Simple and Complex Machines Used in Agriculture

Grades 2-5

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Agriculture in the Classroom

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California Foundation for Agriculture in the Classroom

Vision: An appreciation of agriculture by all.

Mission: To increase awareness and understanding of agriculture among California's educators and students.

California Foundation for
Agriculture in the Classroom

2nd Edition

July 2002

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The California Foundation for Agriculture in the Classroom is dedicated to fostering a greater public knowledge of the agricultural industry. The Foundation works with K-12 teachers, community leaders, media representatives, and government executives to enhance education using agricultural examples. It offers school children the knowledge to make informed choices.

This unit 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.

The Foundation would like to thank the people who helped create, write, revise, and edit this unit. Their comments and recommendations contributed significantly to the development of this unit. However, their participation does not necessarily imply endorsement of all statements in the document.

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Introduction

The frameworks for California public schools emphasize the need to make education meaningful to students so they can apply what they learn in the classroom to their daily lives. Since all students eat food and wear clothing, one natural connection between academic education and the real world is agriculture. Advances in agricultural technology are continually making headlines and are an excellent way for educators to connect current trends and innovations to the lives of every student.

Agriculture is an important industry in the United States, especially in California. As more rural areas become urbanized and more challenges exist to maintain and improve the quality of the planet and feed the people of the world, it is extremely important to educate students about their environment, agriculture, and the current technologies and research that continue to make Earth a viable planet.

Simple and Complex Machines Used in Agriculture, a second through fifth grade unit, introduces 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. Although this unit follows a sequential format, the activities can be performed in any order to meet the needs of your curriculum and students.

This unit teaches or reinforces the specific subject matter Content Standards for California Public Schools. The standards which apply to each lesson are listed by grade level, subject matter, and number, on the sidebars of each lesson. A content standard matrix for the entire unit, with specific standards described, is located on pages 66-74. *Simple and Complex Machines Used in Agriculture* is one of many educational units provided by the California Foundation for Agriculture in the Classroom.

What the future holds for agriculture will determine the quality of life for all . . .

- *farmers and ranchers*
- *suppliers*
- *food processors*
- *wholesalers*
- *retailers*
- *consumers!*

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Unit Overview

Unit Length

Sixteen to eighteen 45-minute sessions

Objectives

The students will:

- Create a useful definition for the word *machine.*
- Examine a machine and think about its usefulness.
- Make a Venn Diagram that compares pictures of two different machines.
- Locate machines used around the home.
- Make models of the six types of simple machines and identify examples of each machine.
- Perform experiments that show the properties and usefulness of each simple machine.
- Sort pictures of machines into six types.
- Apply knowledge of simple machines to agricultural machines.
- Understand, through experimentation, the concepts of force and friction.
- Write a poem about machines used in agriculture.

Brief Description

Through a series of various activities, the students will learn that machines are devices that make work easier, faster—more efficient. After learning about the six kinds of simple machines, they will perform activities which show that complex machines are actually a group of simple machines that work together. Students will also examine relationships between simple machines and the forces that move them. Finally, the students will recognize that combinations of simple machines are used to create complex agricultural machines. Numerous science investigations and writing assignments are included in this unit.

Curriculum Content Standards for California Public Schools

A concerted effort to improve student achievement in all academic areas has impacted education throughout California. The California Foundation for Agriculture in the Classroom provides educators with numerous resource materials and lessons that can be used to teach and reinforce the Curriculum Content Standards for California Public Schools. The lessons encourage students to think for themselves, ask questions, and learn problem-solving skills while learning the specific content needed to better understand the world in which they live.

This unit, *Simple and Complex Machines Used in Agriculture*, includes lessons that can be used to teach or reinforce many of the educational content standards covered in grades two through five. It can be used as a self-contained unit, to enhance themes and lessons already in use, or can provide technical information about machinery used in agriculture.

The specific subject matter content standards covered in the lessons are listed on the sidebars of each lesson. A matrix chart showing how the entire unit is aligned with the Curriculum Content Standards for California Public Schools can be found on pages 66-74.

Unit Overview

- Design and make an advertisement for a machine.
- Complete a semantic map showing what they have learned about machines.

Key Vocabulary

agriculture
axle
complex
energy
equipment
force
friction
fulcrum
gear
inclined plane
lever
lubricant
machine
movement
pulley
screw
simple
tractor
wedge
wheel
work

Evaluation

This unit incorporates numerous activities and questions that can be used as evaluation tools, many of which can be included in student portfolios. Embedded assessment includes oral and written responses to open-ended questions, drawing, group presentations, and other knowledge-application projects. Specific examples include the homework activity in "Six Kinds Do It All," the writing responses in "Made to Move," and the semantic map and writing activities in "Machines in Agriculture."

Visual Display Ideas

- Using yarn, divide a bulletin board into six columns or rectangles, labeling each section with the name of a simple machine. As a homework or a classroom activity, have students find pictures which show a specific simple machine. Post the pictures in the appropriate section of the board.
- Using butcher paper and various art materials, have students create a farm scene. Use the tractor cinquains created in the lesson "Machines in Agriculture" to decorate the scene.
- Take a tour around the school and photograph simple and complex machines the students see. Create a display of simple machines and a display of complex machines. Be sure to examine play equipment, the custodial work area, and the teacher's work room.
- Invite a farmer or two to class. Have them bring in samples of unique machines they use in their operations. Take photographs of each student holding or using one of the machines and then write about their picture. Display the photograph/writing pages on the bulletin board.
- Make mobiles out of student-built simple machine models. Hang them from the ceiling.
- Place a large piece of butcher paper on the wall. With a pencil, lightly draw vertical lines, dividing the paper into as many sections as there are students. Using markers, have each student draw one part of a marble-rolling apparatus that will start in the upper left-hand corner of the paper and end at the lower right-hand corner of the paper.

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Before You Begin

1. Skim over the entire unit. Make appropriate changes to the lessons and student worksheets to meet the needs of your students and teaching style.

2. To provide a successful learning experience for the students, the following materials should be obtained and prepared prior to the start of the unit:

   - Thirty to fifty pictures of machines—small and large, simple and complex. Cut them out from magazines, old calendars, farm equipment brochures, assorted catalogs, advertisements, and newspapers. Mount the pictures on tagboard or construction paper. Laminate, if possible.

   - One overhead transparency of "The Tractor" (page 11).

   - Review the materials lists for the lessons and gather the supplies needed.

3. Arrange for classroom visits from people involved in the food and fiber industry, machine production, and machine operation.

4. Organize appropriate field trips for your students. Examples may include guided tours of grocery stores, working farms, construction sites, and factories.

5. Because this unit may include the tasting of various foods, find out which of your students have food allergies, and be aware that various cultures have dietary restrictions.

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Machines and People

Purpose

The purpose of this activity is for students to form a class definition for the word "machine." They will observe a variety of machines and compare and contrast them.

Time

Teacher Preparation
Thirty minutes

Student Activities
Four 30-minute sessions

Materials

For the teacher:

- Overhead transparency of *The Tractor* (page 11)

For whole class:

- Thirty to fifty pictures of a variety of machines (see *Before You Begin* on page 6)

For each group of 3-4 students:

- Markers
- Sentence strips (4)
- White construction paper (12"x18")

Background Information

A machine is a device that does work. People appreciate machines because they save time and human energy. Machines are a basic part of our heritage. The human's innate genius for invention and tinkering has resulted in the creation of many machines. Thus, machines have turned people's dreams into reality. Almost everything people do depends, in some way, on machines—simple or complex.

The word "machine" itself is derived from the Greek *mechane* and the Latin *machina*. Both loosely translated mean "an ingenious device or invention."

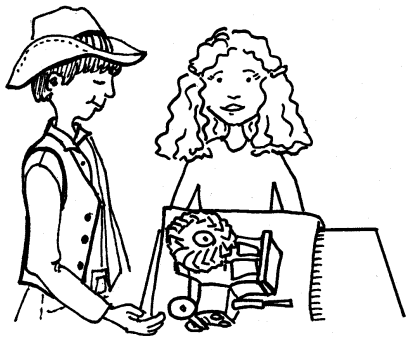
There are six simple machines from which complex machines are made: lever, inclined plane, wedge, screw, pulley, and wheel and axle. Examples of simple machines are listed on page 21.

Procedure

Part 1: Brainstorming the Definition of a Machine

1. Review with your students your rules for brainstorming and cooperative group activities.

2. Place your students in groups of three or four students. Give each group a set or markers and one piece of white 12"x18" construction paper. Instruct the "scribe" or "recorder" of each cooperative group to write one of the following questions on each side of the white paper. Read the questions aloud as you write them on the board:



   - What is a machine?
   - Why do people use machines?

3. Explain to the students that they will do two brainstorms. They will have three to five minutes to brainstorm and write their answers for the first question. At the signal they must stop, turn their paper over, and brainstorm answers to the second question. If necessary, adjust the time for each brainstorm. It is important to provide enough time to write down major ideas, but not quite enough time to write every detail.

Machines and People

Materials *(continued)*

For every two students:

- *People and Machines* Activity Sheet (page 13)
- Pencil
- *Venn Diagram* Activity Sheet (page 12)

For each student:

- *Machines at My House* homework assignment (pages 14-15)

4. Have the groups complete their brainstorms.

5. Allow three to five minutes for each group to review and determine two of their "best" or "most unique" answers from each brainstorming list. Have each group write their choices in complete sentences on four separate sentence strips.

6. Have each group post their answers under the appropriate brainstorm question that you have written on the board. Encourage a classroom discussion about the sentences.

7. Create a class defintion for the word "machine."

Part 2: Discovering a Machine

1. Using the overhead transparency of *The Tractor* (page 11), lead the class in a discussion that previews the questions on the *People and Machines* activity sheet (page 13). Discuss that scientists call machines either "simple" or "complex." The tractor is a complex machine made of simple machines such as wheels and axles, and levers.

2. Group students into pairs.

3. Give each pair of students a pencil, a picture of a machine, and one copy of the *People and Machines* activity sheet. Instruct students to use their pictures to answer the questions on the activity sheet. Allow sufficient time to complete the activity. Have each pair share their answers with the class. You may choose to give certain teams soil preparation equipment, others planters, some cultivators, and some harvesters. You can discuss the varieties of equipment farmers use.

Part 3: Similarities and Differences of Machines

1. For this activity sheet, each pair of students will need a pencil, two pictures of machines, and a *Venn Diagram* activity. If you have not previously performed a *Venn Diagram* activity with your students, take time to do one as a whole class before proceeding.

2. Instruct the students to write the name of one machine on the line in one of the circles and the name of the other machine on the line in the other. In each circle they should list the characteristics that are unique to each particular machine. Where the circles intersect, the students should list ways in which the machines are similar.

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Machines and People

Content Standards

Grade 2

Reading/Language Arts
- Writing • 1.0, 1.1, 1.2, 2.0
- Written and Oral Language Conventions • 1.0
- Listening and Speaking 1.0, 1.3, 1.5, 1.6, 1.9

Science
- Physical Sciences • 1, 1c, 1d
- Investigation and Experimentation • 4c

Grade 3

Reading/Language Arts
- Written and Oral Language Conventions • 1.0
- Listening and Speaking 1.0, 1.3

Science
- Physical Sciences • 1c

Grade 4

Reading/Language Arts
- Reading • 2.1
- Writing • 1.0, 1.3
- Written and Oral Language Conventions • 1.0
- Listening and Speaking 1.0, 1.1, 1.6, 1.8

3. Have students volunteer to share their results, and/or create a bulletin board to display the *Venn Diagrams*.

Part 4: Machines at My House

1. Distribute and explain one or both of the homework assignments to your students. Have the students complete the assignment(s) at home.

2. After collecting the homework, discuss what it would be like if certain machines were not available to assist people in the kitchen.

Variations

- Using a picture of a machine and a variety of materials, have students invent an improved machine.
- Do the Venn Diagram as a whole class activity.
- Have students write a description of how to build or plant something. Their explanations must include a description of the machines used in the process.

Extensions

- **Make Peanut Butter**

For each group of 3-4 students:

- Two cups roasted peanuts in shells
- Nutcracker
- Plastic knife
- Crackers

1. Have one-half of the students in each group shell peanuts by hand while the others use the nutcracker. When partly finished, have the students trade jobs.

2. With your assistance, have each group take turns putting their whole peanuts in a blender and blend until smooth. Discuss how the peanuts could be ground if a blender were not available.

3. When the peanut butter is made, use the knife to spread it on crackers.

Content Standards
(continued)

Grade 5

Reading/Language Arts
- Reading • 2.1
- Writing • 1.0
- Written and Oral Language Conventions • 1.0
- Listening and Speaking 1.0, 1.5

Science
- Investigation and Experimentation • 6a

4. As the students enjoy their snack, have them discuss the following:

    - What machines were used to make the peanut butter?
    - Which machines made the work faster or easier?
    - Would the final peanut butter product have a different appearance if different machines were used?
    - As a class, read Melvin Berger's book *From Peanuts to Peanut Butter*.

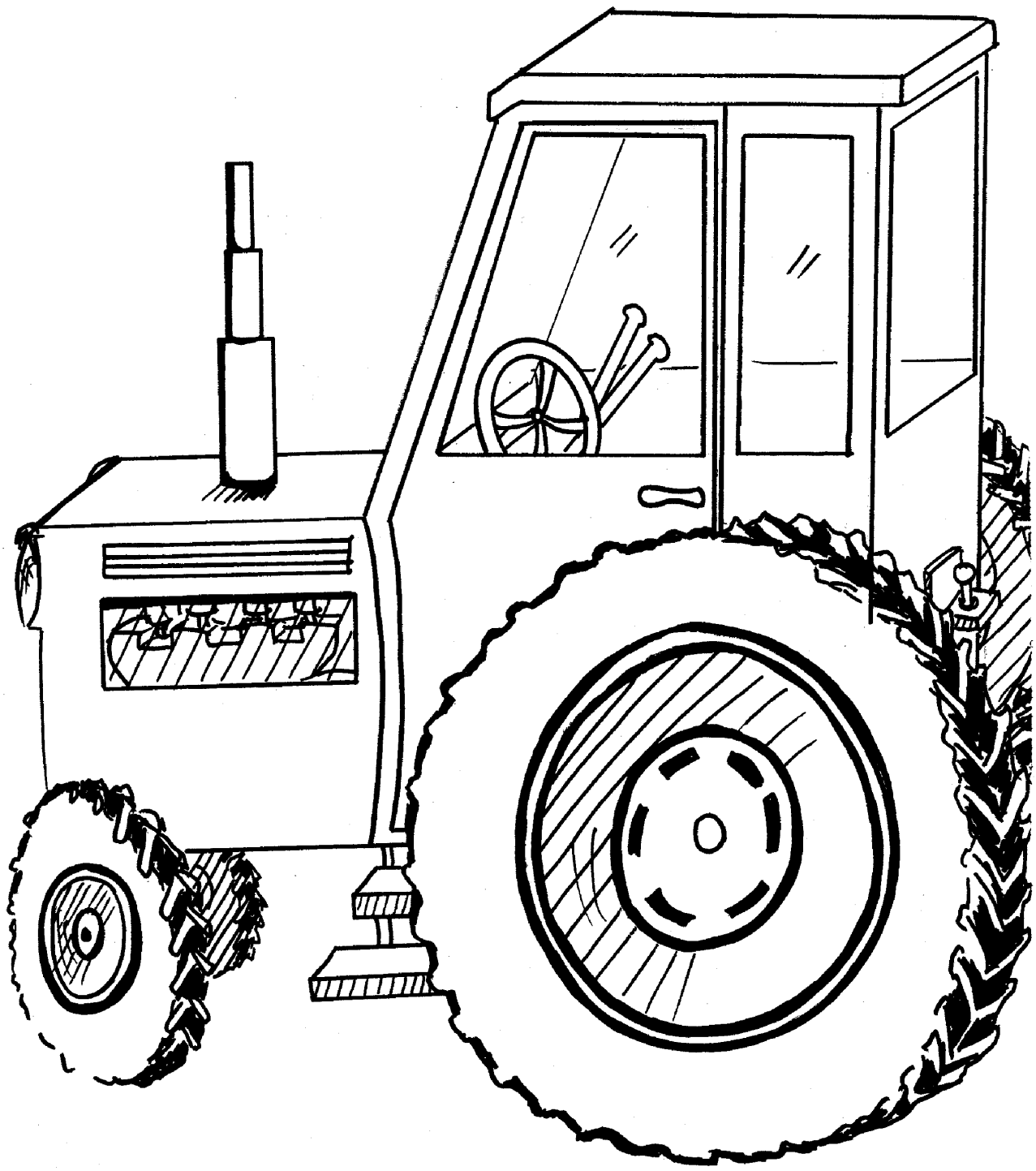
- **Draw Around**

In this activity, each student will need a pencil, a photograph of a machine, and a piece of drawing paper. Place students into groups of five or six. Allow students two or three minutes to draw a part of their photograph before passing it along and receiving another photograph passed to them by a fellow student. Each student will then draw a part from the new photograph. This should continue until each student has incorporated a part of each photograph into his or her own drawing. The result will be a drawing of a new machine. The students may give their new invention a name, describe what it might be used for, color it, add some background, and then display it.

- **"Yes" or "No"**

This game is similar to "20 Questions." Give one pair of students a photograph of a common machine. They must not let anyone else see it. Have the rest of the class try to guess what the machine is by asking questions. The questions must be answerable with a simple "yes" or "no." If the class cannot guess the machine's name in twenty questions, the team holding the photograph is the winner. Bicycles, hoes, shovels, screwdrivers, lawnmowers, and stairs are good machines to use in this activity.

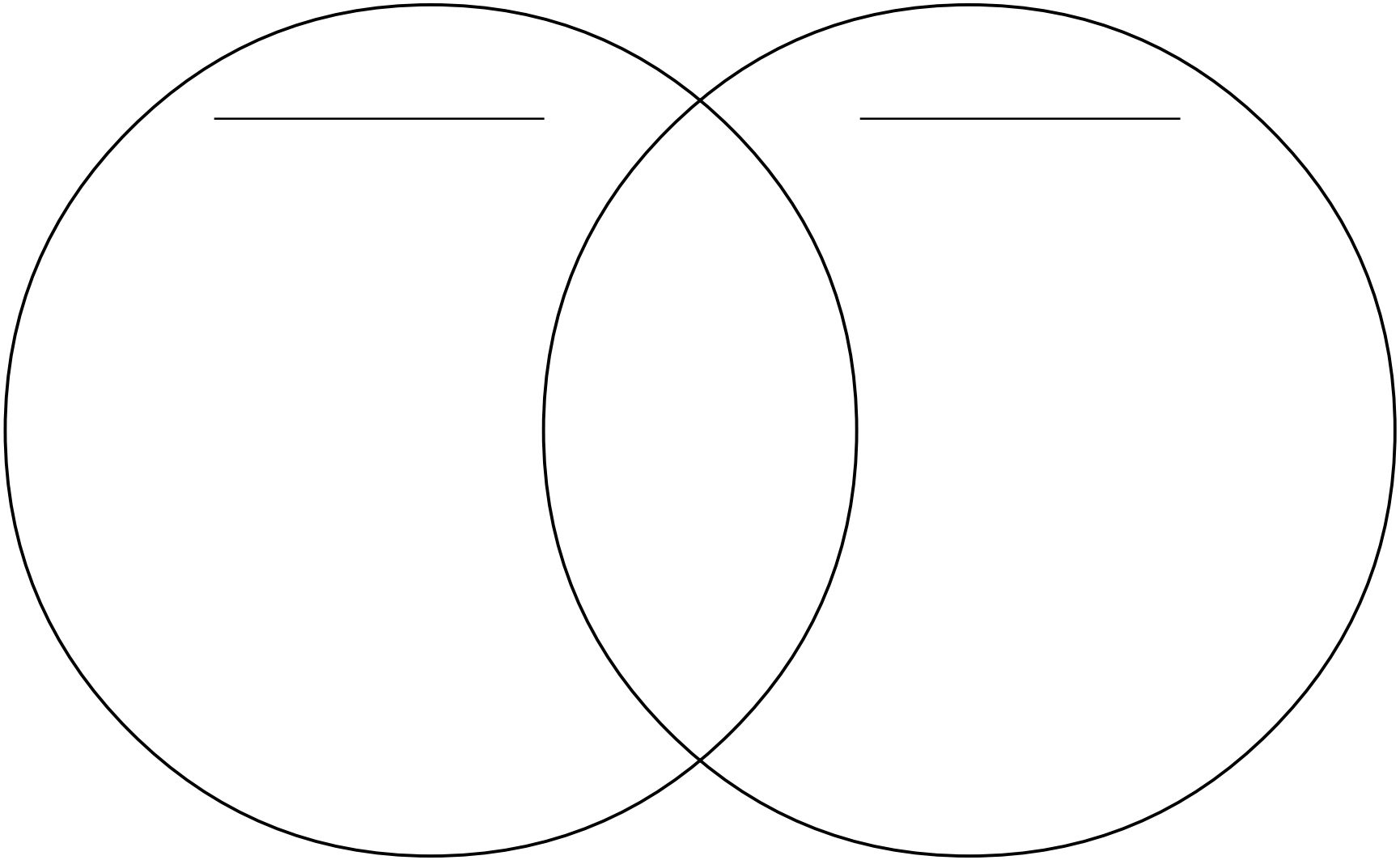
The Tractor



Venn Diagram

Name(s) _____

_____



People and Machines

Name _____

Look at the picture of the machine and then answer the questions.

1. What do you think this machine is called?

_____

_____

2. Who might use this machine?

_____

_____

3. What jobs does it do?

_____

_____

4. How would the work get done without the machine?

_____

_____

5. Is this machine a simple or complex machine? Why?

_____

_____

6. What changes do you think could be made to improve this machine?

_____

_____

Machines at My House

Name _____

Due Date _____

Dear Parent or Guardian:

In class we are learning about machines. We have learned that machines are devices that make work easier, faster, and simpler for people. Please participate in this parent-student homework assignment.

Part 1

Take a walk with your child around your home and discuss together the different machines that your family uses and why you use them.

Part 2

Together with your child, plan the menu for one meal—breakfast, lunch, or dinner. On a piece paper, with your child, draw a picture of the meal and then make a list of all the machines that would be helpful in preparing the meal for your family. Attach the list to this paper. You might enjoy actually preparing the meal with your child's help. Because the machines allow you to make the meal quickly, use the extra time to sit with your child and read a good book together. Discuss the machines you see or read about in the story.

Briefly describe your child's reaction to this activity.

_____

_____

_____

Describe your reaction to this activity.

_____

_____

_____

Parent or Guardian Signature _____

Machines at My House

Name _____

Due Date _____

Draw a picture of a machine in your kitchen.

This machine is called a _____.

Draw a picture of one other machine used in your home.

This machine is called a _____.

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Six Kinds Do It All

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.

Time

Teacher Preparation
45 minutes

Student Activities
Four 45-minute sessions

Materials

For the class:

- Large piece of butcher paper

For each student:

- *Inclined Plane and Lever* template copied onto tag board (page 22)
- *Wedge* template copied onto tag board (page 23)
- *Screw* and *Wheel and Axle* template copied onto tag board (page 24)
- One round wooden "tinker toy," drapery pulley, empty sewing thread spool, or bobbin

Background Information

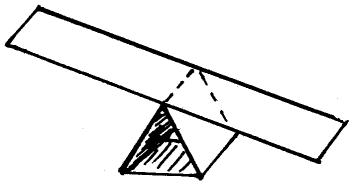
Theoretically, machines are devices that help make work easier for people. Most machines consist of a number of elements, such as gears and ball bearings that work together in a complex way. But no matter how complex they are, all machines are made of one or more of the six types of simple machines—the 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 on page 21.

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.

Procedure

Part 1: Six Simple Machines

1. 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 its 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.



Lever Activity

a. Cut out the lever pattern.

b. Fold and tape the base (fulcrum).

c. Set a small paper clip on one end of the lever and push the other end down. It should lift the paper clip up.

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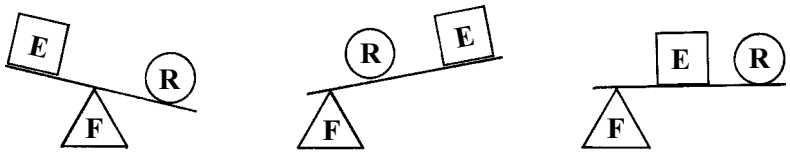
Six Kinds Do It All

Materials *(continued)*

- 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 (pages 25-27)
- *Machines Helping the Rancher* activity sheet (page 28)
- *Keeping it Simple* homework activity (pages 29-30)

There are three classes of levers. The model is a first class lever.

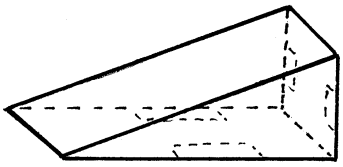


First Class **Second Class** **Third Class**

E = effort **R** = resistance **F** = fulcrum

- 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).

Inclined Plane Activity



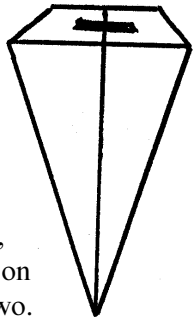
a. Cut out the inclined plane patterns; fold and tape as shown.

b. Set the inclined plane on the table with one long side down.

c. 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.

Wedge Activity



a. Cut out two wedge patterns.

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.

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Six Kinds Do It All

Content Standards

Grade 2

Reading/Language Arts
- Writing • 1.0
- Written and Oral Language Conventions • 1.0
- Listening and Speaking 1.0

Mathematics
- Measurement and Geometry • 2.2

Science
- Physical Sciences • 1, 1c, 1d
- Investigation and Experimentation • 4c, 4d

Grade 3

Reading/Language Arts
- Reading • 2.7
- Written and Oral Language Conventions • 1.1
- Listening and Speaking 1.0, 1.1, 1.3

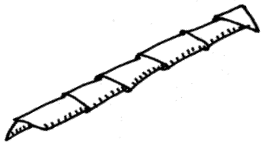
Mathematics
- Measurement and Geometry • 2.5, 2.6

Science
Physical Sciences • 1c

Grade 4

Reading/Language Arts
- Reading • 2.1
- Writing • 1.3
- Written and Oral Language Conventions • 1.0

- 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.



Screw Activity

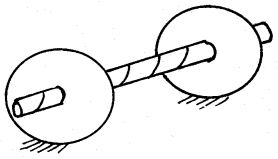
a. Cut out the triangle.

b. 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.

Wheel and Axle Activity



a. Cut out the two circle patterns and punch or poke a hole in the center of each circle. The hole should be slightly smaller than the diameter of the straw.

b. Insert the straw through both holes.

c. 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.

Six Kinds Do It All

Content Standards
(continued)

Listening and Speaking
1.0, 1.1

Mathematics
Measurement and
Geometry • 3.6

Grade 5

Reading/Language Arts
Written and Oral Language
Conventions • 1.0
Listening and Speaking
1.0, 1.1

Mathematics
Measurement and
Geometry • 2.0

Science
Investigation and
Experimentation • 6a

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.

Part 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.

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?

Extensions

- 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**.

- 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.

Six Kinds Do It All

- 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.
- 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.
- Compute the areas, perimeters, and volumes of some simple machine models.

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

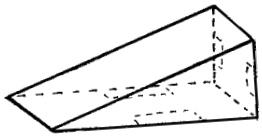
Wheels and Axles
bicycle wheels
skate wheels
potter's wheel
Ferris wheel
egg beater
wheelbarrow
windmill
vehicle tires
door knob
wagon wheels
steering wheels
gears

Pulleys
elevator pulleys
crane
drapery draw
flag pole pulleys
engine hoist

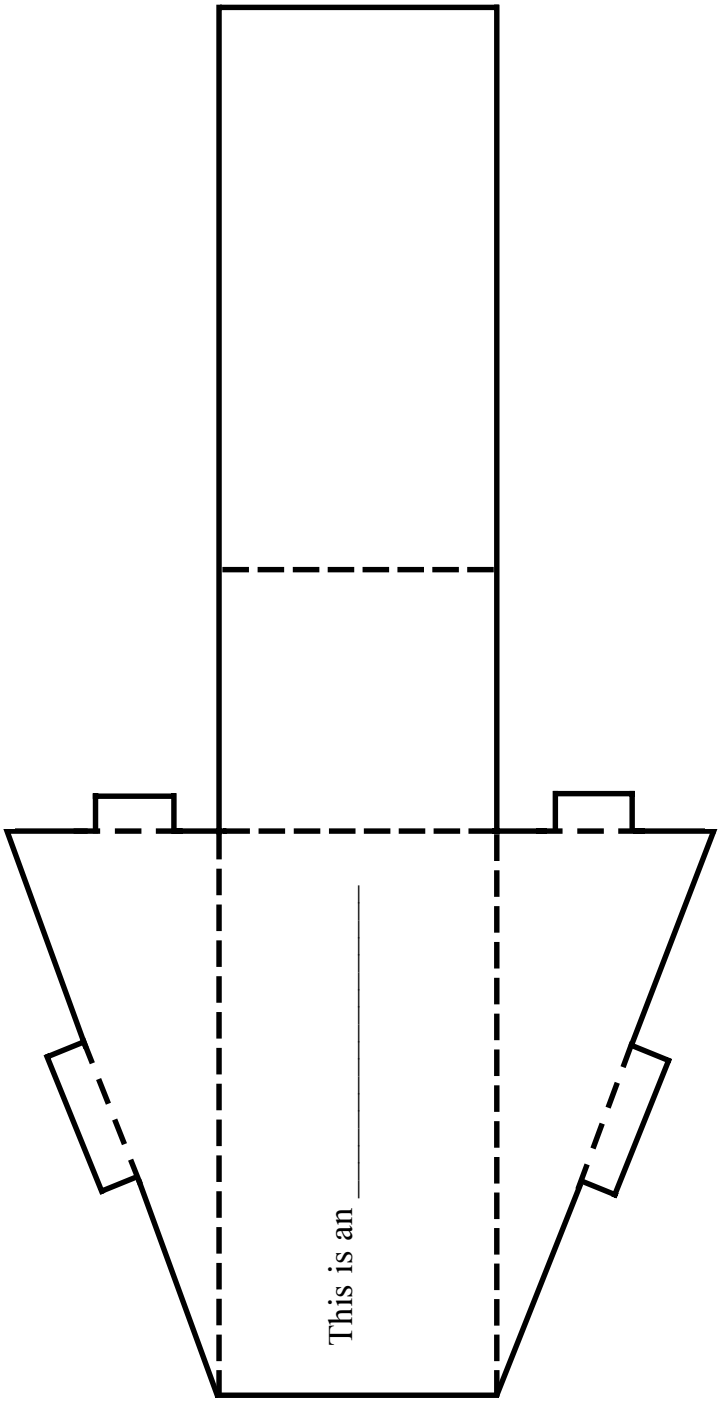
Inclined Planes
ramp
stairs
slide
loading ramp
conveyor belt system
escalator
wheelchair ramp
grain elevator
skateboard ramp

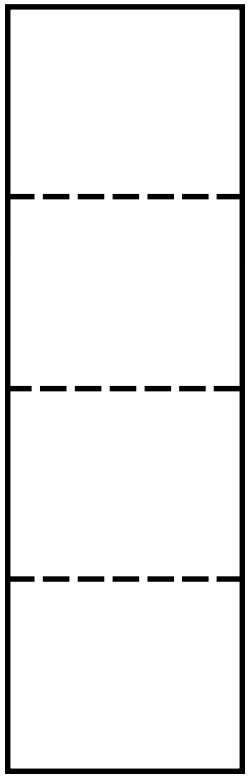
Inclined Plane and Lever

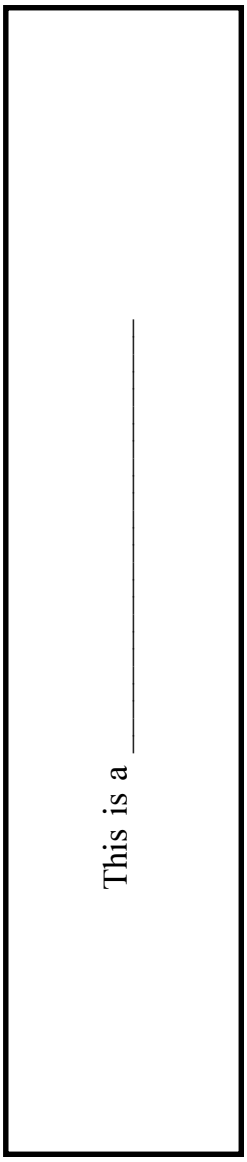
Inclined Plane



- Cut on solid lines.
- Fold on dotted lines.
- Use glue or tape to hold tabs in place.

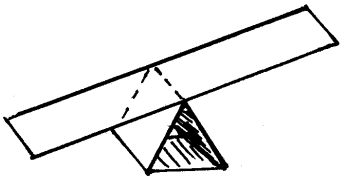






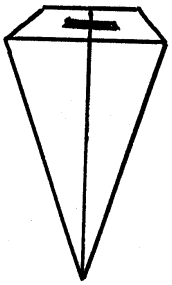
Lever

- Cut on solid lines.
- Fold on dotted lines.
- Tape to hold.

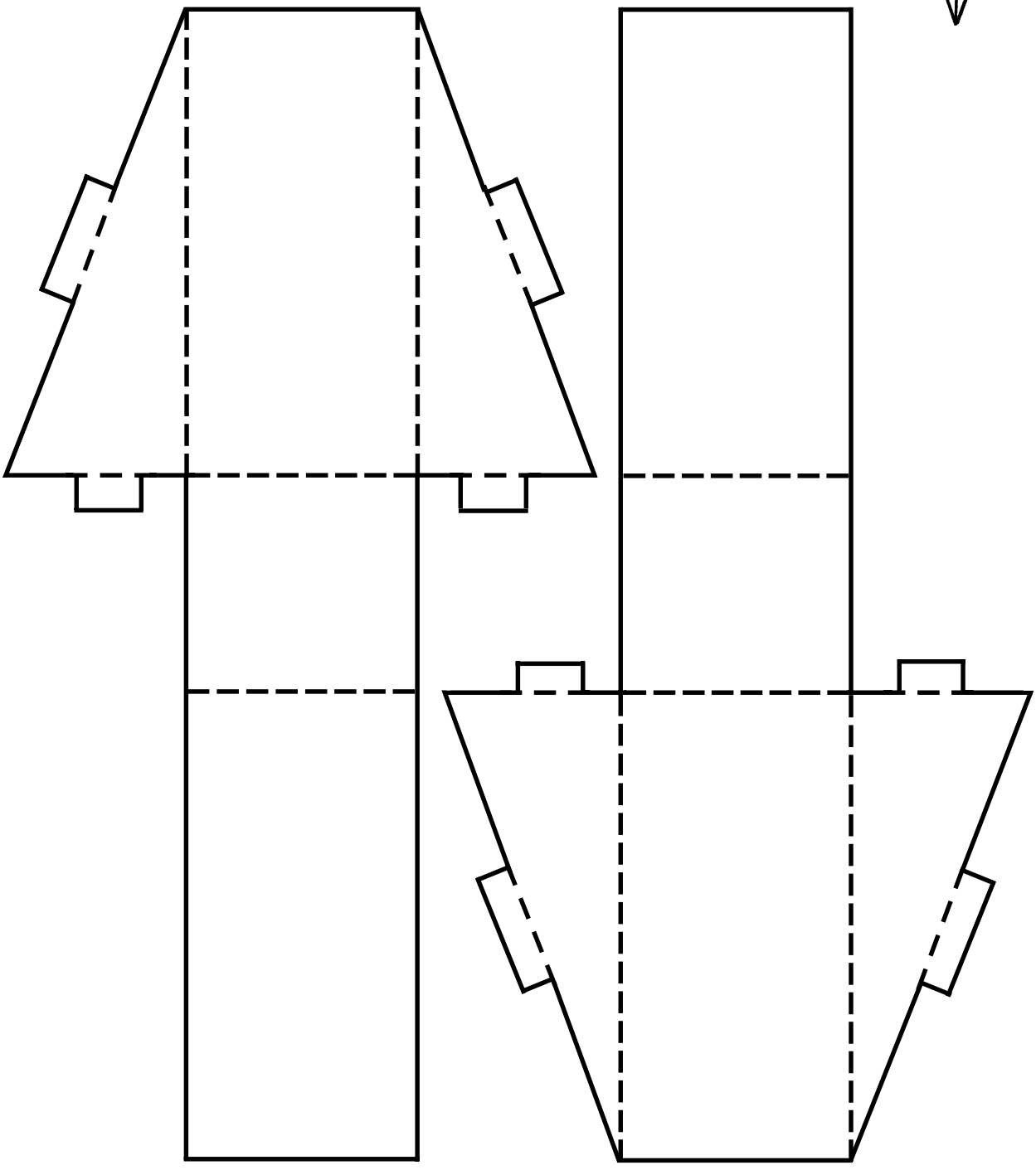


Wedge

Wedge



- Cut on solid lines.
- Fold on dotted lines.
- Glue or tape tabs in place.
- Glue or tape the two incline planes together.



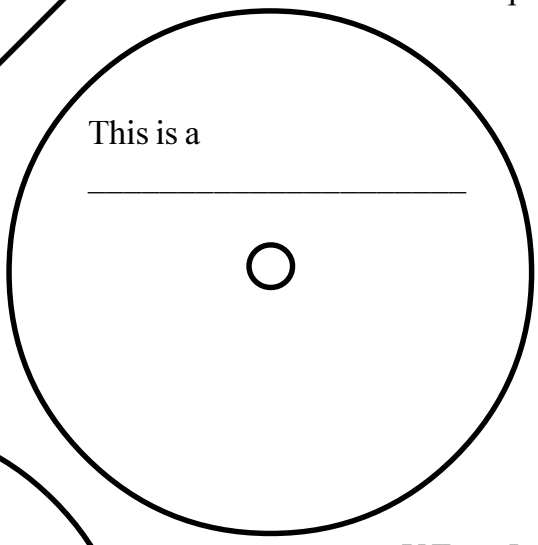
Screw, Wheel and Axle

This is a _____

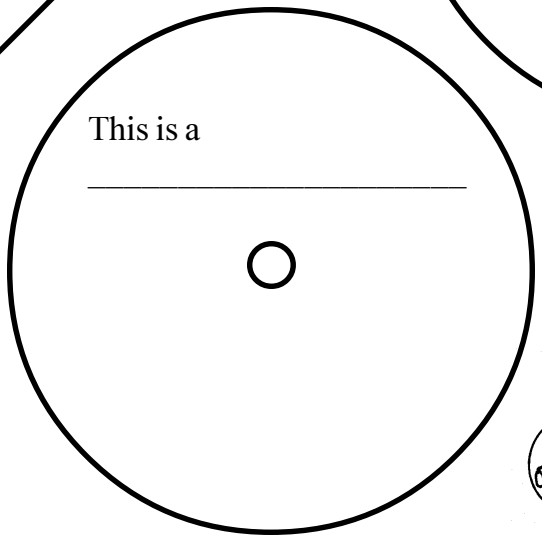
Screw

- Cut on solid line.
- Roll in the direction of the arrows.
- Tape in place.

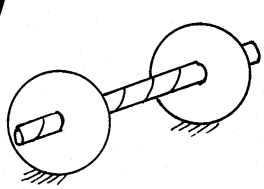
This is a _____



This is a _____



Wheel and Axle



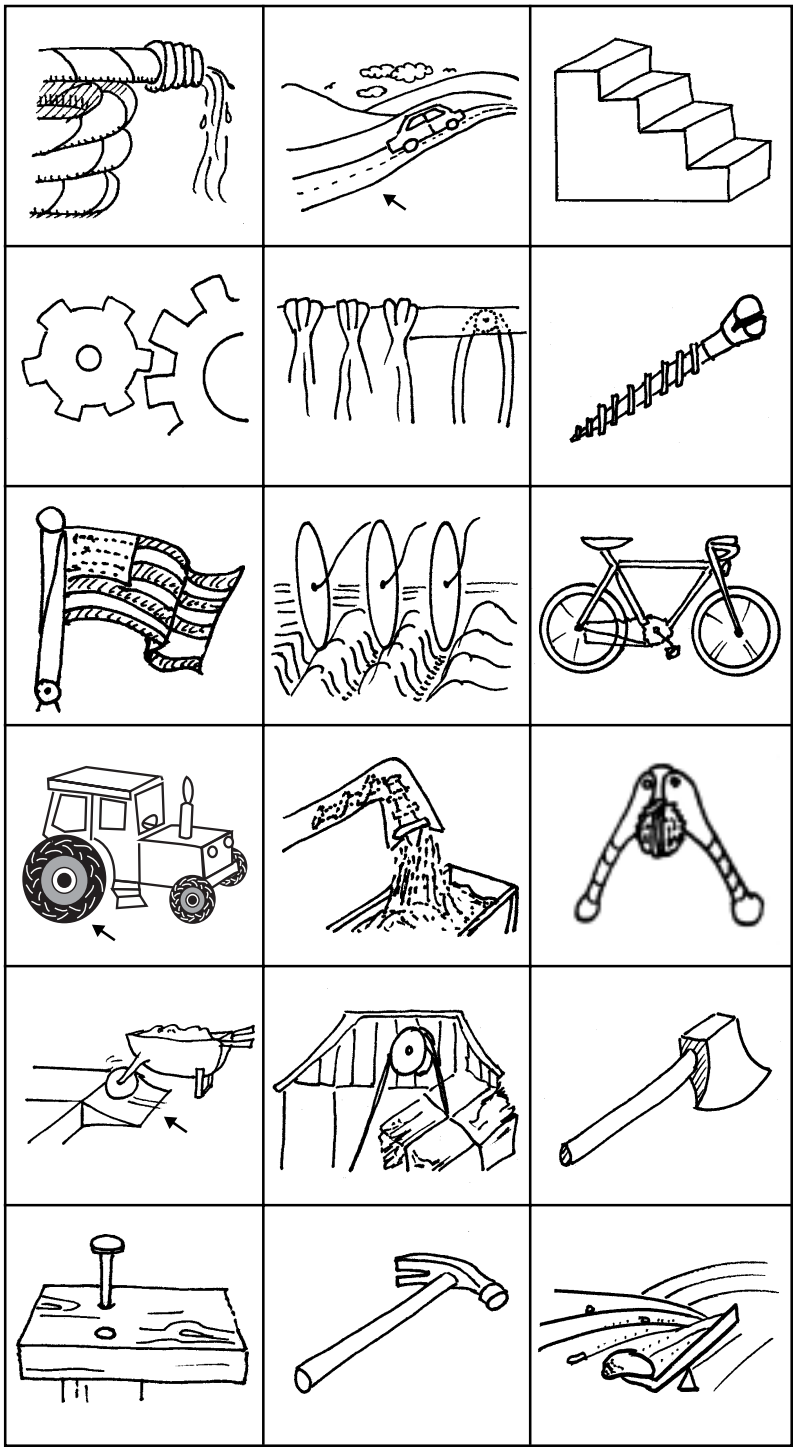
- Cut the wheels out making the center holes just large enough to insert a straw.
- Insert a straw through both holes.
- Tape wheels to straw, if needed.

Simple Machines: Can You Match Them?

Name _____

Cards

Color and cut out all the cards. On the chart, glue each card in the correct row.



Simple Machines: Can You Match Them?

Name _____

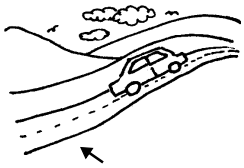
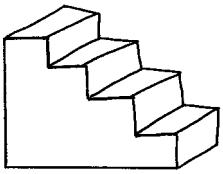
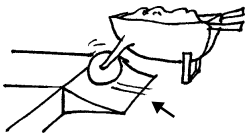
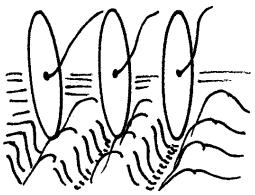
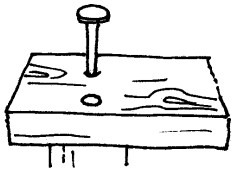
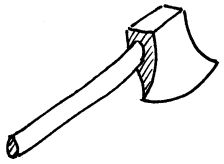
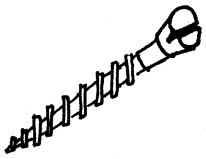
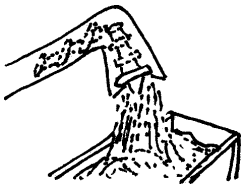
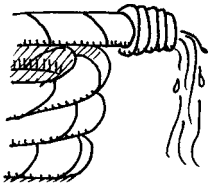
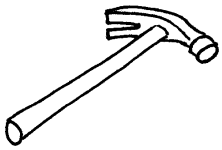
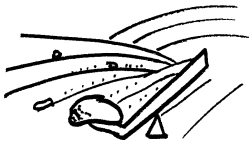
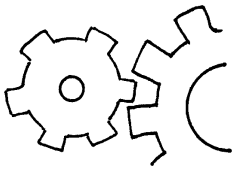
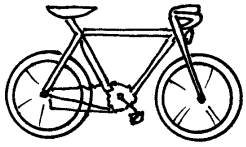
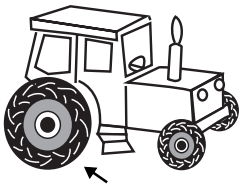
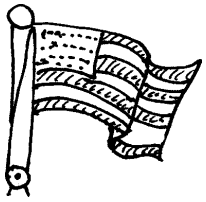
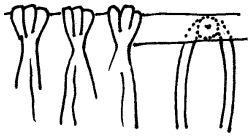
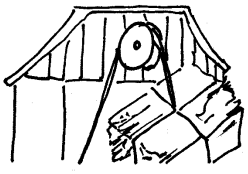
Arrange your cards in the appropriate boxes. Glue them in place. In the blank box in each row, draw and color a different machine that belongs in that group.

inclined plane				
wedge				
screw				
lever				
wheel and axle				
pulley				

Simple Machines: Can You Match Them?

Name **Answer Key**

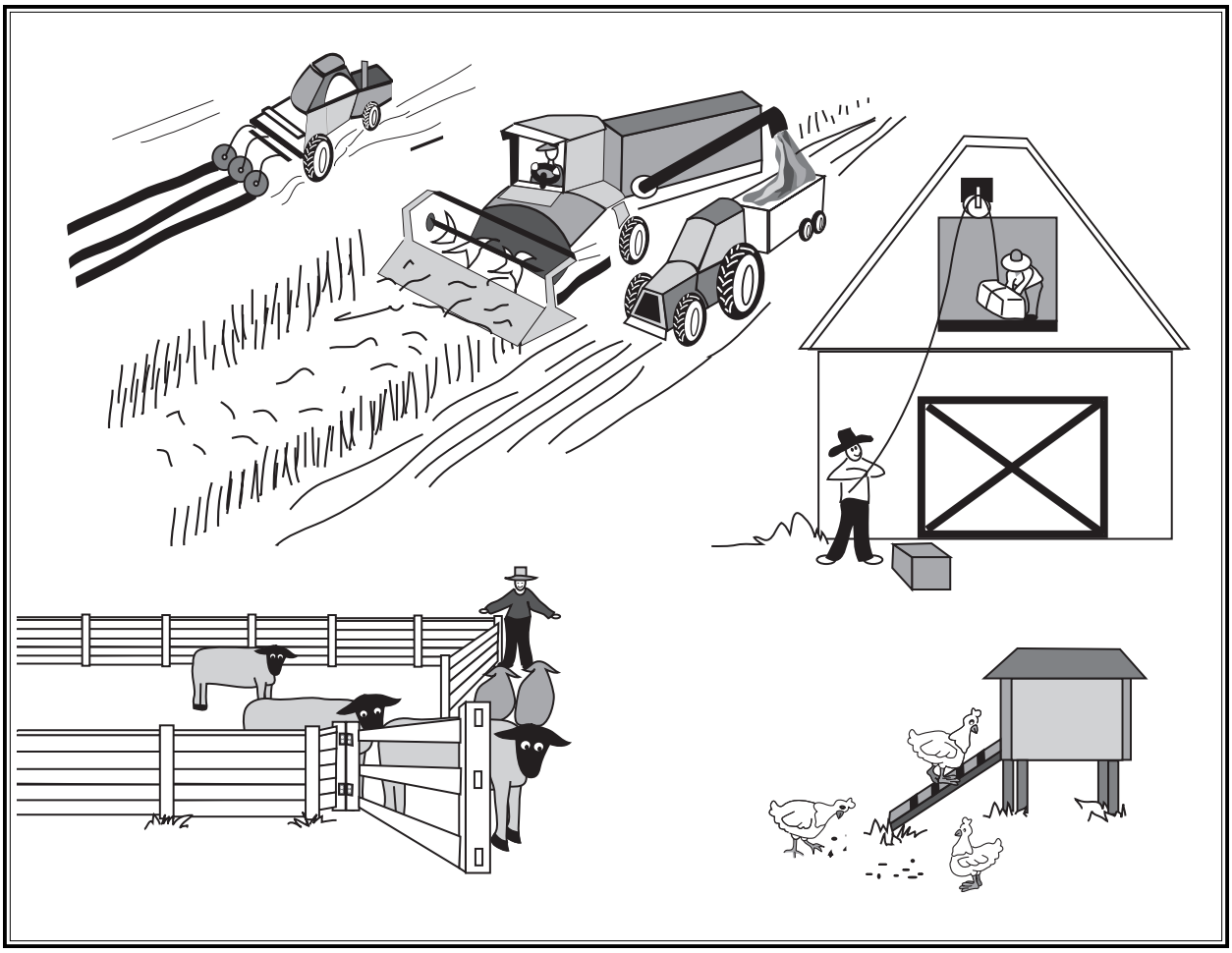
Arrange your cards in the appropriate boxes. Glue them in place. In the blank box in each row, draw and color a different machine that belongs in that group.

inclined plane				*Student Drawn Picture*
wedge				*Student Drawn Picture*
screw				*Student Drawn Picture*
lever				*Student Drawn Picture*
wheel and axle				*Student Drawn Picture*
pulley				*Student Drawn Picture*

Machines Helping the Rancher

Name _____

Simple machines have been used for thousands of years. Today, farmers and ranchers use simple machines as well as their modern complex agricultural equipment. Look at the picture below.



Look carefully at the people working in the picture above. Circle the simple machines you find in the picture. Draw squares around the complex machines you see on the ranch. The word bank below may help you remember the simple machines.

lever	inclined plane	screw
wedge	wheel and axle	pulley

Keeping It Simple

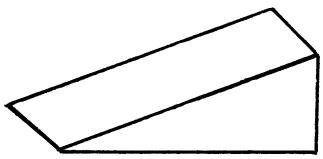
Name _____

Dear Parent or Guardian:

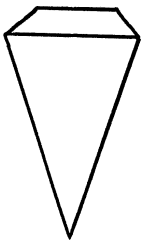
In class your student has made a model of each of the six different kinds of simple machines—the inclined plane, wedge, screw, wheel and axle, lever, and pulley. Please participate in this parent-student homework activity.

Part I

Talk with your child about his or her model-building experience. Discuss the names and functions of the simple machines shown below.

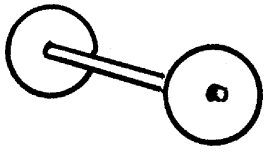


inclined plane

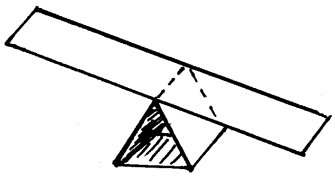


wedge

screw



wheel and axle



lever

pulley

Keeping It Simple

Name _____

Part 2

With your child, walk around your home and notice the different machines you use. As a team, write the names of the machines under the correct heading. Some may fit in more than one category.

Lever	Wedge	Wheel and Axle
_____	_____	_____
_____	_____	_____
_____	_____	_____

Screw	Pulley	Inclined Plane
_____	_____	_____
_____	_____	_____
_____	_____	_____

Briefly describe your child's reaction to this activity.

_____

_____

_____

Do you have any questions or comments about this activity?

_____

_____

_____

Parent or Guardian Signature _____

California Foundation For Agriculture In The Classroom

Made to Move

Purpose

The purpose of this activity is for students to use simple machines to examine the relationships between force and motion.

Time

Teacher Preparation
One hour

Student Activity
Two hours

Materials

For each student:

- Science journal—cover page and station worksheets stapled together (pages 35-50)

For each station:

Station 1
- Three books tied together with string
- Large, sturdy rubber band
- Ruler
- Skateboard or similar object with wheels

Station 2
- Ruler
- Yardstick marked at 24 inches
- Book tied with string
- Large, sturdy rubber band
- Metal bookend or some other object for a balance point (fulcrum)

Background Information

In the previous lessons, the students made models of the six simple machines. Machines involve the *force* of a push or pull. Machines cannot create energy; they use the energy available in an efficient way. Stored (potential) energy is converted to mechanical (kinetic) energy.

As energy is transformed from one form to another or transferred from one object to the next, some of it is converted into heat energy because of friction. *Friction* is the force between two surfaces that resists the motion of one object past another. Friction is useful when one does not want an object to slip. Friction is important when a tire rolls across a road, or sandpaper rubs across wood. Other times friction is less desirable. For example, the rubbing between metal in machine parts causes them to wear down or release heat in unwanted areas. The use of lubricants and ball bearings can reduce unwanted friction. Steel ball bearings often contain bone charcoal, a lubricant made from cattle. Machine lubricants come from many sources, including fossil fuels and inedible beef fats.

The station activities in this lesson allow your students to experience firsthand the six simple machines in action and the effect friction has on the efficiency of the machines. The students will also observe the effects of lubricants and ball bearings.

Procedure

1. Divide students into eight groups. Have students create their science journals for this lesson. This should include the title page and all of the station worksheets stapled together. It may also include blank pages for writing assignments prompted by you or your students.

2. Place the station materials in eight locations around the room.

3. Have the groups rotate from station to station every 15-20 minutes. Four rotations might be done one day and rest another day. Set up the format to accommodate what works best for your classroom.

4. Have the students complete each activity and worksheet at the appropriate station. Each worksheet contains directions for a self-directed activity. Some guidelines for successful station work are described below:

Made to Move

Materials *(continued)*

Station 3
- Apples (one per group)
- Paper towels
- Plastic knife or a metal apple cutter

Station 4
- Two books tied together with string
- Large, sturdy rubber band
- String (three feet)
- Pulley (or broom stick or long dowel) with string for hanging

Station 5
- Books (at least five)
- Large, sturdy rubber band
- Ruler
- Shoe box lid
- Rock (about the size of a baseball) with string tied around it

Station 6
- Screwdrivers
- Several 1" screws
- Several 1/2" thick pieces of wood

Station 7
- Blocks of wood (two per group)
- Grease (petroleum jelly)
- Plastic knife

Station 8
- Carpet piece
- Book
- Marbles

a) Preview the experiments with the students before they begin the station activities.

b) Review your classroom expectations on cooperation, set-up, participation, and clean-up.

c) Assign roles to each member in the group such as supply person and time monitor.

d) Inform your students of the time, five minutes before changing stations.

5. When the rotations are complete, direct a discussion about what the students discovered. Ask them to share their science journal writings with one another.

Variations

- Do each station as a whole class activity.
- Assign older students from another class to be the leaders for each station.

Extensions

- Read *Mike Mulligan and His Steam Shovel*. Have the students discuss the simple and complex machines in the story.
- Ask a farmer, rancher, crop duster, agricultural equipment representative, or food distributor to visit your class to discuss the machines he/she uses.
- Have students do research and report on agricultural by-products used in the production or use of machines.

California Foundation For Agriculture In The Classroom

Made to Move

Content Standards

Grade 2

Reading/Language Arts
- Writing • 1.0, 1.1, 1.2
- Written and Oral Language Conventions • 1.0
- Listening and Speaking 1.0, 1.1, 1.6, 1.9

Mathematics
- Measurement and Geometry • 1.0

Science
- Physical Sciences • 1, 1c, 1d, 1e
- Investigation and Experimentation • 4, 4a, 4d, 4g

Grade 3

Reading/Language Arts
- Reading • 2.7
- Writing • 1.0
- Written and Oral Language Conventions • 1.0
- Listening and Speaking 1.0, 1.3

Mathematics
- Measurement and Geometry • 1.0

Science
- Physical Sciences • 1c
- Investigation and Experimentation • 5, 5a, 5d, 5e

Notes

Made to Move

Content Standards
(continued)

Grade 4

Reading/Language Arts
- Reading 2.2, 2.3, 2.7
- Writing 1.0, 1.1
- Written and Oral Language Conventions 1.0, 1.1
- Listening and Speaking 1.0, 1.1, 1.6

Science
- Investigation and Experimentation • 6, 6b, 6c, 6f

Grade 5

Reading/Language Arts
- Writing 1.0
- Written and Oral Language Conventions 1.0
- Listening and Speaking 1.1

Science
- Investigation and Experimentation • 6, 6a, 6h

Notes

Machines at Work

Science Journal

by

_____

Wheels Rolling Along

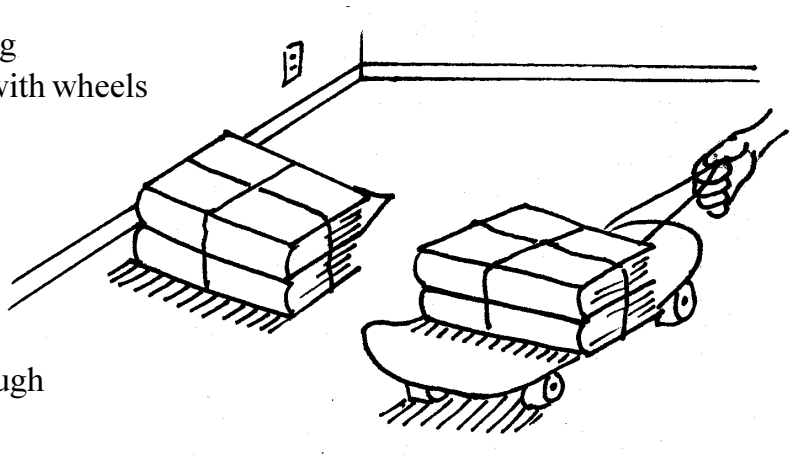
Name _____

Station 1

The wheel is one of the most important machines. It allows things to roll instead of slide when a force is applied. In this activity, you will observe how wheels help move an object.

Materials

- Books tied together with string
- Skateboard or similar object with wheels
- Rubber band
- Ruler



Procedure

1. Make a handle with the rubber band by looping it through the string.
2. Place the books on the floor and use the handle to pull them a short distance.
3. With the ruler, measure how far the rubber band stretches as you pull the books.
4. Place the books on the skateboard and use the handle to pull it a short distance. Use the ruler to measure how far the rubber band stretches.
5. Take turns doing steps 1-4 and discuss what you observe.

Observations *(answer in complete sentences)*

1. What happened to the rubber band when you pulled the books without using the wheels?

   _____

   _____

2. What happened to the rubber band when you pulled the books with the wheels?

   _____

   _____

Wheels Rolling Along *(continued)*

Name _____

Station 1

Think About It!

1. Did it take more or less force to pull the books when they were on wheels? Why?

   _____

   _____

2. Describe two ways a farmer uses wheels to make work easier on the farm.

   a) _____

   _____

   b) _____

   _____

3. Do you think using wheels in special ways makes the food we buy more or less expensive? Explain.

   _____

   _____

   _____

   _____

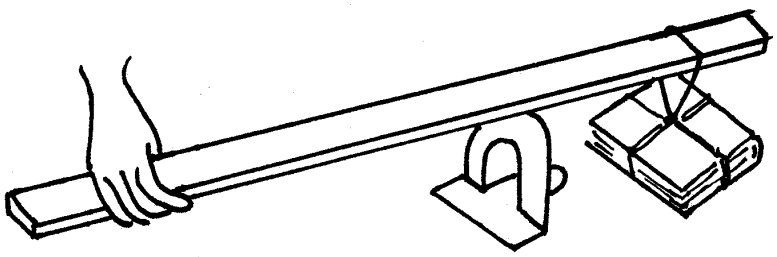
Levers Lifting the Load

Name _____

Station 2

A lever makes it easier to move heavy things. Levers concentrate a force around a pivot point. A cattle rancher needs to use fences around the pasture. The heavy gates open and close easier because they have hinges that are levers. The gate fasteners are often levers too!

Materials



- Light book tied with string
- Rubber band
- Ruler
- Yardstick marked at 24 inches
- Fulcrum or balance point of some kind such as metal bookend

Procedure

1. Make a handle with the rubber band by looping it through the string.

2. With the ruler, measure how far the rubber band stretches as you lift the books off the table with your hand. This demonstrates the amount of force necessary to lift the books.

3. Place the fulcrum or bookend under the yardstick at the mark and put the books over the short end of the yardstick. Push down on the long end of the yardstick. With the ruler, measure how far the rubber band stretches as you push down.

4. Takes turns doing steps 1-3 and discuss what you observe.

Observations *(answer in complete sentences)*

1. Describe how it felt to pick the books straight up with your hand.

   _____

   _____

2. Was it easier or harder to lift the books using a lever? Why?

   _____

   _____

Levers Lifting the Load *(continued)*

Name _____

Station 2

Think About It!

1. List two levers that make work easier for you.

   _____

   _____

2. Describe how a farmer benefits from a hoe (a type of lever).

   _____

   _____

   _____

   _____

The Wedge Forces Apart

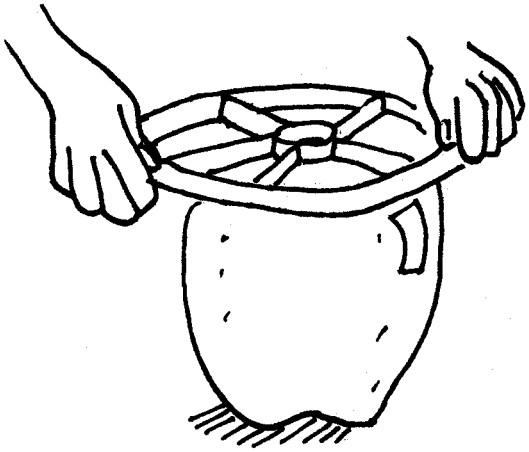
Name _____

Station 3

A wedge makes it easier to split things apart. When the wedge is pushed down, the object pushed upon splits apart. For example, after a farmer harvests apples and sells them, the apples are often peeled, cored and sliced to be used in pies. The knife, apple peeler, and cutter used to prepare the apples are wedges. You will use a wedge in this activity.

Materials

- Apple
- Paper towels
- Plastic knife or metal apple cutter



Procedure

1. Wash your hands and the apple before starting.
2. Put the apple on the paper towel.
3. Position the wedge (knife or apple cutter) on top of the apple and push down with a lot of force to cut the apple into sections.
4. Discuss your observations with the group as you enjoy eating your apple wedges.

Observations *(answer in complete sentences)*

1. What was the wedge in this activity?

   _____

   _____

2. What did the wedge do?

   _____

   _____

3. What wedges did you use that are located in your mouth?

   _____

   _____

The Wedge Forces Apart *(continued)*

Name _____

Station 3

Think About It!

1. Why are knives and apple cutters called wedges?

_____

_____

_____

_____

2. Why do you think a slice of apple is called a wedge?

_____

_____

_____

_____

3. List two wedges that are used in your kitchen.

_____

_____

4. Tractor tire treads are wedges. Why are there treads on tires?

_____

_____

_____

_____

The Pulley Has Pull

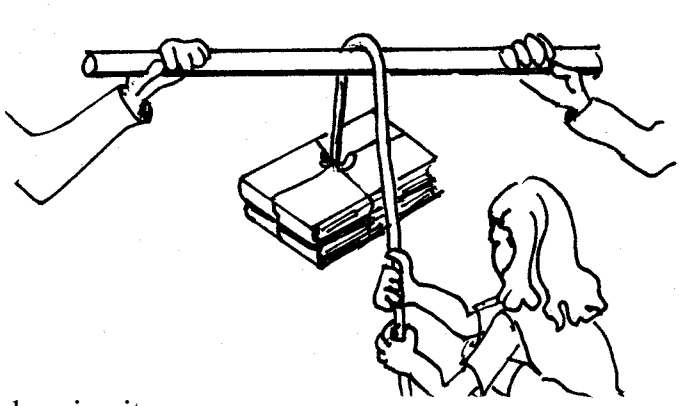
Name _____

Station 4

Pulleys make lifting easier by changing the direction of a pull. There are many different kinds of cranes that lift and move heavy loads. Imagine what it would be like if pulleys were not used to raise and lower flags or to place hay in a barn. In this activity, you will observe how pulleys make work easier.

Materials

- Paperback books tied together with string
- Pulley or dowel
- 3 feet of string



Procedure

1. Make a handle with the rubber band by looping it through the string.

2. Lift the books with your hand using the rubber band as a handle.

3. Tie one end of the piece of string to the rubber band and pass the string through the pulley (or over the stick).

4. Pull down on the string to lift the books up. Measure how far the rubber band stretches as you pull.

5. Take turns pulling down on the string and discuss your observations.

Observations *(answer in complete sentences)*

1. What happened to the books when you pulled down on the pulley?

_____

_____

_____

_____

The Pulley Has Pull *(continued)*

Name _____

Station 4

2. Was it easier to lift the books with your hand or with the pulley—or was it the same?

_____

_____

Think About It!

1. Describe a situation where using a pulley would be helpful.

_____

_____

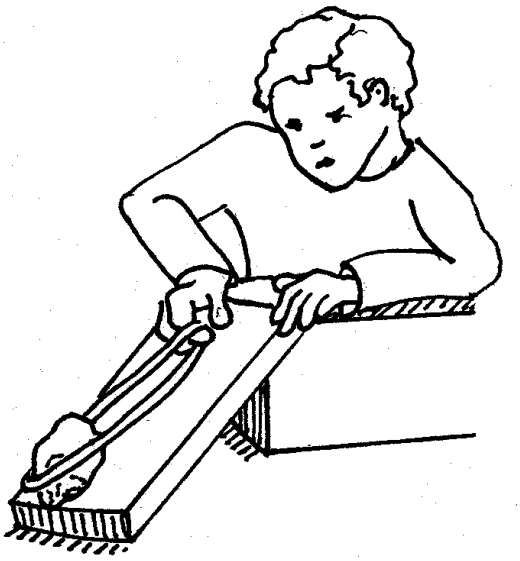
2. Most elevators have pulleys. Draw a sketch of an elevator including the pulley.

Inclined Plane Going Up

Name _____

Station 5

It is much easier to move a heavy weight up or down if an inclined plane is used. A ramp (a type of inclined plane) is very useful when a cattle rancher loads cattle onto trucks to move them from one pasture to another. In this activity, you will observe the usefulness of inclined planes.



Materials

- Several books
- Rock tied with a string
- Rubber band
- Ruler
- Shoe box lid

Procedure

1. Make a handle with the rubber band by looping it around the string.

2. With the ruler, measure how far the rubber band stretches as you use one hand to lift the rock straight up from the desk to the top of the books.

3. Stack three books on the desk. Rest the shoe box lid, top side up, against the books to make an inclined plane or slope. Use the ruler to measure how far the rubber band stretches as you pull the rock up the inclined plane. Stack more or less books to vary the steepness of the slope.

4. Take turns doing steps 1-3 and discuss your observations.

Observations *(answer in complete sentences)*

1. Describe what happened when you changed the steepness of the inclined plane.

   _____

   _____

2. When did the rubber band stretch less—using or not using the inclined plane?

   _____

   _____

Inclined Plane Going Up *(continued)*

Name _____

Station 5

Think About It!

1. Do you think it would be easy or hard to run up a steep inclined plane? Why?

   _____

   _____

2. Farmers use conveyor belts to move fertilizer and seed from the ground to the top of the trailer or bin they are filling. When does an inclined plane come in handy for you?

   _____

   _____

Draw a comical cartoon that shows a farmer loading cattle into a truck without a ramp.

I wish I had an inclined plane!

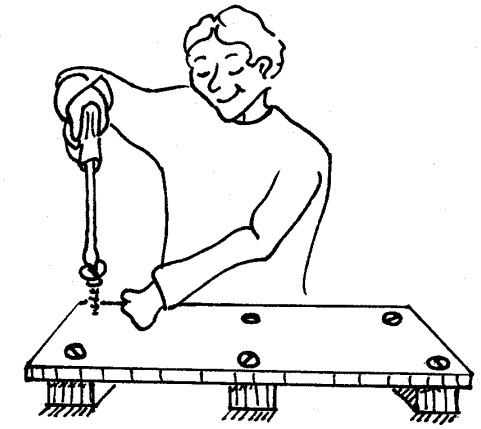
Screw a Firm Hold

Name _____

Station 6

A screw is very useful because it concentrates the force you apply to move something away from you. Screws also can be used to attach things together. In an agricultural machine called a "combine," an auger, or moving screw, pushes grain into a container.

Materials



- Wood (2 pieces)
- Screw
- Screwdrivers

Procedure

1. Stack the two pieces of wood together.
2. While holding the screw over the top piece of wood, use the screwdriver to turn the screw through the pieces of wood. They will be held together firmly.
3. Your teacher may have used a special screw called a drill to pre-make holes for you.
4. Take turns using the screwdriver and discuss your observations.

Observations *(answer in complete sentences)*

1. Describe what you did to put the screw through the pieces of wood.

   _____

   _____

2. Did the screw go away from you or towards you? Explain.

   _____

   _____

Think About It!

1. Which would be easier to get out of a piece of wood—a nail or screw? Why?

   _____

   _____

Friction and Grease

Name _____

Station 7

Friction is not wanted when using some machines. It not only causes the machines to work harder, but it can wear out the parts more quickly. Friction converts some energy to heat. Lubricating the parts can make the machines more efficient. Many lubricants, such as hydraulic brake fluid, are made from cattle by-products. Others are made from fossil fuels, such as oil or coal, or plant oils. Farmers use lubricants to keep their equipment running smoothly.

Materials

- 2 blocks of wood
- Plastic knife
- Petroleum jelly

Procedure

1. Take turns rubbing the two pieces of wood together. Notice the resistance or friction that slows down the movement.

2. Lubricate the sides you rubbed together by putting a tiny dab of grease between them. Take turns rubbing the two pieces together now.

Observations *(answer in complete sentences)*

1. Describe the difference you felt when you rubbed the blocks of wood together before and after putting on the grease.

_____

_____

_____

Think About It!

2. Name at least two machines that work better when they are lubricated or greased.

_____

_____

Friction and Grease *(continued)*

Name _____

Station 7

3. Where do lubricants come from?

_____

_____

_____

4. When might friction be a useful force?

_____

_____

_____

_____

Ball Bearings are Friction Fighters

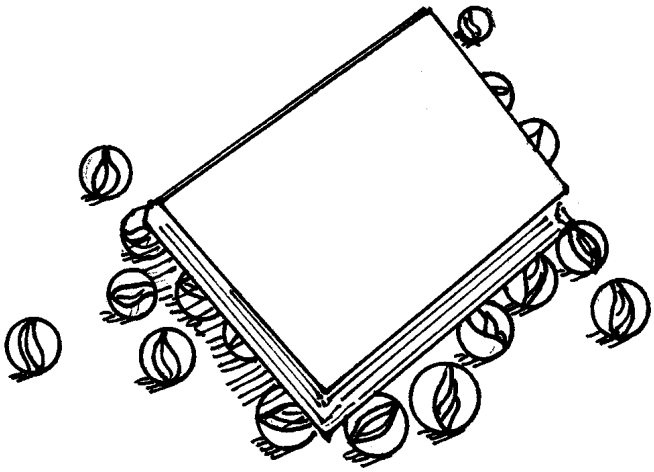
Name _____

Station 8

Ball bearings are often used inside machines. Ball bearings reduce the amount of friction so the moving parts turn more easily and do not wear out as quickly. Ball bearings are made from bone charcoal, which is a cattle by-product or metal that is mined from the ground.

Materials

- Carpet piece
- Book
- Marbles



Procedure

1. Push the book along the carpet. When the two surfaces rub together, a force called friction prevents them from moving easily.

2. Put some marbles under the book and push it along the carpet. The marbles are like ball bearings in machines.

3. Take turns doing steps 1 and 2 and discuss what you observe.

Observations *(answer in complete sentences)*

1. Describe what happened when you pushed the book with the marbles under it.

_____

_____

Think About It! *(answer in complete sentences)*

1. Sometimes friction is useful. How is friction useful when riding a bicycle?

_____

_____

Ball Bearings are Friction Fighters *(continued)*

Name _____

Station 8

2. You might find ball bearings in wheels. Where in the wheels might they be?

_____

_____

_____

_____

3. Draw a picture of what you think ball bearings might look like in a machine.

California Foundation For Agriculture In The Classroom

Machines in Agriculture

Purpose

The purpose of this activity is for students to make connections between the six types of simple machines and the complex machinery used to produce food and fiber.

Time

Teacher Preparation
Forty-five minutes

Student Activity
Two hours

Materials

For each group of 3-4 students:

- Markers, colored pencils, or watercolor paints
- Poster size pieces of butcher paper
- One picture or toy model of farm equipment

For each student:

- Small (half pint) milk carton
- Brown construction paper
- Scissors
- Glue and/or scotch tape
- 3 straws
- Black pipe cleaner

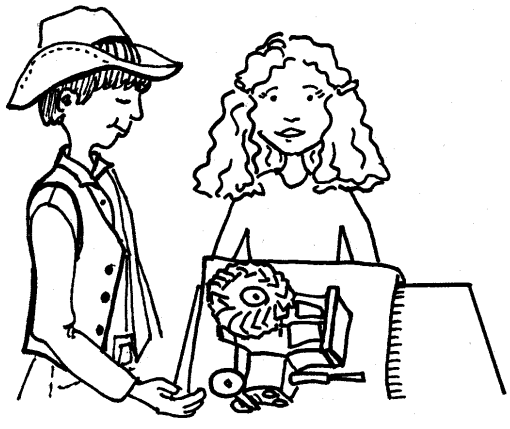
Background Information

The development of agricultural implements has not only made work easier for the farmer, but advanced technology continues to make the machines more efficient. Regardless of the complexity of the machinery, all of the parts of agricultural machinery consist of variations of the six kinds of simple machines.

The overall number of farmers has decreased over the years. Approximately 85% of our population were ranchers and farmers when our nation was formed. Today, only 1-2% of the population is in production agriculture, growing the food and fiber for everyone.

Animal and plant by-products play an important role in technology. For example, many plastic parts of machinery contain fats and fatty acids from cattle. Rubber tires may contain fats, fatty acids, and stearic acid from animals. Walnut shells are used as an abrasive in sandpaper and put into snow tires to increase friction. Animal manure and corn and rice by-products are used as energy sources to run agricultural equipment. As your students complete these activities, encourage them to think about the interconnectedness of science, agriculture, the environment, and the quality of life.

> *"But machines mean much more to us than just easing our daily burden. The really significant thing about a machine is not that it allows a man to do a given job in half the time, but that it can also allow a man to produce twice as much in a given time."*
>
> *Henry Ford II*



Machines in Agriculture

- Modeling clay
- Tag board
- Markers and pencils
- *Flip Book* activity sheet (page 56)
- *Writing a Cinquain* activity sheet (page 57)
- *Tractor Cinquain* activity sheet (page 58)
- *Semantic Map* worksheet (page 59)

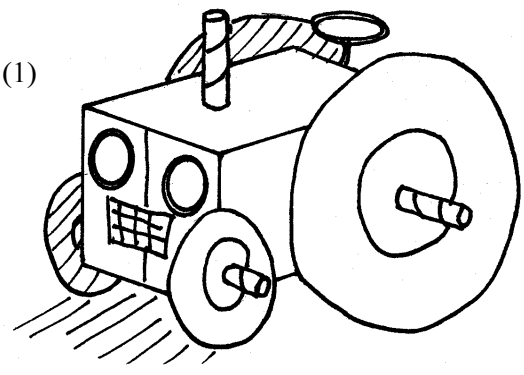
Procedure

Before beginning this series of activities, display a variety of pictures of agricultural equipment for students to examine.

Part 1: A Tractor is a Machine

1. Each student needs the following materials to make a tractor:

   - Brown construction paper to cover the milk carton
   - Tag board for wheels and headlights
   - Milk carton (1 small)
   - Straws (3)
   - Scissors
   - Black pipe cleaner (1)
   - Glue and/or tape
   - Modeling clay
   - Markers



2. Have the students:

   - Cover the milk carton with brown construction paper using glue or tape. Use the tag board to cut out two large circles for wheels. Decorate the wheels using the markers or crayons. Cut out two headlights. Glue the headlights to the front of the tractor.

   - Poke 2 holes with a pencil in the top of the tractor, one near the front and one close to the back. Cut a section of a straw and put it into the hole near the front. With the pipe cleaner, fashion a steering wheel and column and put that into the other hole. Use glue or a dab of modeling clay to hold the parts in place so they do not slip through the holes.

   - On either side of the tractor, poke holes where the axles should go for the front and rear wheels.

   - Use straws as axles and poke them through the tractor at the appropriate places.

Machines in Agriculture

Content Standards

Grade 2

Reading/Language Arts
Writing • 1.0, 1.1, 1.4
Written and Oral Language Conventions • 1.0, 1.1, 1.3, 1.6

Science
Physical Sciences • 1, 1c, 1d

Grade 3

Reading/Language Arts
Writing • 1.0, 1.4
Written and Oral Language Conventions • 1.0, 1.1
Listening and Speaking 1.4, 1.5, 1.9

Science
Physical Sciences • 1c

Grade 4

Reading/Language Arts
Writing • 1.0, 1.3, 1.10
Written and Oral Language Conventions • 1.0, 1.1
Listening and Speaking 1.0, 2.4

Grade 5

Reading/Language Arts
Writing • 1.0, 1.6
Written and Oral Language Conventions •1.0, 1.4

- Poke a hole through the center of each wheel. Put the wheels on either side of the tractor where the axles protrude. Use modeling clay to hold the wheels in place on the axle. This will keep the wheels on the axles, but will allow the axles to turn.

3. Challenge the students to exercise their inventive nature by providing a variety of other materials and giving them the opportunity to add an implement to the front or back of their tractor. They must be able to explain what simple machine this implement employs and what job it does to make work easier for the farmer.

Part 2: Farm Landscape Flip Book

1. Distribute the *Flip Book* activity sheet and ask students to draw a piece of farm equipment on each of the ten pages. They may also draw a farm landscape. Each drawing should be done in such a way as to portray a sequence like series of frames in a movie film. The short vertical lines at the bottom of each page may serve as guidelines as the drawing progresses from frame to frame. For example, on page one, the tractor might be on the far left side of the page. The sun might be in the middle of the sky and perhaps some birds in the sky. As each succeeding page is drawn, the details of the scene change slightly to show movement.

2. When the drawings are complete, instruct the students to cut out the pages and staple them together in the margin allowed. If the drawing on each page is done in sequence like a series of frames in a movie, the objects will move when the pages are flipped quickly with the thumb. Thus, the sun and birds will seem to move across the sky and the tractor will plow or harvest a field.

Part 3: Machine Advertisement

1. Review with your students your rules for cooperative group activities.

2. Place students in groups of three or four. Give each group a set of markers, a large piece of butcher paper, and a toy model or picture of a piece of farming equipment.

3. Explain to the students that they are going to create an advertisement for this machine. They must make it appealing and interesting so a farmer will consider purchasing the equipment.

4. Have a class discussion about what should be included in the advertisement. Write the ideas on the board. Some suggestions might be:

    - A list and labeling of the simple machines it contains.
    - A drawing and the name of the machine.
    - An explanation of its use:
        - Preparing the soil
        - Planting the crop
        - Maintaining the crop
        - Harvesting the crop
        - Livestock management/transportation
    - A description of commodities it is used for.
    - An approximate cost and where it can be purchased.

5. Prior to making the final advertisement, require students to proof their work for proper spelling and grammer, including sentence structure, punctuation, and capitalization.

6. Have the students create their advertisements and share them with the class. Create a bulletin board display or catalog of the student work.

Part 4: Tractor Cinquain

1. Have your students use the *Writing a Cinquain* activity sheet to create a tractor cinquain.

2. After the students have proofed their tractor cinquains, have them rewrite their work onto the *Tractor Cinquain* diagram. Cut out the tractors and display then on a bulletin board or on a piece of butcher paper designed as a field.

Part 5: Semantic Map

The purpose of this activity is for the students to use the concepts they have learned to write about four specific ideas related to agricultural machines. An important aspect of this activity is the discussion that takes place. Using a copy of the activity on an overhead transparency is suggested. Have the students suggests words, thoughts, and ideas

that fit each category. After some discussion, let the students work on their own. You may want to designate a certain number of ideas they must write in each section. When they are finished, collect the work and use it as an assessment tool.

Extensions

- Invite a farm equipment mechanic to your classroom to share information about farming equipment. Have this person discuss how pieces of equipment are used and how farm equipment has changed over the years.

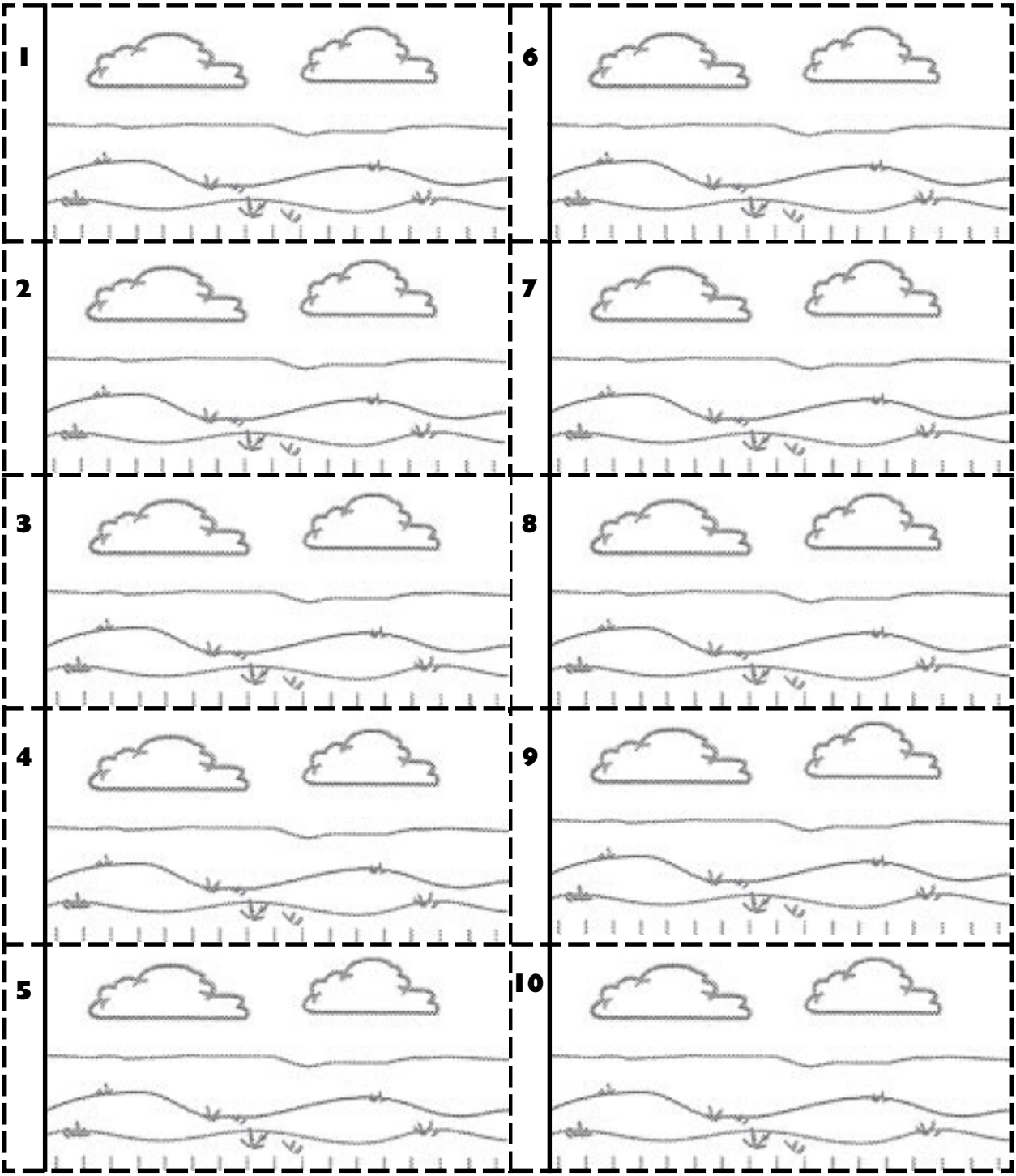
- Divide the students into groups of five or six. Give each group a picture of a machine or let them come to a consensus on a machine. Have each group make this machine with their bodies and demonstrate their human machine to the other groups. Encourage the use of movement and sound. Have the others guess what the machine is, some simple machines it contains, and what it is used for.

- Have the groups of students sort and classify agricultural equipment pictures into six categories:

    - Preparing the soil
    - Planting the crop
    - Maintaining the crop
    - Harvesting the crop
    - Livestock management
    - Transportation of a crop or livestock

Flip Book

Draw and color the same farm landscape in each picture frame. Be sure to include a piece of agricultural equipment. Those objects that move should show a little progress in each frame. Cut along dotted lines. Put pages in order and staple together. Flip pages with thumb and watch the picture "move."



Writing a Cinquain

Name _____

A cinquain is a simple, five line verse. Its structure follows a specific form.

Examples:

Kittens
Frisky, playful
Meow, jumping, bouncing
Creep on padded paws
Mischief

Agriculture
Plants, animals
Abundant and ever-growing
Food on our table
Life

1. Write a cinquain about a tractor on the lines below

One word _____
(title)

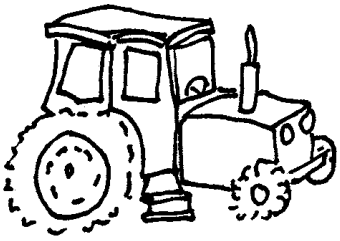
Two words _____
(describe title)

Three words _____
(an action of title)

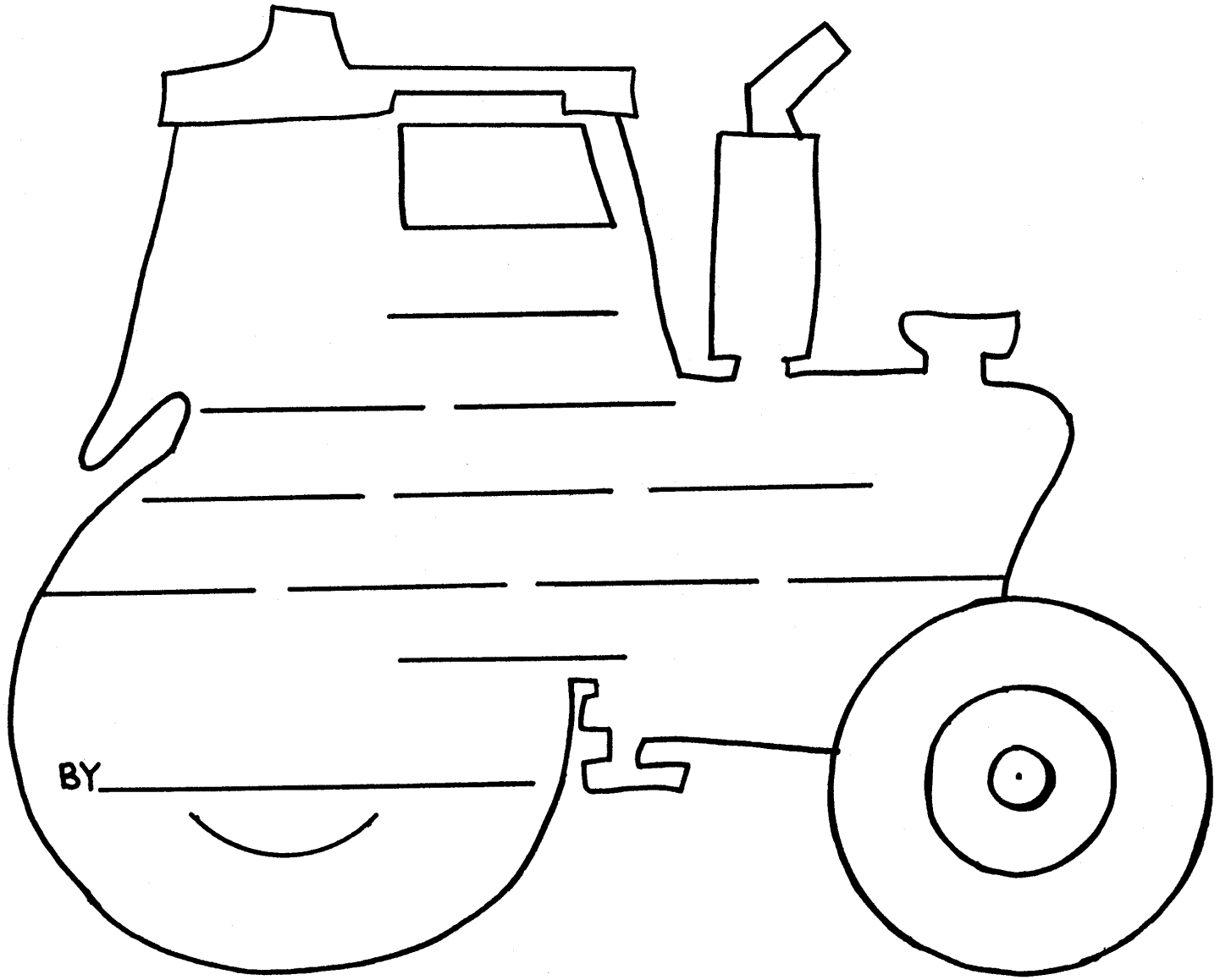
Four words _____
(statement or feeling)

One word _____
(synonym of title)

2. Copy your tractor cinquain neatly onto the tractor diagram.



Tractor Template



What I Know About Agricultural Machines

Name _____

Semantic Map

Agricultural machines are:

Agricultural machines have:

Agricultural Machines

Agricultural machines can:

Agricultural machines cannot:

California Foundation For Agriculture In The Classroom

Teacher Resources and References

AIMS Education Foundation
These math-science hands-on activities encourage students to look at the world around them. Many require building models. Activities with teacher and student pages available in book form on a variety of topics.

AIMS Education Foundation
Post Office Box 8120
Fresno, CA 93747-8120
(888) 733-2467
Fax: (559) 255-6396
E-Mail: aimsales@fresno.edu
Web Site: www.AIMSedu.org

Amazing Machines
This video provides interesting photographs and explanations of a variety of machines.

IShow.com
1530 Eastlake Avenue East, Suite 202
Seattle, WA 98102
(800) 323-7995
Web Site: Ishow.com

California Foundation for Agriculture in the Classroom
Provides a variety of programs and resources, which can increase the understanding of agriculture and its impact in today's world. Commodity and natural resource fact and activity sheets, lesson plans, and teacher and student programs are available. Request a free teacher packet.

California Foundation for Agriculture in the Classroom
2300 River Plaza Drive
Sacramento, CA 95833
(800) 700-2482
Fax: (916) 561-5697
E-Mail: cfaitc@cfbf.com
Web Site: www.cfaitc.org

Careful Country, Farm Safety
A child-oriented coloring and activity book teaches children about farm safety. A video and teacher's guide is also available.

Indiana Rural Safety and Health Council
Purdue University
1146 Agricultural Engineering & Biological Engineering
West Lafayette, IN 47907-1146
(765) 494-5088
Fax: (765) 496-1356
Web Site: www.farmsafety.org

Compliments of Cattle
This free four-page coloring book shows students what products besides beef are made from beef by-products. Request a catalog.

California Beef Council
5726 Sonoma Drive, Suite A
Pleasanton, CA 94566
(925) 484-2333
Fax: (925) 484- 2686
E-Mail: calbeef@calbeef.org
Web Site: www.calbeef.org
Cyber Catalog: www.teachfree.com

Farm Safety 4 Just Kids Catalog
This catalog is full of interesting items which can be used to teach children about farm safety. Items include educational materials, videos, promotional items, and displays.

Farm Safety 4 Just Kids
Post Office Box 458
Earlham, IA 50072-0458
(800) 423-KIDS
Fax: (515) 758-2517
Web Site: www.fs4jk.org

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Teacher Resources and References

InventorLabs Technology
This CD-ROM for Macintosh, Windows 95/98/ME takes you on a journey into the labs of celebrated inventors such as Thomas Edison and James Watt. Explore circuits, gears and more.

Available through Amazon.com

Kids, Crops and Critters in the Classroom
Contains 60 lessons including a simple machine series in a variety of curricular areas. Hands-on activities, worksheets, and resource lists are included.

Illinois Agricultural Association
1701 N. Towanda Avenue
Post Office Box 61702-2901
Bloomington, IL 61702-2901
(309) 557-3334
Fax: (309) 557-2641
Web Site: www.agintheclassroom.org

Perma-Bound, Inc.
This company has many educational videos including *Simple Machines—Using Mechanical Advantage* and *Push and Pull: Simple Machines at Work*.

Perma-Bound Inc.
617 East Vandalia
Jacksonville, IL 62650
(800) 637-6581
Fax: (800) 551-1169
Web Site: www.perma-bound.com

Return of the Incredible Machine
This CD-ROM for Macintosh, Windows 95/98/ME encourages the creation of unusual machines using the six simple machines as a premise. Over 200 puzzles and activities included.

Available from Amazon.com

Tractors, Combines and Things on the Grow
Thirty-minute video shows children the wonders of where food really comes from and how it ends up on the grocers' shelves.

Just Our Size Videos
14010 Falls Road
Cockeysville, MD 21030
(800) 808-FARM
Fax: (410) 584-7261

Tractors, Cotton-Pickers and the Stuff Kids Wear
Thirty-minute video shows how a child's favorite pair of blue jeans comes from a tiny cottonseed. Shows a variety of machines including a cotton harvester and weaving looms.

Just Our Size Videos
14010 Falls Road
Cockeysville, MD 21030
(800) 808-FARM
Fax: (410) 584-7261

Wow That Cow
Brochure and poster details on beef by-products including non-edible and pharmaceutical products. Available in English, Spanish, and Japanese.

American National CattleWomen
Post Office Box 3881
Englewood, CO 80155
(303) 694-0313
Fax: (303) 694-2390

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Simple Machines, Farm Equipment, and Related Web Sites

4-H Virtual Farm
www.ext.vt.edu/resources/4h/virtualfarm

About Inventors
inventors.about.com

Agricultural Machinery Index
www.history.rochester.edu/appleton/a/agmac-m.html

Farm Unit Classroom Resources
Viking.stark.k12.oh.us/~greentown/farmunit.htm

International Agricenter
www.farmshow.org/heritage.htm

John Deere
www.deere.com *and* www.deerefun.com

Lesson Plans Page.com
www.lessonplanspage.com

Ontario Cattleman's Association
www.cattle.guelph.on.ca/kids_cattle/beef_everywhere/index.html

ProTeacher™
www.proteacher.com

Wisconsin Historical Society
www.shsw.wisc.edu

Student Literature

Anderson, Joan. ***Cowboys: Roundup on an American Ranch***. Scholastic, Inc., 1996. This photo-essay shows how two brothers help their parents and hired hands with an annual roundup on a New Mexico ranch. Authentic photographs included.

Ardley, Neil. ***The Science Book of Machines***. Harbrace, 1992. This simplified book shows actual photographs of many common machines one finds around the house and community.

Berger, Melvin. ***From Peanuts to Peanut Butter***. Newbridge Communications, Inc. 1992. The sequential steps of producing peanut butter are shown beginning at the farm.

Berger, Melvin. ***Make Mine Ice Cream***. Newbridge Communications, Inc. 1993. Using photographs, this book shows the process of making ice cream, from the cow to home.

Brown, Craig. ***Tractor***. Greenwillow, 1995. In simple language, this book covers the use of a tractor from the working of the soil all the way to the delivery of the produce to market.

Burns, Diane L. ***Cranberries: Fruit of the Bogs***. Carolrhoda Books, Inc., 1994. A brief history of the "bog ruby" reveals the berry's versatility and importance to the Native Americans and the pilgrims as well as shows the activities that take place throughout the growing season on a cranberry farm.

Burton, Virginia. ***Mike Mulligan and His Steam Shovel***. Houghton Mifflin, 1999. Mike Mulligan and his steam shovel make some amazing changes in the town of Popperville.

Bushey, Jerry. ***Farming the Land, Modern Farmers and Their Machines***. Carolrhoda Books, 1987. Photographs and text show many pieces of farm equipment in use.

Cowley, Joy. ***The Rusty, Trusty Tractor***. Boyd Mills, 1999. Tractor salesman Mr. Hill tries to convince Michah's grandfather that his old tractor has seen better days.

Erlback, Arlene. ***Peanut Butter***. Lerner Publishing, 1994. Describes how peanut butter is made, from the cultivation of peanuts through filling the jars with the nutty spread. Includes simple, no-bake recipes.

Student Literature

Harrington, Roy. ***A Tractor Goes Farming***. American Society of Agricultural Engineers, 1995. This picture book shows numerous photographs of farm equipment in use and describes their functions in simple text.

Macaulay, David, and Neil Ardley. ***The New Way Things Work***. Houghton Mifflin, 1998. Learn the basics and some specifics on how a variety of machines work including windmills, zippers, and tractors.

Parker, Steve. ***The Random House Book of How Things Work***. Random House, 1991. This book with cut-away illustrations explains the inner workings of many household appliances.

Peterson, Cris. ***Harvest Year***. Boyd Mills Press, 1996. Full color photos and clear, concise text take readers month-by-month through a sampling of the wide diversity and volumes of crops grown throughout the United States. Agricultural equipment is shown in many of the photographs.

Robbins, Ken. ***Make Mine a Peanut Butter Sandwich and a Glass of Milk***. Scholastic, 1992. Text and photographs show how a lunch of a peanut butter sandwich and milk is made, from field, to store, to table.

Ziefert, Harriet. ***A New Coat for Anna***. Knopf, 1986. Anna visits the sheep that provide the wool and, meets all the people involved in making her winter coat.

Content Standard Details

Content Standards for California Public Schools
Addressed in *Simple and Complex Machines Used in Agriculture**

Obtained from the California Department of Education

Grade 2		
Standard	**Lesson(s) in which Standard is Taught or Reinforced**	**Standard Description**
Reading Language Arts		
Writing 1.0	Machines and People Six Kinds Do It All Made to Move Machines in Agriculture	Students write clear and coherent sentences and paragraphs that develop a central idea.
Writing 1.1	Machines and People Made to Move Machines in Agriculture	Group related ideas and maintain a consistent focus.
Writing 1.2	Machines and People Made to Move	Create readable documents with legible handwriting.
Writing 1.4	Machines in Agriculture	Revise original drafts to improve sequence and provide more descriptive detail.
Writing 2.0	Machines and People	Write compositions that describe and explain familiar objects, events, and experiences.
Written and Oral Language Conventions 1.0	Machines and People Six Kinds Do It All Made to Move Machines in Agriculture	Write and speak with a command of standard English conventions appropriate to this grade level.
Written and Oral Language Conventions 1.1	Machines in Agriculture	Distinguish between complete and incomplete sentences.
Written and Oral Language Conventions 1.3	Machines in Agriculture	Identify and correctly use various parts of speech, including nouns and verbs, in writing and speaking.
Written and Oral Language Conventions 1.6	Machines in Agriculture	Capitalize all proper nouns, words at the beginning of sentences and greetings, months and days of the week, and titles and initials of people.
Listening and Speaking 1.0	Machines and People Six Kinds Do It All Made to Move	Listen critically and respond appropriately to oral communication. Then speak in a manner that guides the listener to understand important ideas by using proper phrasing, pitch, and modulation.
Listening and Speaking 1.1	Made to Move	Determine the purpose or purposes of listening.

Content Standard Details

Grade 2 *(continued)*

Standard	Lesson(s) in which Standard is Taught or Reinforced	Standard Description
Listening and Speaking 1.3	Machines and People	Paraphrase information that has been shared orally by others.
Listening and Speaking 1.5	Machines and People	Organize presentations to maintain a clear focus.
Listening and Speaking 1.6	Machines and People Made to Move	Speak clearly and at an appropriate pace for the type of communication.
Listening and Speaking 1.9	Machines and People Made to Move	Report on a topic with supportive facts and details.
Mathematics		
Measurement and Geometry 1.0	Made to Move	Understand that measurement is accomplished by identifying a unit of measure, iterating that unit, and comparing it to the item to be measured.
Measurement and Geometry 2.2	Six Kinds Do It All	Put shapes together and take them apart to form other shapes.
Science		
Physical Sciences 1	Machines and People Six Kinds Do It All Made to Move Machines in Agriculture	The motion of objects can be observed and measured.
Physical Sciences 1c	Machines and People Six Kinds Do It All Made to Move Machines in Agriculture	The way to change something that is moving is giving it a push or a pull. The size of change is related to the strength, or by the amount of force of the push or pull.
Physical Sciences 1d	Machines and People Six Kinds Do It All Made to Move Machines in Agriculture	Tools and machines are used to apply pushes and pulls to make things move.
Physical Sciences 1e	Made to Move	Objects fall to the ground unless something holds them up.
Investigation and Experimentation 4	Made to Move	Scientific progress is made by asking meaningful questions and conducting careful investigations.
Investigation and Experimentation 4a	Made to Move	Make predictions based on observed patterns and not random guessing.

Grade 2 *(continued)*		
Standard	**Lesson(s) in which Standard is Taught or Reinforced**	**Standard Description**
Investigation and Experimentation 4c	Machines and People Six Kinds Do It All	Compare and sort common objects according to two or more physical attributes.
Investigation and Experimentation 4d	Six Kinds Do It All Made to Move	Write or draw a description of a sequence of step, events, and observations.
Investigation and Experimentation 4g	Made to Move	Follow oral instructions for a scientific investigation.

Content Standard Details

Grade 3		
Standard	**Lesson(s) in which Standard is Taught or Reinforced**	**Standard Description**
Reading/Language Arts		
Reading 2.7	Six Kinds Do It All Made to Move	Follow simple multiple-step written instructions.
Writing 1.0	Made to Move Machines in Agriculture	Write clear and coherent sentences and paragraphs that develop a central idea. Writing considers audience and purpose.
Writing 1.4	Machines in Agriculture	Revise drafts to improve the coherence and logical progression of ideas by using an established rubric.
Written and Oral Language Conventions 1.0	Machines and People Made to Move Machines in Agriculture	Write and speak with a command of standard English conventions appropriate to this grade level.
Written and Oral Language Conventions 1.1	Six Kinds Do It All Machines in Agriculture	Understand and be able to use complete and correct declarative, imperative, and exclamatory sentences in writing and speaking.
Listening and Speaking 1.0	Machines and People Six Kinds Do It All Made to Move	Listen critically and respond appropriately to oral communication. Speak in a manner that guides the listener to understand important ideas by using proper phrasing, pitch, and modulation.
Listening and Speaking 1.1	Six Kinds Do It All	Retell, paraphrase, and explain what has been said by a speaker.
Listening and Speaking 1.3	Machines and People Six Kinds Do It All Made to Move	Respond to questions with appropriate elaboration.
Listening and Speaking 1.4	Machines in Agriculture	Identify the musical elements of literary language.
Listening and Speaking 1.5	Machines in Agriculture	Organize ideas chronologically or around major points of information.
Listening and Speaking 1.9	Machines in Agriculture	Read prose and poetry aloud with fluency, rhythm, and pace, using appropriate intonation and vocal patterns to emphasize important passages of the text being read.
Mathematics		
Measurement and Geometry 1.0	Made to Move	Students choose appropriate units and measurement tools to quantify the properties of objects.
Measurement and Geometry 2.5	Six Kinds Do It All	Identify, describe, and classify common three-dimensional geometric objects.

Grade 3 *(continued)*		
Standard	**Lesson(s) in which Standard is Taught or Reinforced**	**Standard Description**
Measurement 2.6	Six Kinds Do It All	Identify common solid objects that are the components needed to make a more complex solid object.
Science		
Physical Sciences 1c	Machines and People Six Kinds Do It All Made to Move Machines in Agriculture	Machines and living things convert stored energy to motion and heat.
Investigation and Experimentation 5	Made to Move	Scientific progress is made by asking meaningful questions and conducting careful investigations.
Investigation and Experimentation 5a	Made to Move	Repeat observations to improve accuracy and know that the results of similar scientific investigations seldom turn out exactly the same because of differences in the things being investigated, methods being used, or uncertainty in the observation.
Investigation and Experimentation 5d	Made to Move	Predict the outcome of a simple investigation and compare the result with the prediction.
Investigation and Experimentation 5e	Made to Move	Collect data in an investigation and analyze those data to develop a logical conclusion.

Content Standard Details

Grade 4		
Standard	**Lesson(s) in which Standard is Taught or Reinforced**	**Standard Description**
Reading/Language Arts		
Reading 2.1	Machines and People Six Kinds Do It All	Identify structural patterns found in informational text to strengthen comprehension.
Reading 2.2	Made to Move	Use appropriate strategies when reading for different purposes.
Reading 2.3	Made to Move	Make and confirm predictions about text by using prior knowledge and ideas presented in the text itself including illustrations, titles, topic sentences, important words, and foreshadowing clues.
Reading 2.7	Made to Move	Follow multiple-step instructions in a basic technical manual.
Writing 1.0	Machines and People Made to Move Machines in Agriculture	Write clear, coherent sentences and paragraphs that develop a central idea.
Writing 1.1	Made to Move	Select a focus, an organizational structure, and point of view based upon purpose, audience, length, and format requirements.
Writing 1.3	Machines and People Six Kinds Do It All Machines in Agriculture	Use traditional structures for conveying information.
Writing 1.10	Machines in Agriculture	Edit and revise selected drafts to improve coherence and progression by adding, deleting, consolidating, and rearranging text.
Written and Oral Language Conventions 1.0	Machines and People Six Kinds Do It All Made to Move Machines in Agriculture	Write and speak with a command of standard English conventions appropriate to this grade level.
Written and Oral Language Conventions 1.1	Made to Move Machines in Agriculture	Use simple and compound sentences in writing and speaking.
Listening and Speaking 1.0	Machines and People Six Kinds Do It All Made to Move Machines in Agriculture	Listen critically and respond appropriately to oral communication. Speak in a proper manner that guides the listener to understand important ideas by using proper phrasing, pitch, and modulation.
Listening and Speaking 1.1	Machines and People Six Kinds Do It All Made to Move	Ask thoughtful questions and respond to relevant questions with appropriate elaboration in oral settings.
Listening and Speaking 1.6	Machines and People Made to Move	Use traditional structures for conveying information.

Content Standard Details

Grade 4 *(continued)*		
Standard	**Lesson(s) in which Standard is Taught or Reinforced**	**Standard Description**
Listening and Speaking 1.8	Machines and People	Use details, examples, anecdotes, or experiences to explain or clarify information.
Listening and Speaking 2.4	Machines in Agriculture	Recite brief poems, soliloquies, or dramatic dialogues, using clear diction, tempo, volume, and phrasing.
Mathematics		
Measurement and Geometry 3.6	Six Kinds Do It All	Visualize, describe, and make models of geometric solids in terms of the number and shape of faces, edges, and vertices; interpret two-dimensional representations of three-dimensional objects; and draw patterns for a solid that, when cut and folded, will make a model of the solid.
Science		
Investigation and Experimentation 6	Made to Move	Scientific progress is made by asking meaningful questions.
Investigation and Experimentation 6b	Made to Move	Measure and estimate the weight, length, or volume of objects.
Investigation and Experimentation 6c	Made to Move	Formulate and justify predictions based on cause-and-effect relationships.
Investigation and Experimentation 6f	Made to Move	Follow a set of written instructions for a scientific investigation.

Content Standard Details

Grade 5		
Standard	**Lesson(s) in which Standard is Taught or Reinforced**	**Standard Description**
Reading/Language Arts		
Reading 2.1	Machines and People	Understand how text features make information accessible and usable.
Writing 1.0	Machines and People Made to Move Machines in Agriculture	Write clear, coherent, and focused essays exhibiting awareness of audience and purpose. Essays include formal introductions, supporting evidence and conclusions.
Writing 1.6	Machines in Agriculture	Edit and revise manuscripts to improve the meaning and focus of writing by adding, deleting, consolidating, clarifying, and rearranging words and sentences.
Written and Oral Language Conventions 1.0	Machines and People Six Kinds Do It All Made to Move Machines in Agriculture	Write and speak with a command of the standard English conventions appropriate to this grade level.
Written and Oral Language Conventions 1.4	Machines in Agriculture	Use correct capitalization.
Listening and Speaking 1.0	Machines and People Six Kinds Do It All	Deliver focused coherent presentations that convey ideas clearly and relate to the background and interests of the audience.
Listening and Speaking 1.1	Six Kinds Do It All Made to Move	Ask questions that seek information not already discussed.
Listening and Speaking 1.5	Machines and People	Clarify and support spoken ideas with evidence and examples.
Mathematics		
Measurement and Geometry 2.0	Six Kinds Do It All	Identify, describe, and classify the properties of, and the relationships between, plane and solid geometric figures.
Science		
Investigation and Experimentation 6	Made to Move	Scientific progress is made by asking meaningful questions and conducting careful investigations.
Investigation and Experimentation 6a	Machines and People Six Kinds Do It All Made to Move	Classify objects in accordance with appropriate criteria.

Grade 5 *(continued)*		
Standard	**Lesson(s) in which Standard is Taught or Reinforced**	**Standard Description**
Investigation and Experimentation 6h	Made to Move	Draw conclusions from scientific evidence and indicate whether further information is needed to support a specific conclusion.

* For a complete listing of the Content Standards for California Public Schools, contact CDE Press, Sales Office, California Department of Education, Post Office Box 271, Sacramento, CA 95812-0271; (916) 445-1260; www.cde.ca.gov.

California Foundation For Agriculture In The Classroom

Glossary

Agriculture: the science, art, and business of food, fiber, and floral production. Includes the processes required to get a product from farm to market.

Axle: the bar or rod on which a wheel or wheels turn.

Complex: made up of parts.

Energy: the ability to do work.

Equipment: the material, supplies, tools, and other things requied to do a job.

Force: a push or a pull.

Friction: a resistant force caused by rubbing.

Fulcrum: a pivot point on which a lever turns.

Gear: a toothed wheel.

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.

Lubricant: a substance such as oil or grease applied to an area to make objects move with less friction.

Machine: a device used to do work.

Movement: an action or activity.

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.

Simple: easy, not complicated. In machines, there are six.

Tractor: a complex piece of farm equipment; usually used with an implement attached to the back.

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.

Work: scientifically speaking, something that causes movement.