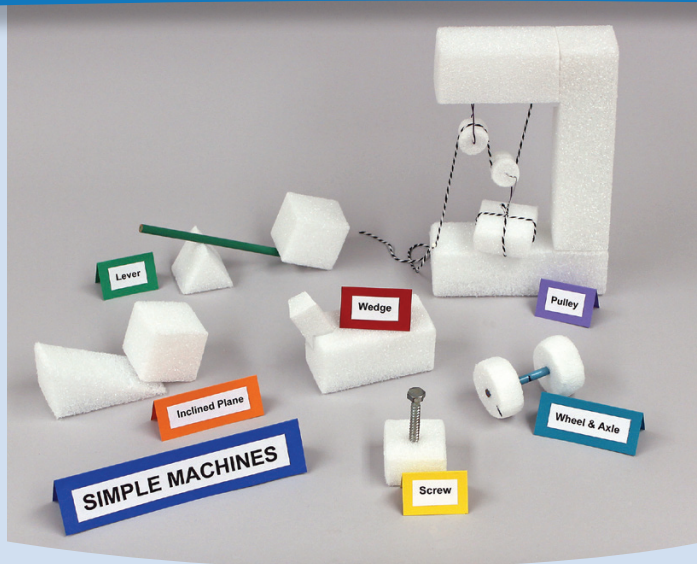


# Simple Machines

## MATERIALS

**FOR STUDENT:** (one per group of two students unless otherwise noted)

- FloraCraft® Make It: Fun® Foam Blocks, cut from large Foam Block (see "FOR TEACHER") to 9" x 12" x 2" thick
- Screw, 3", wood or lag type
- Wire, 22 gauge, 16" length
- Baker's twine, 1 yd. length
- Toothpicks, four
- Large paper clip
- Cardstock, 9" x 12" white
- Colored pencils: One long and one short
- Pencil
- Ruler
- Plastic knives, two
- Scissors
- Glue stick
- Paper plate
- Large zip-sealed bag



## FOR TEACHER:

- FloraCraft® Make It: Fun® Foam Block, 12" x 36" x 2" thick (will get four 9" x 12" x 2" thick per block, enough for four groups of two students)
- FloraCraft® Design It:® Wire Cutter (for students to share with teacher supervision)
- Cardstock, 12" x 12": Blue (will yield enough for four groups); teal, green, red, purple, orange and yellow (will yield enough for twelve groups of each color)
- Copy paper
- Pencil
- Ruler
- Serrated knife
- Paper cutter
- Scissors
- Glue gun (for teacher only)
- Computer and printer

**SCIENCE**  
GRADE LEVEL  
**SECOND – THIRD**

## COMPLETION TIME

- Two 50 minute sessions

## OBJECTIVES

Students:

- Learn the names and functions of the six simple machines
- Understand the functions well enough to make small models to illustrate
- Be able to give examples of real-life machines that use the simple machines principles

## STANDARDS

- The motion of an object can be observed and measured
- An object's motion can be described by recording the change in position of the object over time
- The way to change how something is moving is by giving it a push or a pull
- The size of the change is related to the strength of the amount of force, of the push or pull
- Tools and machines are used to apply pushes and pulls (forces) to make things move

## TEACHER PREPARATION

*Note: Read through all the instructions first and check out the TIPS! Plan for two class sessions. Have a glue gun plugged in and ready to use (ideally set on low temperature) but out of student reach. This can give you immediate adhesion when you're in a hurry to help students. It is also recommended that you make a complete set of machines first, before preparing the materials for any others, since knowing the process, first hand, might affect how you prepare.*

**[1]** Use a serrated knife to cut the foam block into four 9" x 12" pieces, one per two students.

**[2]** Use a wire cutter to cut a 16" length of wire per two students. Use scissors to cut 1 yd. lengths of baker's twine per two students.

**[3]** Use a paper cutter to cut a 3 1/2" x 8" strip of blue paper for the main title for each group. Then for the other machine names, cut a 2 3/4" x 4" strip of each of six colors for each group. (Students can trim them to the correct lengths.)

Photocopy title / name sheet for each group and cut into strips to fit on colored paper with border showing. (Students can trim them to the correct lengths.) Set them aside until after they make their machine models.

**[4]** For each group, set on paper plate: Glue stick, baker's twine, wire, pencil, long and short colored pencils, plastic knife, screw, paper clip, four toothpicks and scissors. Set the foam, 9" x 12" white cardstock and a ruler beside the plate for each group.

## LESSON INTRODUCTION

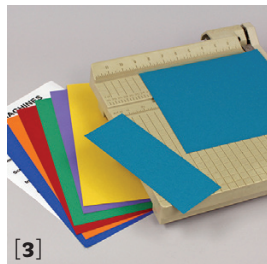
Introduce and explain the functions of each of the six simple machines: Lever, wedge, wheel and axle, inclined plane, screw, and pulley. Explain that the students can work with a partner to create all six machine models, and they are intended to represent the machines, not be fully functioning. The students can design them any way they want. (These instructions are intended to give you ideas as well as the option of sharing the same construction with the students. However, if you show the students your models, then put them away and give them the sheet of foam to come up with their own designs, it will be more educational and memorable.)



[1]



[2]



[3]



[4]



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# INSTRUCTIONS



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**[1]** Show students your models, discussing each one. Then, put yours away, so that the students can design their own machines. Show them how they can plan the size of each part of each machine using a pencil and ruler on the white cardstock (which is heavy enough for them to cut apart to use as patterns to trace onto the foam, or they can use the ruler and pencil to draw directly on the foam). The idea is for the students to come up with their own models that represent how each machine works.

If students seem stuck on how to begin, you can mention that the foam is 2" thick so if they cut 2" x 2" x whatever length they need, they will have a workable piece. (Note: This size foam block is large enough to allow students a few do-overs, if needed.)



**[2]** Students should trace their paper patterns or measure and draw on the foam. Demonstrate how to cut the foam with the plastic knife by putting it against the edge of the ruler and scoring first. Then, show how to cut through, with multiple passes of the knife, using a sawing motion. (Still press against the ruler to keep the cut line straight.) Caution them to keep the knife straight up and down so that the sides of the foam don't angle in or out.



**[3]** Machine model notes:

**Screw** – Since that can't be easily made from foam, you have provided one. Students simply need to create a base large enough to support it.

**Lever** – The long colored pencil can represent the lever with a base (triangular prism) to support it and a cube or item can be lifted.

**Inclined plane** - A long rectangular block (cuboid) can be cut diagonally to

create the incline and a block or item can be pushed up or down the incline.



**[4]** Machine model notes:

**Wedge** – A wedge (long triangular prism) can be cut and then mounted on any form to represent that it is used to split something apart.

**Wheel & Axle** – By cutting a cube in half, a narrower block can become a wheel by trimming the corners off and rounding the foam by compressing it on the table. A small colored pencil can join two wheels. (Reminder- to illustrate how it works, a line needs to be placed on both wheel and axle to show the revolution difference.)



**[5]** Machine model notes:

**Pulley** – This requires constructing a base to hold the pulleys. Pieces can be joined with toothpicks and glue stick. Pulleys can be constructed like wheels and shaped. Wire can allow one pulley to turn and a bent paper clip can connect with a package to lift by baker's twine wrapped around the package. Another length is run through the pulleys. This machine is a little more difficult and might require that groups collaborate with each other to figure it out.



**[6]** As students finish making their machines, hand out the colored cardstock strips and names of the machines. Have them fold the cardstock in half lengthwise, trim it to size and mount the name on it. Ideally, have an area for each group to display their machines.



## MODIFICATIONS

### To simplify project:

- Cut 2" x 2" strips of foam so that the students have less cutting to do.
- Pre-assemble the pulley base/side/top so that they just need to make the pulleys and package.

### To expand project:

- Find photo examples of current day machines based on each of the 6 simple machine principles.
- Have students work together to create a large machine in which all 6 simple machines are included – something like a Rube Goldberg invention.

### For multiple ages:

- Younger and older students can work side-by-side, with younger students making the more simple machines and older students building the more involved ones.
- Have older students research more on each simple machine and how they are the basis to more involved machines that everyone uses today.

## ADDITIONAL IDEAS

- Let students paint foam models with acrylic paint.
- As a class or group, make jumbo simple machines to display in the class. Use large foam blocks by gluing together 2" thick blocks and scaling all other parts accordingly.
- Find real examples of other machines that use one or more of the simple machine principles.
- Use the project for science fair presentations.

# INSTRUCTIONS

## TIPS

- Encourage students to think through this with their partner, and even with other groups. The most successful experience will be one in which the students come up with different looking machines than your models and different from each other group's machines.
- Encourage the students to saw back and forth when using the plastic knife on foam – don't just press down or it mashes more than cuts.
- For a more finished look, show students how to compress the cut edges of the foam. Place the foam edge on the table and press down, to round it, rocking it back and forth a little. Rotate and repeat with each side. For round objects, trim corners, press and roll them all around to get an even, circular edge.
- Encourage students, explaining that inventing is all about trial and error. Find and share quotes from famous inventors like Alexander Graham Bell with the many failed attempts he made before inventing the telephone.
- This project is an opportunity for the students' tendency to want "immediate gratification" to be balanced with patience and persistence.
- Have extra materials available for students to use. Also have a scrap box of miscellaneous items such as: Chenille stems, craft sticks, felt, paper, etc.





**Screw**

**Screw**

**Lever**

**Lever**

**Pulley**

**Pulley**

**Wedge**

**Wedge**

**Wheel & Axle**

**Wheel & Axle**

**Inclined Plane**

**Inclined Plane**

**SIMPLE MACHINES**

**SIMPLE MACHINES**