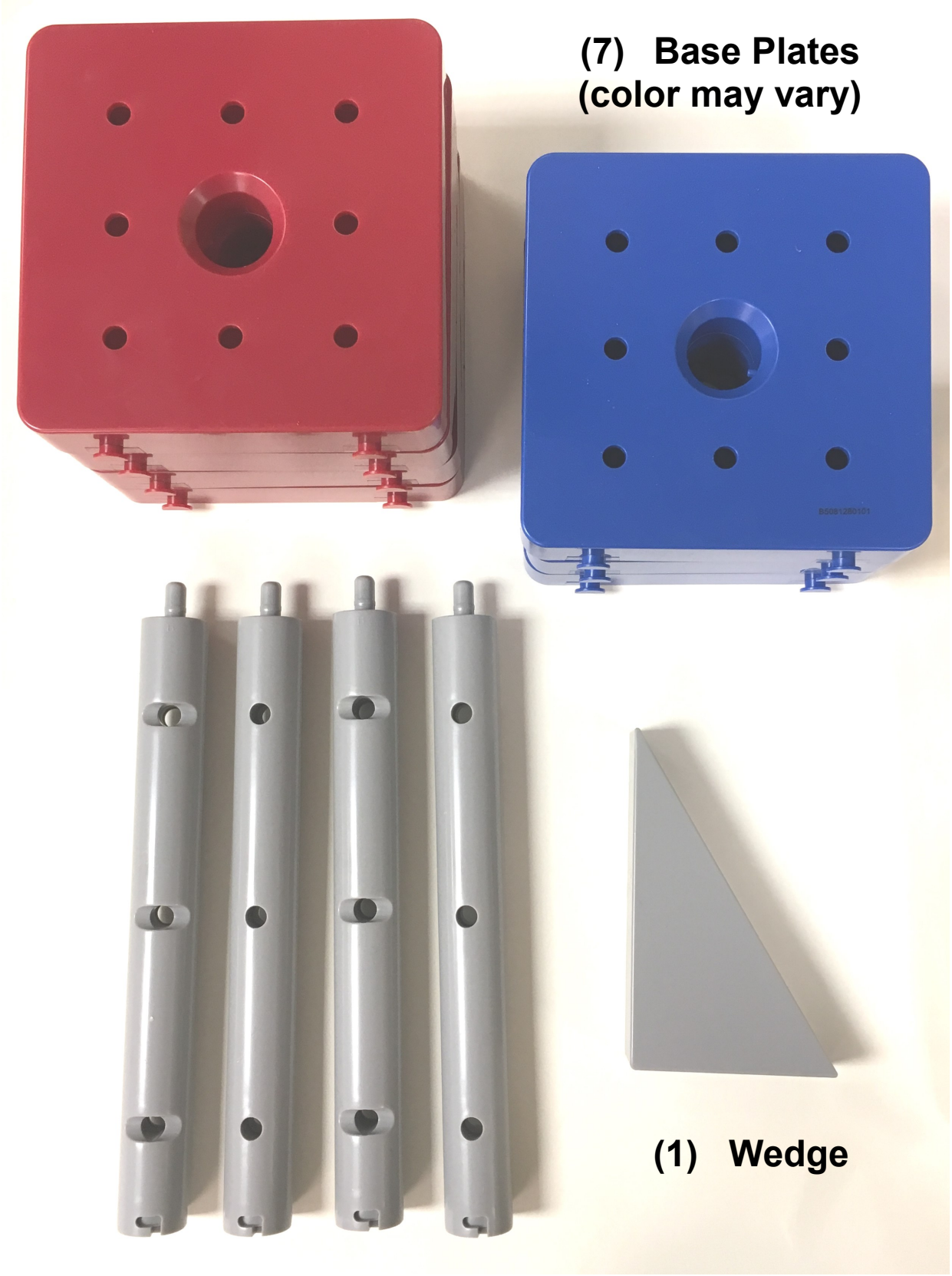
Simple Machines Components

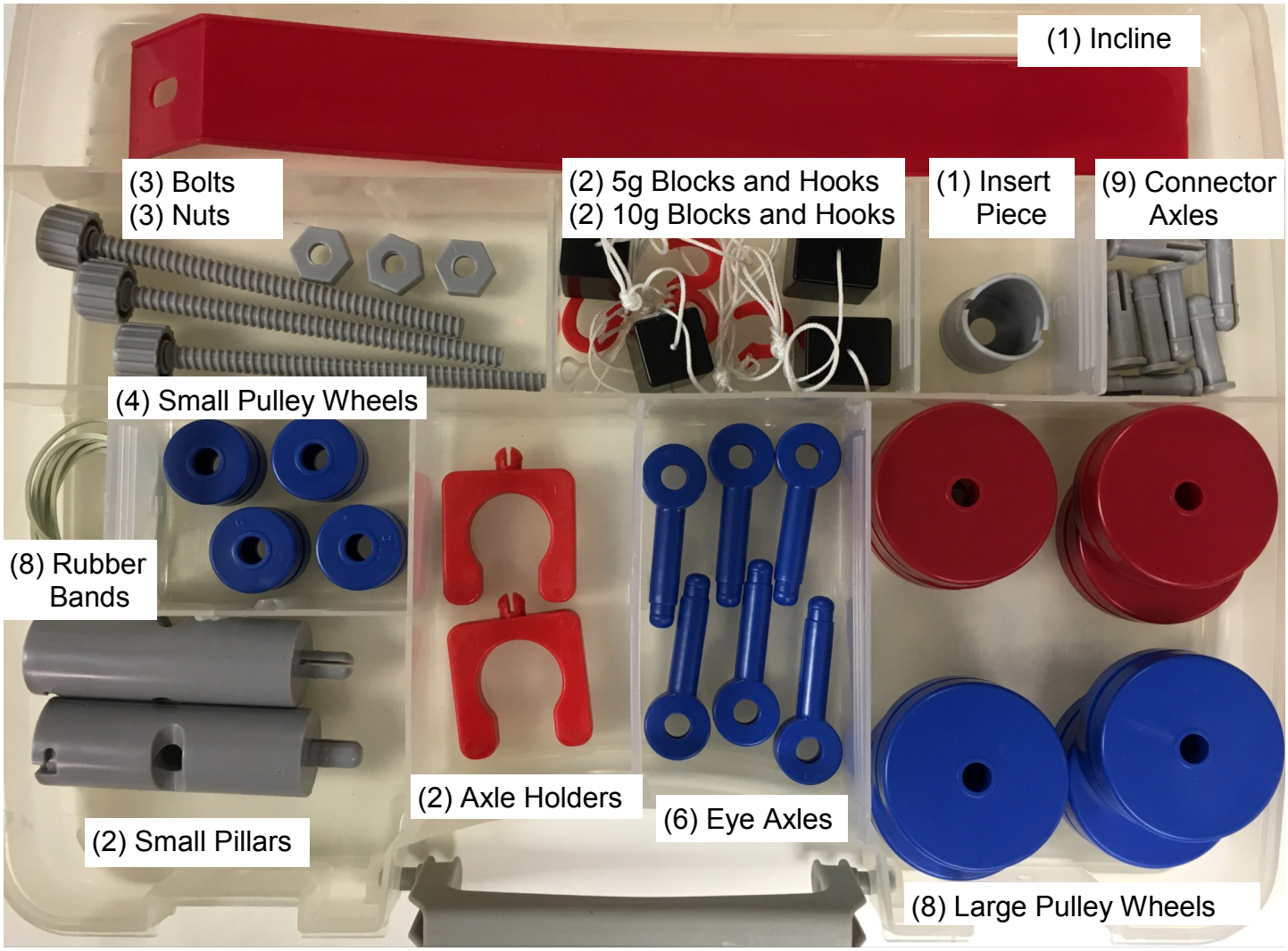


(7) Base Plates
(color may vary)

(1) Wedge

(4) Large Pillars

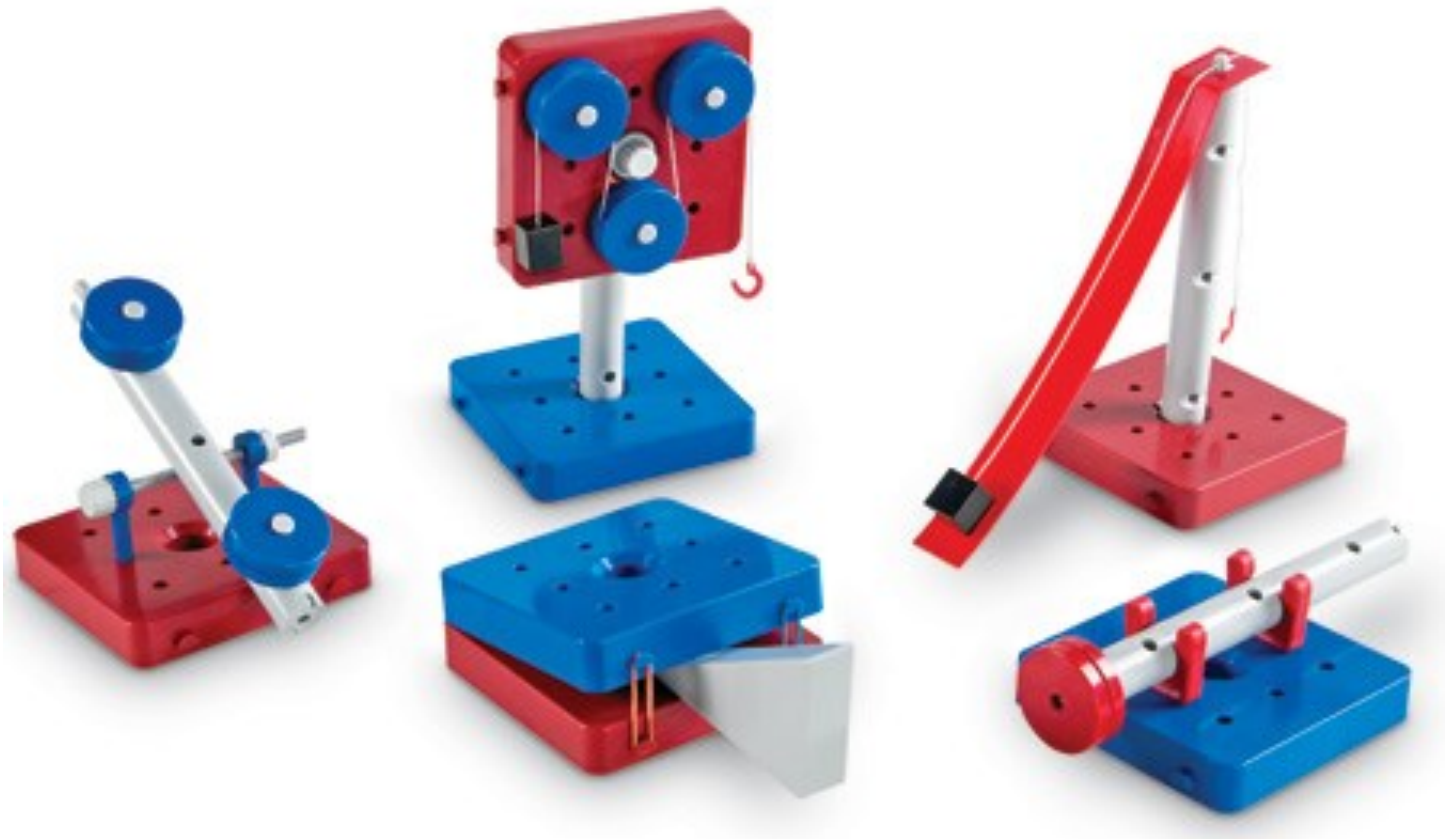
Simple Machines Box Diagram



Glossary

- **effort -** amount of force applied to move an object
- **force -** any push or pull on an object
- **fulcrum -** the support on which a lever rests while moving or lifting an object
- **inclined plane -** flat surface that moves an object from one level to another with less force over a greater distance
- **lever -** a bar, rod, or other surface that rests on a fulcrum point and lifts objects with less effort
- **load -** object that is moved
- **pulley -** a cord or wire moving over a wheel or set of wheels that changes the direction of applied force to an object making it easier to move
- **simple machine -** a machine that consists of very few or no moveable parts that makes moving an object easier
- **wedge -** consists of at least one, but usually two, inclined planes put together to form a sharp point that splits or separates an object
- **wheel and axle -** a wheel with a rod, called an axle, in the center on which the wheel rotates in order to move objects
- **work -** amount of force exerted multiplied by the distance an object moves

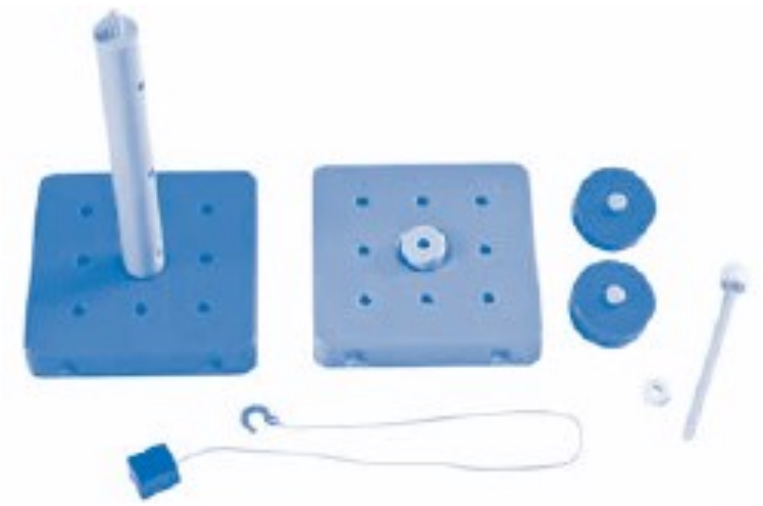
Assembly Instructions & Information



Pulley

Components Needed:

- 2 - Base
- 1 - Large Pillar
- 1 - 5g Block and Hook
- 2 - Large Pulley Wheel
- 1 - Bolt
- 1 - Nut
- 1 - Insert Piece
- 2 - Connector Axle



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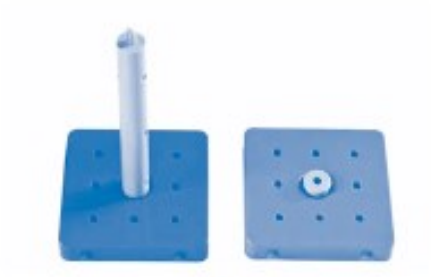
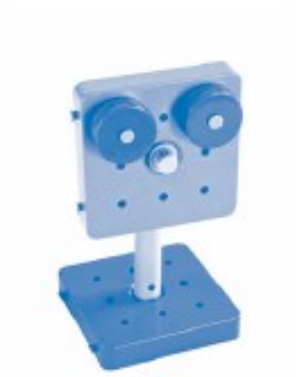


A

B

C



D

E

F

G

(alternative setup with 3 Large Pulley Wheels)

Note: If the pulley wheels are not turning when fully assembled, make sure they are not pushed tightly against the base.

Pulley

A pulley's main function is to change the direction of an applied force, which, in turn, decreases the amount of effort and force needed to move an object. Applying a downward force on a pulley will move an object upward.

Demonstrate this principle by looping the string and hook of the 10g block over one pulley wheel and pull downward on the hook. Notice how the block moves upward while the hook is being pulled downward. The applied force changes the direction in which the block moves, making it easier to move upward.

Imagine a construction worker trying to push a large beam to the top of a building. It would be easier to lift the beam upward using a machine with a pulley system.

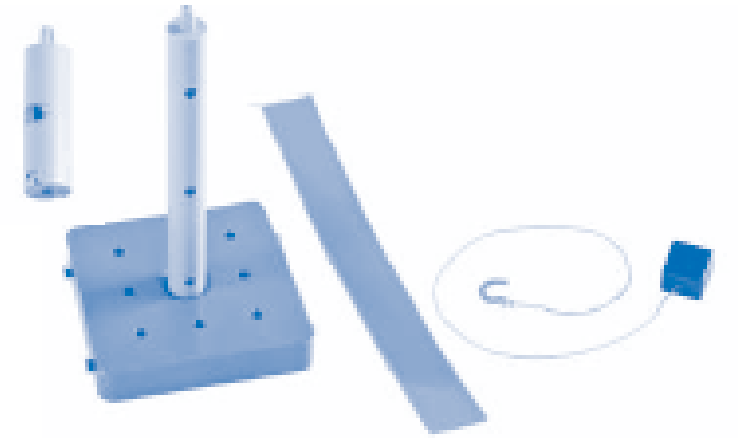
A pulley consists of a cord or wire moving over at least one wheel or a system of wheels. Real-life examples of pulleys include a flag pole, construction crane, window blinds, and older elevators.

Experiment with the pulley model by changing the location, amount, or size of the wheels. Add washers to the end of the hook. How many washers does it take to move the 5g block and the 10g block? Does effort change when moving the string through more or less wheels? How does the direction change? Does effort increase or decrease when using small or large wheels? Does effort change when the location of the wheels changes? How does the direction change?

Inclined Plane

Components Needed:

- 1 - Base
- 1 - Large Pillar
- 1 - Small Pillar
- 1 - 10g Block and Hook
- 1 - Incline



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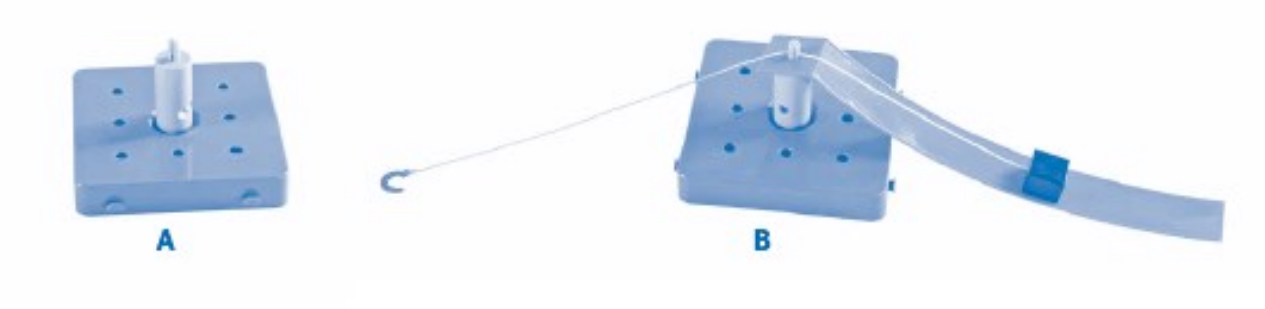


Note: If the inclined is bent, gently bend the inclined in the opposite direction by sliding it through your fingers to straighten it out.

Inclined Plane

An inclined plane's main purpose is to move an object to a certain height by pulling or pushing it with less effort and force over a greater distance.

Demonstrate this principle by pulling the 10g block up the incline. Then, set the block down on the table and lift it straight up to the same height. Notice how it is easier to pull the block up the incline than manually lifting it upward. Pulling the block requires a greater distance, but the inclined plane eases the process.

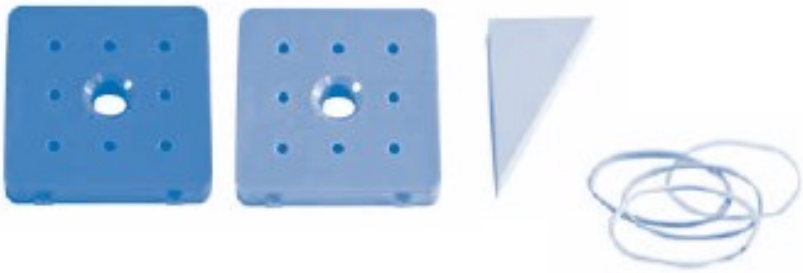
Imagine a person loading boxes by lifting them from the ground and placing them in the back of a truck. It would be easier to carry or push boxes up a ramp. Even though the distance is greater, an inclined plane exerts less effort than manual lifting. An inclined plane consists of a ramp leading to another level. Real-life examples of inclined planes include stairs and slides.

Experiment with the inclined plane by changing its height. Does a higher inclined increase or decrease the amount of effort needed? At the same time, drop a ball beside the incline from the same height and roll a second ball down the incline. Which ball reaches the bottom first? Less force is needed to accelerate the ball down the incline; therefore, that ball should reach the bottom last.

Wedge

Components Needed:

- 2 - Base
- 1 - Wedge
- 4 - Rubber Bands



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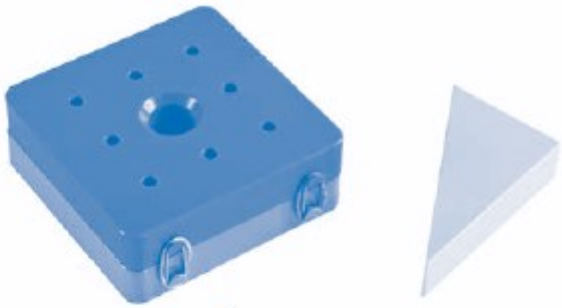
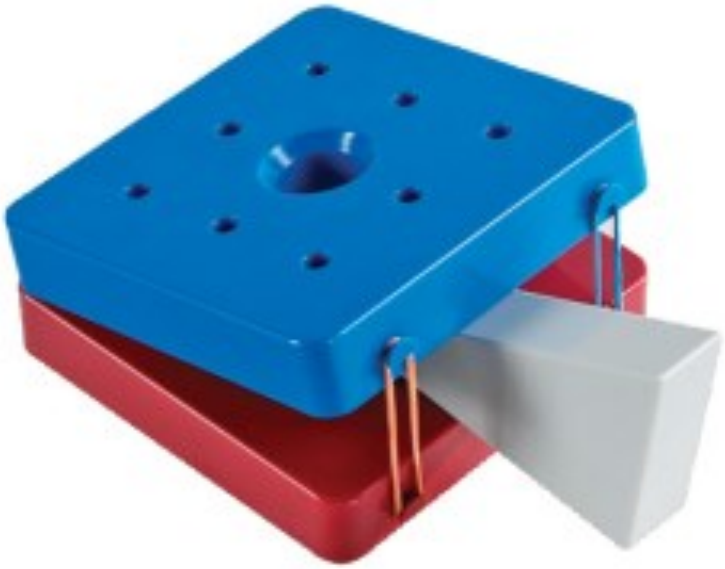


A

B

Wedge



The purpose of a wedge is to split or separate objects into two or more pieces by inserting a sharp-edged inclined into another object.

Demonstrate this principle by inserting the wedge piece between two bases linked together by rubber bands. Notice how the space between the two bases increases as the wedge is inserted.

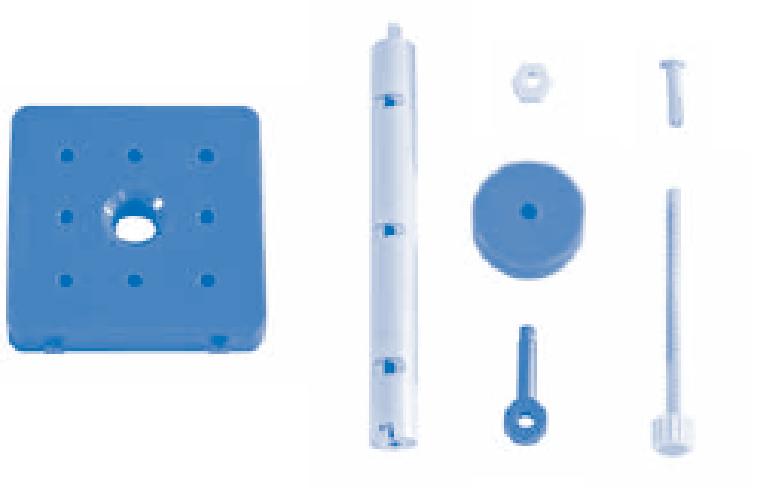
Imagine the front of a boat moving through water. The pointed tip, or wedge, makes the boat move more easily. The boat would not move as efficiently through water if its front was merely a flat surface.

A wedge consists of at least one, but usually two, inclined planes put together. Some real-life examples of wedges include knives, axes, chisels, and boat fronts.

Lever

Components Needed:

- 1 - Base
- 1 - Large Pillar
- 2 - Large Pulley Wheel
- 2 - Eye Axle
- 1 - Nut
- 1 - Bolt
- 2 - Connector Axle



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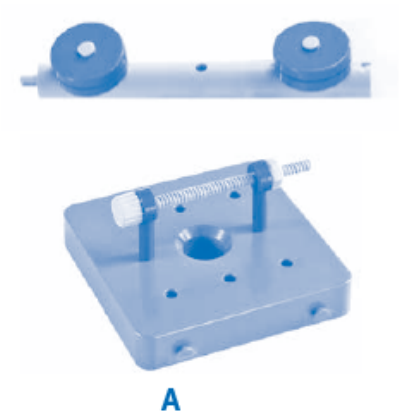
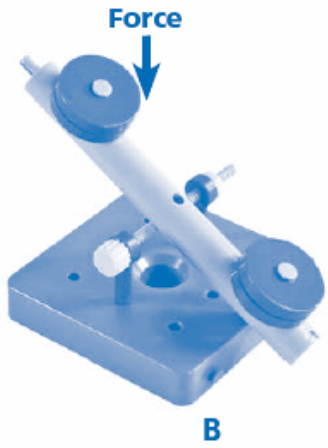
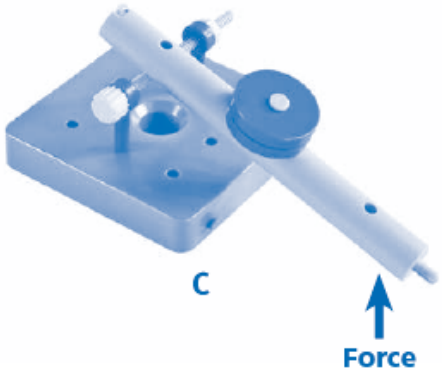
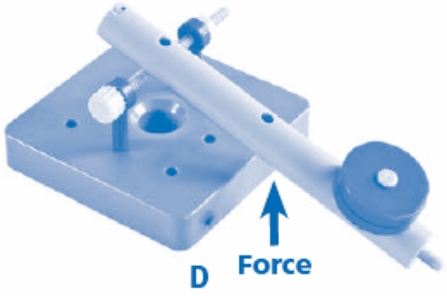




First-Class Lever



Second-Class Lever



Third-Class Lever

Lever

There are three different types of levers, but each one has a few things in common. All levers have a bar, rod, or other surface that rests on a fulcrum point. Force is applied to one end of a rod, which, in turn, moves a load. If a load is located close to the fulcrum point, less effort is required.

In a first-class lever, the fulcrum point is located in the middle of the load. A seesaw is an example of a first-class lever, which applies the force in one direction with the load moving in the opposite direction. Set up the model with the rod resting on the center of the fulcrum and place two wheels on either end of the rod to demonstrate this principle. Notice when one end is pushed down, the other end rises.

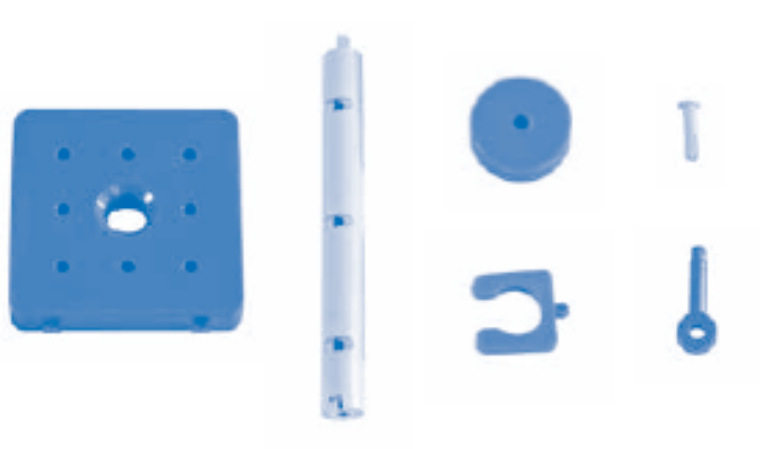
In a second-class lever, the fulcrum point is located on one end, with the load located between the fulcrum point and applied effort. A wheelbarrow is an example of a second-class lever. The load is in the center and the fulcrum point is the wheel. Effort is applied to the handles, allowing a person to lift and easily move the load. Set up the model with the rod resting on one end of the fulcrum and place one wheel in the center. Lift up the other end of the rod to demonstrate this principle. Notice how the load is raised in the same direction as the effort.

In a third-class lever, the fulcrum point is also located on one end, but this time the applied effort is in the center between the fulcrum point and load. An example of this type of lever is a fishing pole. When fishing, the arm acts as the fulcrum point, the effort is applied to the center of the rod, and the load is at the end of the fishing line. The load moves in the same direction as applied effort. Set up the model with the rod resting on one end of the fulcrum and place one wheel on the other end. Lift up the center of the rod to demonstrate a third-class lever. Notice how the load is raised in the same direction as the effort.

Wheel and Axle

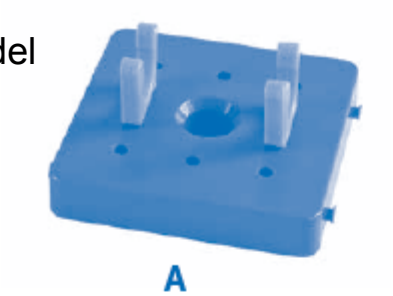
Components Needed:

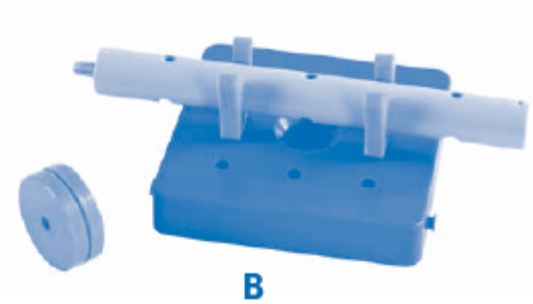
- 1 - Base
- 1 - Large Pillar
- 4 - Large Pulley Wheel
- 2 - Axle Holder
- 4 - Eye Axle
- 4 - Connector Axle

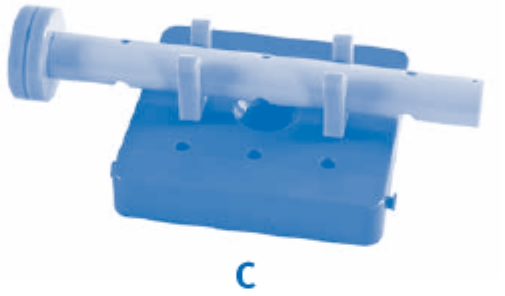


Assembly Instructions:

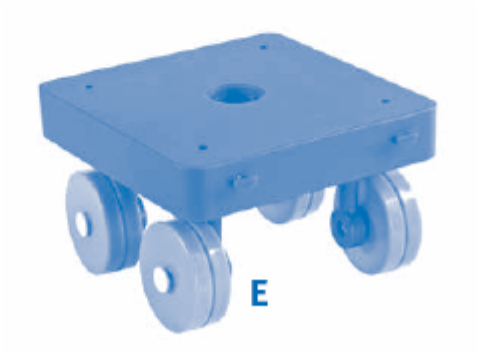
Doorknob Model







Car Model



Wheel and Axle

A wheel and axle is one of the most common and useful simple machines. Its purpose is to move objects from one place to another with very little effort. Movement is accomplished by rolling an object while the wheel is turning on the axle.

Demonstrate this principle by creating the doorknob model. Roll the wheel back and forth and watch the axle turn.

The wheel and axle consists of a wheel with a rod, called the axle, at its center. Cars, clock gears, wheelbarrows, and doorknobs are just a few examples in which a wheel and axle can be found.

Experiment with the wheel and axle by creating the car model. Set a heavy object atop the car and roll it on a surface. Notice how little effort is needed. Now, place the same object on the same surface without the car. Push the object along the surface. Notice how much more effort is needed to move the same object over the same distance.