Simple and Complex Machines

Grade Level: 4-8

Lesson Overview

Students will identify simple and complex machines as they analyze a variety of household, classroom, and farm items. Follow up the opening task by sending students on a machine scavenger hunt in their classroom, school, or home.

Student Objectives

1. Define and identify simple machines.
2. Identify simple machines that make up complex machines.
3. Describe the application of simple and complex machines in agriculture.

Materials

- ✓ complex & simple machine examples for activity (Note: cards are included in the lesson, but any tangible items the teacher may bring in may be easier for the students to identify with)
- ✓ Simple Machines Information Sheet
- ✓ Simple & Complex Machines Worksheet
- ✓ Machine Scavenger Hunt Worksheet

Vocabulary

- **axle** - the bar or cylinder on which a wheel turns.
- **complex machine** - a machine made up of more than one simple machine.
- **fulcrum** - a pivot point (which can be moved) on which a lever turns.
- **horsepower** - a measurement of power (the power needed to lift 550 pounds one foot off the ground in exactly one second).
- **inclined plane** - a sloping surface.
- **lever** - a device such as a bar or board that pivots on a fulcrum.
- **machine** - a device used to do work.
- **Power Take Off (PTO)** - a rotating shaft extending from the rear of a tractor which transfers power from the tractor engine to an implement. When connected to an implement such as a roadside mower, the PTO provides the power to make the mower work.
- **pulley** - a wheel with a grooved rim over which a rope, cable, or chain passes.

- **RPM** - stands for revolutions per minute which is the measure of speed for any rotating device.
- **screw** - an inclined plane wrapped around a shaft or cylinder.
- **simple machine** - a machine with few or no moving parts.
- **wedge** - two inclined planes attached back to back.
- **wheel** - a circular object or disk which revolves on a central point such as an axle.

Background Information

A simple machines information sheet is included with this lesson.

Procedure

1. Interest approach ideas can be found in the lesson Made to Move found at: https://agclassroom.org/matrix/lesson/341/.
2. Define and discuss simple machines. A simple machines information sheet is provided for reference.
3. Define and discuss complex machines. Divide students into groups to complete Simple and Complex Machines Worksheet based on the pictures included in the lesson the group selected. Each group must choose six items to complete the worksheet.
4. Have students conduct a scavenger hunt around the classroom and school to identify simple and complex machines. Students should record their findings on Machine Scavenger Hunt Worksheet.
5. How are simple and complex machines used on the farm? Three resources are provided to help illustrate the answer to this question. Have students try to identify the simple machines that make up the complex machines used in agriculture. Some pictures of combine and tractor cutaways are provided at the end of this lesson.

Extension Activities

1. Ask the students to estimate how many times per day they use simple machines. Have them keep track of the object used, type of simple machine and the number of times used. Did any students use any interesting simple machines? Which were the most common?
2. Models of some farm equipment may be available on a free-loan basis from your local Illinois Agricultural Literacy Coordinator

(http://www.agintheclassroom.org/AGLitCoord/contact_your_county_agricultural.shtml). These may be used to illustrate types of machines.

3. Machines in Agriculture lesson found at: https://agclassroom.org/matrix/lesson/342/
4. Six Kinds Do It All lesson found at: https://agclassroom.org/matrix/lesson/337/

Additional Resources

Note: The following two items may be available in the Machines mAGic kit from your local Illinois Agricultural Literacy Coordinator http://www.agintheclassroom.org/AGLitCoord/contact_your_county_agricultural.shtml

- *Simple and Complex Machines on the Farm* DVD by Chris Fesko
- *How John Deere Tractors & Implements Work* by Roy Harrington ISBN 978-0929355887

- Machine lessons & resources https://www.agclassroom.org/matrix/search_result/?search_term=machines&findlesson=on&findresource=on&maxlessons=25&maxresources=25
- https://www.youtube.com/watch?v=_z1UPnNf8nU Combine cropflow animation
- https://www.youtube.com/watch?v=RMU0goBWRjY Combine Harvesting Animation
- https://www.youtube.com/watch?v=ZMDw9mUoG2M How a combine works: a view inside the combine
- https://www.youtube.com/watch?v=u2AvESRQRsg How stuff works corn combine
- https://www.youtube.com/watch?v=vHAyaiNbqiE How does a combine work? Why is a combine called a combine?
- https://www.ilfbpartners.com/farm/how-do-combines-work/ How Do Combines Work? video

Standards

Illinois Science Standard

MS-PS2 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

Illinois English Language Arts Standard

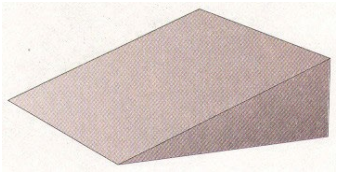
L5 Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.

The **M**ultidisciplinary **AG**ricultural **I**ntegrated **C**urriculum (mAGic) was created in 2004 under the leadership of the Illinois State Board of Education (ISBE) and the Facilitating Coordination in Agricultural Education Project (FCAE). Funding was made available through the FCAE grant budget from the agricultural education line item of the ISBE budget. This revision, as printed, was developed in September 2021.

These mAGic lessons are designed to bring agriculture to life in your classroom. They address the Illinois Learning Standards in math, science, English language arts and social studies.

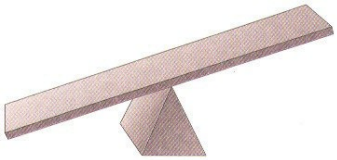
Machines mAGic project update writers/reviewers: Rhodora Collins – Dekalb County; Suzi Myers – Kane County; Connie Niemann – Montgomery County; Debbie Ruff – Livingston County; Jennifer Waters – Sangamon County; and Dawn Weinberg – Hancock County.

Simple Machines Information Sheet



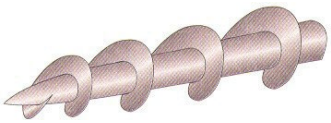
An **inclined plane** is a sloping surface that can be used to help move items over a certain distance. By spreading the amount of work needed over a larger distance, less force is needed at any particular moment. It can help move things up and down.

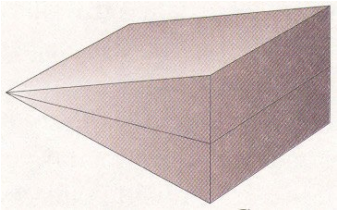
A **lever** is a device such as a bar or board that pivots on a fulcrum. It allows weight to be moved a short distance with a concentrated amount of force. The fulcrum can be moved depending on the weight of the object being lifted. For instance, when you push down on one end the other end lifts up.



A **pulley** is a wheel with a grooved rim over which a rope, cable or chain passes. It changes the direction of the force applied which makes the work easier. For instance, when you pull down on the rope, you can lift an object attached to the other end of therope.

A **screw** is an inclined plane wrapped around a shaft or cylinder. It allows a force to be concentrated. It may be used to fasten or move things. It may move itself, an object, or material surrounding the object.





A **wedge** is two inclined planes attached back to back. When you use the pointed and often sharp edge of an inclined plane, you can separate or split things when force is applied.

A **wheel** is a circular object or disk which revolves on a central point such as an **axle**,such as a bar or cylinder. These two parts work together. As the wheel turns the axle also turns. When the axle turns, the wheel turns a greater distance than the axle, but less force is needed to move it. The axle moves a shorter distance but requires a greater force to move it. They are used to move things and change power, speed or direction. It reduces the amount of friction an object creates during its motion.

Name _____

Simple and Complex Machines Worksheet

Group Members:

Machine	How many and what types of simple machines are used?	Simple or Complex
Example: axe	*1 - wedge, 1 - lever*	*complex*

Simple and Complex Machines Worksheet – ANSWER KEY

Wheelbarrow – complex – 1 wheel and axle; 1 lever

Shovel – complex – 1 wedge; 1 lever

Can opener – complex – 1 wedge; 1 lever

Can opener – complex – 1 screw; 1 lever; 1 wedge; 1 wheel and axle

Wrench – complex – 1 screw; 1 lever

Funnel – simple – 1 inclined plane

Fan – complex – 5 wedges; 1 wheel and axle

Axe – complex – 1 wedge; 1 lever

Hand drill – complex – 1 screw; 1 lever; 1 wheel and axle

Screwdriver – complex – 1 wedge; 1 lever

Lightbulb – simple – 1 screw

Corkscrew – complex – 1 wheel and axle; 2 levers; 1 wedge; 1 screw

Bulldozer – complex – wheel and axels; levers; wedge

Bicycle – complex – 1 lever; 1 pulley; 2 wheel and axle

Post hole digger – complex – 2 wedges; 2 levers

Fishing rod – complex – 1 pulley; 1 wedge; 1 lever

Hand auger – complex – 1 screw; 1 lever; 1 wheel and axle

Fingernail clippers – complex – 2 wedges; 2 levers

Name _____

Machine Scavenger Hunt Worksheet

Directions: Look around your school to find different types of machines. In the last column, identify whether it is a simple or complex machine. If it is a complex machine, note the types ofsimple machines that make up the items you found.

Name of Item	Where Found	Type of Machine
Example: *flag pole*	*in front of school*	*simple - pulley*
Example: *stapler*	*teacher's desk*	*complex - lever & wedge*

Simple and Complex Machine Cards

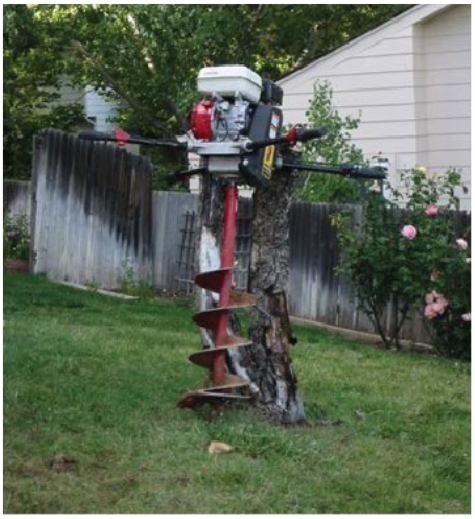
Cut apart and use with Simple and Complex Machines Worksheet.

Simple and Complex Machine Cards

Cut apart and use with Simple and Complex Machines Worksheet.

Simple and Complex Machine Cards

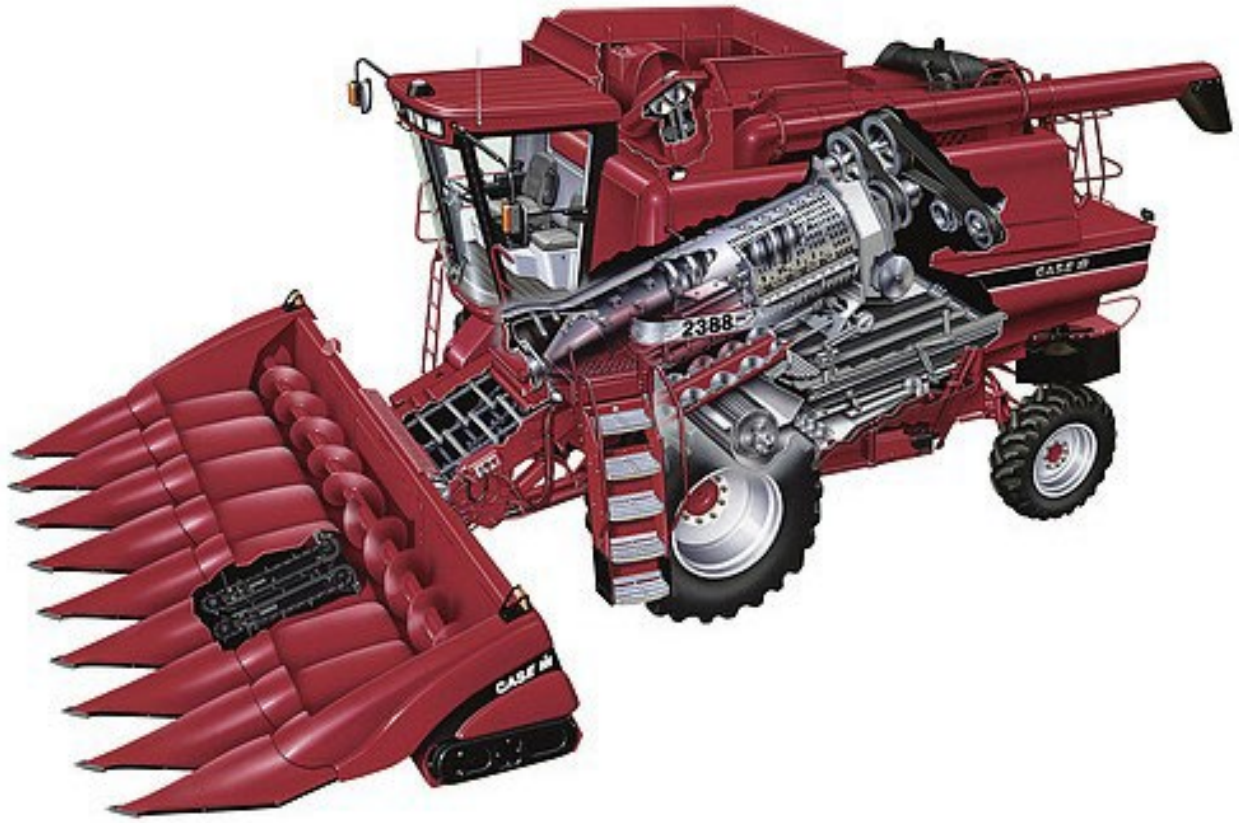
Cut apart and use with Simple and Complex Machines Worksheet.



Combine with Grain Head Cutaway

(Picture provided by Case IH)

Combine with Corn Head Cutaway



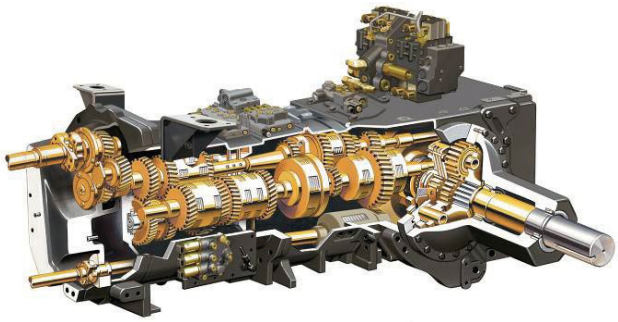
(Picture provided by Case IH)

Interior Tractor Cab Controls

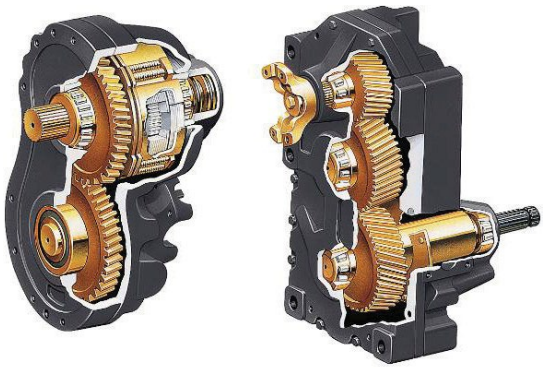
(Picture provided by Case IH)

Other Machine Cutaways

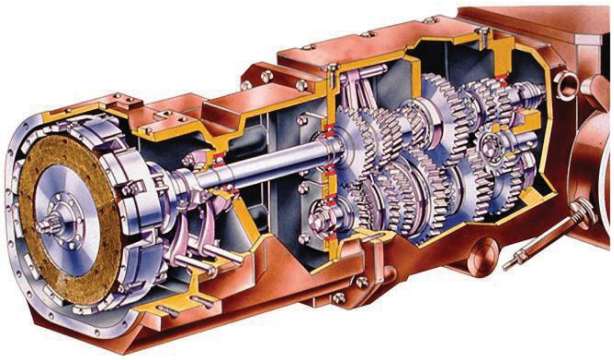
Case IH tractor axle cutaway



Case IH tractor transmission cutaway



Case IH power take off (PTO) cutaway



Case IH tractor transmissioncutaway

(Pictures provided by Case IH)