



National Agriculture in the Classroom

Relevancy and Engagement: agclassroom.org

Six Kinds Do It All

Grade Level(s)

3 - 5

Estimated Time

Four, 45-minute sessions

Purpose

The purpose of this lesson is for students to become familiar with the six kinds of simple machines-the inclined plane, pulley, screw, wedge, lever, and wheel and axle. These machines are combined to form complex machines.

Materials

For the class:

- Large piece of butcher paper
- Simple Machine Pictures (Print 1 copy. Cut out the labels)

For each student:

- *Simple Machine Templates* copied onto tag board
- One round wooden "tinker toy," drapery pulley, empty sewing thread spool, or bobbin
- String (one 1-foot piece and one 2-foot piece)
- Straw
- Pencil
- Scissors
- Paper clip
- Masking tape or cellophane tape
- *Simple Machines-Can You Match Them?* activity sheets
- *Machines Helping the Rancher* activity sheet
- *Keeping it Simple* homework activity

Essential Files (maps, charts, pictures, or documents)

- Simple Machine Templates
[https://naitc-api.usu.edu/media/uploads/2016/05/17/Simple_Machine_Templates.pdf]
- Answer Key- Simple Machines: Can You Match Them?
[https://naitc-api.usu.edu/media/uploads/2015/09/28/Answer_Key_-_Simple_Machines_1.pdf]
- Simple Machines: Can You Match Them? activity sheet
[https://naitc-api.usu.edu/media/uploads/2015/09/28/Simple_Machines_-_Can_You_Match_Them_1.pdf]

- Machines Helping the Rancher activity sheet
[https://naitc-api.usu.edu/media/uploads/2015/09/28/Machines_Helping_the_Rancher_1.pdf]
- Keeping it Simple homework activity
[https://naitc-api.usu.edu/media/uploads/2015/09/28/Keeping_It_Simple_1.pdf]
- Simple Machine Pictures
[https://naitc-api.usu.edu/media/uploads/2015/09/28/Simple_Machine_Pictures.pdf]

Vocabulary

axle: the bar or rod on which a wheel or wheels turn

inclined plane: a ramp which allows a force to be transferred over a certain distance

lever: a device which pivots on a fixed point called a fulcrum

machine: a device used to do work

pulley: a wheel over which a rope or chain passes; used to lift or move things

screw: theoretically a rolled up inclined plane; allows a force to be concentrated

wedge: two inclined planes attached together; a simple machine used to split an object

wheel: a disk or circular object arranged to revolve on an axle that passes through its center

Interest Approach – Engagement

1. Print one copy of the attached file, *Simple Machine Pictures*. Place the pictures of the six simple machines on the board in front of the class. Explain that each picture represents a simple machine.
2. Draw on the prior knowledge of your students by asking them if they can name any of the machines.
3. Place the word strips with the names of the machines where the students can see them. Help the students match the word strip with the correct machine. Inform your students that they will be learning how these simple machines work and how they make hard jobs on the farm easier.

Background - Agricultural Connections

This lesson is part of a series called *Simple and Complex Machines Used in Agriculture*. These lessons introduce students to the simple and complex machines used in their daily lives and in food and fiber production. Through a variety of hands-on activities, students create models of the six types of simple machines and discover the concepts of force and friction. The essential role of complex machines in people's daily lives and in agriculture is interwoven through a number of class and homework activities that incorporate cooperative learning, writing, mathematics, art, and drama. Together these activities are designed to stimulate creative thinking and motivate learning. Other related lessons include:

- [Machines and People](#)
- *Six Kinds Do It All*
- [Made to Move](#)
- [Machines in Agriculture](#)

Theoretically, machines are devices that help make work easier for people. Most machines consist of a number of elements, such as gears and ball bearings that work together in a complex way. But no matter how complex they are, all machines are made of one or more of the six types of simple machines—the **lever**, **inclined plane**, **wedge**, **screw**, **pulley**, and **wheel and axle**. Historically, simple machines were invented and used long before anyone ever classified them. Examples of the six types of simple machines are listed in the conclusion at the end of the lesson procedures.

Preview the entire set of activities before you start and determine the length of time (or days) it will take you to complete the activities. Make the lesson appropriate for your students and class schedule. Be sure to have a wall display that lists the names of the six simple machines. Leave room to write in examples.

Procedures

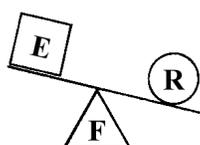
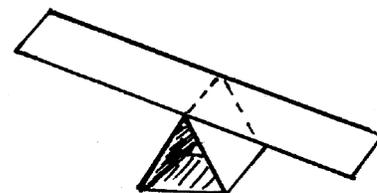
Activity 1: Six Simple Machines

Discuss with the students that each team will do the following for each simple machine:

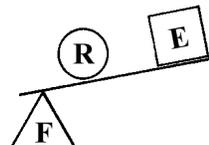
- Make a model of it.
- As it is built, discuss geometric terms such as faces, vertices, planes, etc.
- Write the name of the simple machine on the model.
- Explain how it makes work easier for people.
- Create a list of examples of the simple machine.

1. Lever Activity:

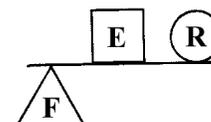
1. Cut out the lever pattern.
2. Fold and tape the base (fulcrum).
3. Set a small paper clip on one end of the lever and push the other end down. It should lift the paper clip up.
 - There are three classes of levers. The model is a first class lever.
 - Examples of levers include: see-saws and car jacks (first class), wheelbarrows and nutcrackers (second class), and shovels and brooms (third class).
 - A lever has three parts—effort, fulcrum, and load or resistance. The fulcrum is the point on which the lever pivots. This allows the weight to be moved a short distance with a concentrated amount of force (effort).



First Class



Second Class



Third Class

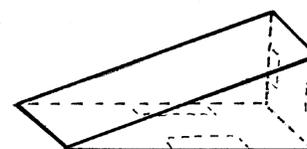
E = effort

R = resistance

F = fulcrum

2. Inclined Plane Activity

1. Cut out the inclined plane patterns found in the attached *Simple Machine Templates* file. Fold and tape as shown.
2. Set the inclined plane on the table with one long side down.
3. Roll a pencil up and down the incline.
 - Examples of inclined planes include boat ramps, stairs, wheelchair ramps, truck loading ramps, and driveways, and grain elevators.
 - An inclined plane spreads the amount of work needed to move an object over a larger distance so that less force is needed at any particular instant.

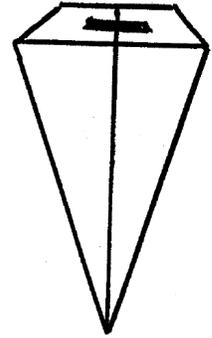
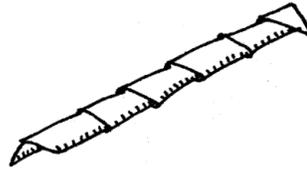


3. Wedge Activity

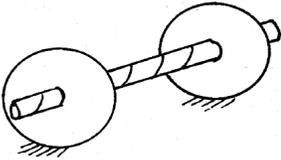
- a. Cut out two wedge patterns found in the attached *Simple Machine Templates* file.
- b. Fold and tape them together.
 - Examples of wedges include axes, wedges, nails, ice picks, knives, plows, discs, treads on tires, and other objects that split things in two.
 - A wedge is theoretically two inclined planes attached together. A wedge makes work easier for people by splitting something perpendicular to the force that is applied. Wedges are often used in conjunction with levers.

4. Screw Activity

1. Cut out the triangle found in the attached *Simple Machine Templates* file.
2. Using the arrows as a guide, roll the paper around a pencil and then tape in place.
 - Examples of screws include bolts, wood screws, jar lids, augers, and drill bits.
 - A screw is an inclined plane rolled up. A screw concentrates the force applied on an object to a smaller area. It pushes a concentrated amount of force away from you.



5. Wheel and Axle Activity

1. Cut out the two circle patterns found in the attached *Simple Machine Templates* file and punch or poke a hole in the center of each circle. The hole should be slightly smaller than the diameter of the straw.
 
2. Insert the straw through both holes.
3. Roll the wheel and axle across the desk. The circles are the wheels and the straw is the axle. If appropriate, have the students tape the wheels to the axle.
 - Examples of wheels and axles include tires, doorknobs, the crank shafts on bicycles, steering wheels, gears, and egg beaters.
 - A wheel and axle reduces the amount of friction an object creates during its motion, because less surface is exposed to the stationary object, usually the ground, at any given time.

6. Pulley Activity

- a. Cut a one-foot piece of string, and thread it through the middle of a round wooden tinker toy, drapery pulley, thread spool, or bobbin.
- b. Tape the two ends of the string on the edge of the desk so that the "pulley" hangs freely off the edge of the desk.
- c. Thread the remaining piece of string around the top of the pulley so that it fits into the groove. Have students attach their pencils or other objects to one end of the string and provide time for students to experience how a pulley works.
 - Items that contain pulleys include drape draws, elevators, flagpoles, sails on windsurfers and sailboats, scaffolding for window washers, engine hoists, and cranes.
 - Pulleys make work easier by changing the direction of the force applied. With a pulley, when one pulls down, the object goes up.



Activity 2: Simple Machines-Can You Match Them?

1. After discussing the directions on the activity sheet, have each student complete the activity, *Simple Machines-Can You Match Them?*
2. Direct a classroom discussion to assess the results of the students' work.

Part 3: Machines Helping the Rancher

1. After discussing the directions, have each student complete the activity, *Machines Helping the Rancher*.
2. Direct a classroom discussion to assess the results of their work.

Part 4: Keeping It Simple

1. Distribute and explain the homework assignment, *Keeping It Simple* to your students. Have the students complete the assignment at home.
2. After collecting the homework, discuss which kinds of machines seemed to be the most common around the house.

Conclusion:

After conducting these activities, review and summarize the following key concepts:

- The food that we eat and the fiber we use for fabric is produced on a farm. It takes a lot of work and energy to grow crops and raise animals.
- Machines make farm work easier.
- Farmers need fewer workers when machines can be used to perform heavy labor.
- Technology is continually improving. It helps farmers produce more food with less labor.

Examples of Simple Machines**Levers**

wheelbarrow
crowbar
oar
nutcracker
scissors
pliers
see-saw
salad tongs
hoe
rake
broom
shovel
tweezers
hammer
tin snips

Wedges

jack hammer
knife
chisel
hatchet
ax
plow
nail
fork
pizza cutter
tire tread
hoe

Screws

propeller
meat grinder
pencil sharpener
windmill
vise
grain auger
wood screw
jar lid
bolt
hose nozzle

Wheels and Axles

bicycle wheels
skate wheels
potter's wheel
Ferris wheel
egg beater
wheelbarrow
windmill
vehicle tires
door knob
wagon wheels
steering wheels
gears

Pulleys

elevator pulleys
crane
drapery draw
flag pole pulleys
engine hoist

Inclined Planes

ramp
stairs
slide
loading ramp
conveyor belt system
escalator
wheelchair ramp
grain elevator
skateboard ramp

Concept Elaboration and Evaluation

After conducting these activities review and summarize the following key concepts:

- Tools and machines make work on a farm (or other location) easier.
- There are 6 simple machines- levers, wedges, screws, wheels and axels, pulleys and inclined planes.
- When multiple simple machines are combined, they form a complex machine.

Variations

- Using the laminated pictures of machines prepared at the beginning of this unit, have the students decide whether the machines are simple or complex. For complex machines, they should identify the simple machines that are combined to make them.
- Bring in a large variety of simple machines. Divide the class into two teams in front of a starting line, giving each team an equal number of machines. Set up large name cards for each kind of simple machine at a finish line. Have students carry their machines to the finish line and place them in front of the correct name card. The team that completes its work the fastest is the winner. Call this game the Machine Relay.
- Gather small machines such as an eggbeater, spatula, wooden spoon, rolling pin, paintbrush, screwdriver, hammer, toy tractor, key, and tweezer. Place each machine in a brown paper bag. Have a student reach in, feel the machine, and answer a variety of questions pertinent to the machine. As the student answers the questions, have the rest of the class try to identify the machine. Possible descriptive questions are listed below:
 - Is it hard or soft?
 - Is it rough or smooth?
 - Is it large or small?
 - What do you think it is made of?
 - Who might use it and for what reason?

Enriching Activities

- Read the story *The Three Little Pigs* to the class. Divide students into three groups. Give each group a big piece of butcher paper and markers. Have each group draw a picture of one of the three houses in the middle of the paper and surround it with drawings of all the machines that would be used to build that house. When the charts are complete, ask the students to explain what each machine did in the building of the house.
- Obtain old complex machines from garage sales and repair shops. Have the students take the machines apart to discover the simple machines involved in their operation. NOTE: Safety rules must be set and followed to avoid injury.
- Compute the areas, perimeters, and volumes of some simple machine models.
- Invite a farmer to class. Ask him or her to bring in important or unique machines used in his/her operation. Photographs can be brought in as well.
- On a tape cassette, record sounds made by different machines. As you play each sound, have the students listen and write down the name of the machine they think is making the sound.

Suggested Companion Resources

- **Machines on the Farm (Book)**
[<https://www.agclassroom.org/teacher/matrix/resources.cfm?rid=426>]
- **Simple and Complex Machines on the Farm (Multimedia)**
[<https://www.agclassroom.org/teacher/matrix/resources.cfm?rid=818>]
- **How a Combine Works (Multimedia)**
[<https://www.agclassroom.org/teacher/matrix/resources.cfm?rid=778>]
- **Modern Marvels: World's Largest Combine (Multimedia)**
[<https://www.agclassroom.org/teacher/matrix/resources.cfm?rid=555>]
- **Hookin' Up and How it Works on the Farm (Multimedia)**
[<https://www.agclassroom.org/teacher/matrix/resources.cfm?rid=419>]
- **Tractor Timeline- A History of Tractors (Website)**
[<https://www.agclassroom.org/teacher/matrix/resources.cfm?rid=646>]

Sources/Credits

This lesson was funded in 1996 by the California Beef Council and the California Farm Bureau Federation. To meet the needs of California educators, Simple and Complex Machines Used in Agriculture was revised to support the Curriculum Content Standards for California Public Schools and updated to include recent agricultural innovations. Funding from the Wells Fargo Foundation made this revision possible.

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Curriculum Matrix: agclassroom.org/teacher/matrix