

# Everyday Simple Machines

## Teacher's Guide



**Editors:**

Brian A. Jerome Ph.D.  
Stephanie Zak Jerome

**Assistant Editors:**

Louise Marrier  
Hannah Fjeld

**Graphics:**

Fred Thodal  
Heidi Berry  
Lyndsey Canfield

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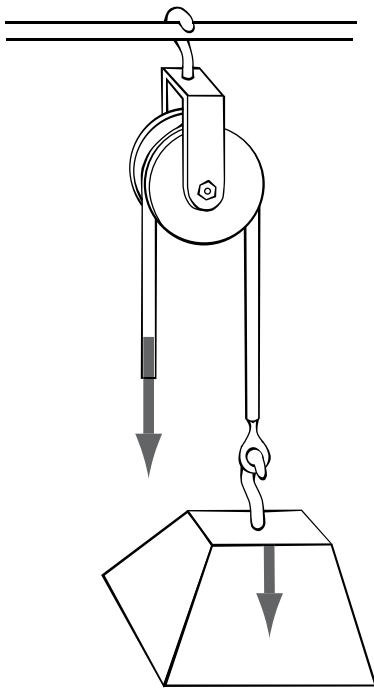
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# Table of Contents



A Message from our Company	2
Viewing Clearances	2
Use and Copyright	2
National Standards Correlations	4
Student Learning Objectives	5
Assessment	6
Introducing the Program	7
Program Viewing Suggestions	7
Video Script	8
Answer Key to Student Assessments	12
Answer Key to Student Activities	13
Pre-Test	14
Post-Test	16
Video Review	18
Vocabulary	19
Writing Activity	20
Identifying Simple Machines	21
Lifting Heavy Objects More Easily	22
Dissecting Compound Machines	24

# National Standards Correlations

## Benchmarks for Science Literacy

(Project 2061 – AAAS)

Grades 3–5

### The Nature of Technology – Technology and Science (3A)

By the end of the fifth grade, students should know that:

- Throughout all of history, people everywhere have invented and used tools. Most tools of today are different from those of the past but many are modifications of very ancient tools.

### The Physical Setting - Motion (4F)

By the end of fifth grade, students should know that:

- Something that is moving may move steadily or change its direction. The greater the force is, the greater the change in motion will be. The more massive an object is, the less effect a given force will have.

## National Science Education Standards

(Content Standards: K–4, National Academy of Sciences)

### Physical Science - Content Standard B

As a result of their activities in grades K-4, all students should develop an understanding of:

#### Position and Motion of Objects

- The position and motion of objects can be changed by pushing or pulling. The size of the change is related to the strength of the push or pull.

# Student Learning Objectives

**Upon viewing the video and completing the enclosed student activities, students will be able to do the following:**

- Understand and explain the concept of force as something that initiates or changes the motion of an object.
- Describe work as the use of force to move an object.
- Explain that simple machines are devices that make a job easier by changing the size or direction of a force.
- Generally explain the concept of mechanical advantage as the amount that a simple machine increases an effort.
- Recognize that simple machines do not decrease the total amount of work that is done.
- Create a simple sketch of the six main types of simple machines including: levers, inclined planes, wedges, screws, wheel and axles, and pulleys.
- Describe the general function or tool made from each of the different types of simple machines.
- Provide a real-world use of each type of simple machine.
- Understand that simple machines can be combined to make compound machines.

# Assessment

## Preliminary Test (p. 14–15):

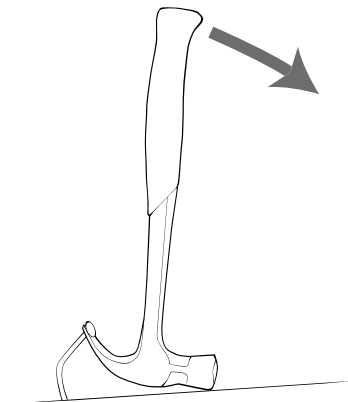
The Preliminary Test is an assessment tool designed to gain an understanding of students' preexisting knowledge. It can also be used as a benchmark upon which to assess student progress based on the objectives stated on the previous pages.

## Post-Test (p. 16–17):

The Post-Test can be utilized as an assessment tool following student completion of the program and student activities. The results of the Post-Test can be compared against the results of the Preliminary Test to assess student progress.

## Video Review (p. 18):

The Video Review can be used as an assessment tool or as a student activity. There are two sections. The first part contains questions displayed during the program. The second part consists of a five-question video quiz to be answered at the end of the video.



# Introducing the Program

Before showing students the video, ask if anyone has ever moved to a new house or apartment. Ask the class what kinds of tools are used when moving heavy things from one place to another. Answers should include a hand truck, a ramp, or a pulley. Ask students why movers need these tools.

Explain that a simple machine is a tool that changes the size or direction of a force to make work easier. Introduce the six types of simple machines including: levers, wedges, inclined planes, wheel and axles, screws, and pulleys. Write the names of all six on the blackboard. If possible show students pictures of the various types of simple machines. Tell students to pay close attention to the video to learn more about simple machines. After showing the class the video, discuss examples of simple and compound machines they use in their everyday lives.

## Program Viewing Suggestions

The student master “Video Review” is provided (p. 18) for distribution to students. You may choose to have your students complete this Master while viewing the program or do so upon its conclusion.

The program is approximately 14 minutes in length and includes a five-question video quiz. Answers are not provided to the Video Quiz in the video, but are included in this guide on page 12. You may choose to grade student quizzes as an assessment tool or to review the answers in class.

The video is content-rich with numerous vocabulary words. For this reason you may want to periodically stop the video to review and discuss new terminology and concepts.

# Video Script

1. Have you ever used a wrench to tighten a bolt?
2. Or have you used a bottle opener to pry the cap off a bottle?
3. Maybe you have skateboarded up a ramp.
4. Most likely you have used a hammer to hammer a nail into a board.
5. If you have done any of these things you have used one or more simple machines.
6. What are simple machines?
7. How do simple machines make our lives easier . . .
8. . . . and more enjoyable?
9. During the next few minutes we are going to take a look at different types of simple machines . . .
10. . . . and we are going to see how we use simple machines everyday.
- 11. Graphic Transition – What Is A Simple Machine?**
12. Every time you use a pencil or pen . . .
13. . . . cut a piece of paper . . .
14. . . . or turn the handle on a faucet, you are using a simple machine.
15. What exactly is a simple machine? A simple machine is a device that makes a job easier by changing the size or direction of a force.
16. For example, think about how hard it would be to pry the lid off this paint can with your bare hand.
- 17. You Decide!** Which tool would make this job easier?
18. That's right, a screwdriver makes this job a lot easier.
19. A screwdriver used in this situation is a type of simple machine called a lever.
20. In this case, the simple machine makes the job easier by increasing the amount of force, also called effort, applied at a specific point on the lid enabling it to pop off.
21. In short, a simple machine is a tool used to make work easier.
22. Many of the machines we use are made up of two or more simple machines.
23. We call these compound machines because they are made up of two or more simple machines.
24. An eggbeater and bicycle are examples of compound machines.
- 25. Graphic Transition – Work and Mechanical Advantage**
26. Push your hand on the desk in front of you as hard as you can and keep pressing for 20 seconds.
27. Are you doing work?
28. Even though it feels like work, you aren't doing any work. Work is done when a force causes an object to move.
- 29. You Compare!** What takes more work, throwing a baseball 10 meters or throwing a large rock 10 meters?
30. It takes more force to throw a large rock than a lighter baseball. Therefore, it requires more work to throw a heavier rock than a lighter baseball.
31. Simple machines do not decrease the total amount of work done, but they can decrease the amount of force or effort needed to do the work.
32. Notice how this person is struggling to push this wheelbarrow up this steep ramp called an inclined plane - that is another a type of simple machine.



# Video Script

33. Now see how much easier it is for this person to push the wheelbarrow up an inclined plane that is not as steep.
34. This is because the second inclined plane has a greater mechanical advantage than the steep inclined plane.
35. Mechanical advantage is the number of times the force exerted on a machine is multiplied by the machine.
36. One of the great benefits of simple machines is mechanical advantage.
37. Let's take a look at some examples of simple machines.
- 38. Graphic Transition – Levers**
39. There are six different kinds of simple machines: a lever, inclined plane, screw, wedge, wheel and axle, and pulley.
40. Let's first take a look at levers.
41. Every time you brush your teeth, . . .
42. . . . paddle a canoe, . . .
43. . . . or swing a baseball bat, you are using a lever.
44. A lever consists of two parts – a bar, stick, plank, or rod, and a fixed point called a fulcrum.
45. The fulcrum supports the straight bar and allows the bar to turn or pivot.
46. Levers enable us to move things and do work with less effort.
47. As with other simple machines, levers don't decrease the total amount of work that needs to be done, but they can decrease the amount of force or effort needed to do the task.
48. It seems like everywhere you look there are levers like these fishing poles, . . .
49. . . . shovels, . . .
50. . . . and even eating utensils.
- 51. Graphic Transition – Inclined Planes**
52. You probably have seen ramps designed for people in wheelchairs or those who have difficulty climbing stairs.
53. These are all examples of a type of simple machine called an inclined plane.
54. An inclined plane is a flat, slanted surface. Sometimes inclined planes are referred to as ramps.
55. An inclined plane makes moving heavy objects easier. . .
56. . . . instead of lifting heavy objects straight from the ground.
- 57. Graphic Transition- Wedges**
58. Imagine how difficult it would be to cut bread with a spoon.
59. A knife is a much better tool for the job.
60. A knife is a type of simple machine called a wedge.
61. Wedges can be thought of as two inclined planes positioned back to back.
62. This ax blade is a powerful wedge that is capable of splitting wood.
63. The mechanical advantage of a wedge increases as it gets longer and thinner.
64. This is why wedges cut better when they are sharpened, or made thinner.
65. Doorstops, chisels, and plows are all examples of wedges.
- 66. Graphic Transition- Screws**
67. This piece of furniture, . . .

# Video Script

68. . . . and these docks,  
69. . . . are held together with a type of simple machine.
- 70. You Decide!** What is this simple machine?  
71. These things are held together with screws.  
72. You can think of a screw as an inclined plane wrapped around a cylinder.  
73. As a force is applied to the screw, the threads of the screw turn and exert an outward force on the wood.  
74. The closer the threads on a screw, the greater the mechanical advantage.  
75. In the case of two pieces of wood – the screw holds them together.  
76. There are many other devices which take advantage of the principles of screws.  
77. Examples include drill bits, bolts, and the lids of jars to name just a few.
- 78. Graphic Transition – Wheel and Axle**  
79. Everytime you twist the handle on a faucet . . .  
80. . . . and turn a doorknob you are using a simple machine called a wheel and axle.  
81. A wheel and axle consists of two circular objects of different sizes.  
82. The wheel, such as the tire on this truck, is the bigger part, . . .  
83. . . . and the smaller part is called the axle.  
84. As the wheel grows bigger relative to the axle, mechanical advantage increases.
- 85. Graphic Transition – Pulleys**  
86. Pulleys are some of the most fascinating simple machines because they can do so many things.  
87. The sails on this sailboat are raised by pulleys.  
88. And this large crane uses a pulley system to hoist heavy objects.  
89. A pulley consists of a grooved wheel that holds a rope or cable. At one end of the rope is a load. A force is applied at the other end of the rope.  
90. There are two main kinds of pulleys – fixed pulleys and movable pulleys.  
91. A fixed pulley is attached to something that does not move, and it changes the direction of the force.  
**92. You Predict!** In what direction will the rock move when the rope is pulled downward?  
93. As a downward force is applied, the rock goes up. In the case of a single fixed pulley, no mechanical advantage is achieved, but the pulley does change the direction of the force.  
94. Unlike fixed pulleys, movable pulleys are attached to the load being moved.  
95. Movable pulleys are designed to increase the force or effort.  
96. In the case of both kinds of pulleys, two or more pulleys can be used together in a configuration called a block and tackle.  
97. By using several pulleys together in a block and tackle, the mechanical advantage can be increased many times.
- 98. Graphic Transition – Summing Up**  
99. During the past few minutes we have seen many of the useful ways simple machines make our lives easier.  
100. We saw that simple machines help make tasks easier by reducing the force needed to do work, or changing the direction of the force.

# Video Script

101. While simple machines do not decrease the total amount of work, they can decrease the force applied.
102. Mechanical advantage is the number of times the force exerted on a machine is multiplied.
103. We examined the six main types of simple machines.
104. Levers consists of a straight bar and a fulcrum.
105. Inclined planes, also called ramps, are made up of flat slanted surfaces.
106. Wedges consist of two inclined planes placed back to back.
107. Screws consist of a cylinder with a threaded or grooved circular surface.
108. A wheel and axle is made up of a large wheel connected to a smaller rod.
109. And a pulley is a simple tool consisting of a grooved wheel which can change the direction of a force, or produce mechanical advantage.
110. So the next time you turn a door handle, . . .
111. . . . unscrew the lid of a jar, . . .
112. . . . or swing a bat, . . .
113. . . . think about some of the things we have discussed during the past few minutes.
114. You just might think about simple machines a little differently.

## **115. Graphic Transition – Video Assessment**

Fill in the correct word to complete the sentence. Good luck and let's get started.

1. A \_\_\_\_\_ machine is a tool that makes work easier.
2. This simple machine is a \_\_\_\_\_.
3. The fixed point on a lever is called the \_\_\_\_\_.
4. Ramps are a kind of \_\_\_\_\_ plane.
5. Examples of \_\_\_\_\_ include drill bits, bolts, and lids of jars.

Answers can be found on page 12.

# Answer Key to Student Assessments

## Pre-Test (p. 14-15)

1. c - work
2. b - a force
3. d - compound machine
4. a - mechanical advantage
5. a - lever
6. b - wheel and axle
7. c - inclined plane
8. b - wedge
9. b - axe blade
10. a - screw
11. true
12. false
13. false
14. true
15. false
16. A simple machine is a device that makes a job easier by changing the size or direction of a force.
17. A compound machine is made up of a combination of two or more simple machines.
18. The six types of simple machines include: lever, inclined plane, screw, wedge, wheel and axle, and pulley.
19. A screw is a simple machine that consists of an inclined plane wrapped around a cylinder.
20. No, a simple machine does not let you do less work, it only decreases the amount of force needed to do the work.

## Post-Test (p. 16-17)

1. b - wedge
2. a - screw
3. b - wheel and axle
4. d - compound machine
5. b - axe blade
6. c - work
7. a - mechanical advantage
8. c - inclined plane
9. b - a force
10. a - lever
11. false
12. true
13. false
14. true
15. false
16. The six types of simple machines are: lever, inclined plane, screw, wedge, wheel and axle, and pulley.
17. No, a simple machine does not let you do less work, it only decreases the amount of force needed to do the work.
18. A screw is a simple machine that consists of an inclined plane wrapped around a cylinder.
19. A simple machine is a device that makes a job easier by changing the size or direction of a force.
20. A compound machine is made up of a combination of two or more simple machines.

## Video Review (p. 18)

1. A screwdriver would make prying the lid off a paint can much easier.
2. It takes more work to throw the rock, because it is larger and would require more force to move.
3. The simple machine holding two pieces of wood together is called a screw.
4. When a downward force is applied to the rope, the brick will move upward.
1. A **simple** machine is a tool that makes work easier.
2. This simple machine is a **pulley**.
3. The fixed point on a lever is called the **fulcrum**.
4. Ramps are a kind of **inclined** plane.
5. Examples of **screws** include drill bits, bolts, and lids of jars.

# Answer Key to Student Activities

## Vocabulary (p. 19)

1. mechanical advantage
2. lever
3. simple machines
4. screw
5. wedge
6. work
7. pulley
8. compound machine
9. wheel and axle
10. inclined plane

## Writing Activity (p. 20)

**Simple machines** are devices that make jobs easier by changing the size or direction of a force. **Work** is done when a force causes an object to move. Simple machines are tools used to make work **easier**. The number of times a force exerted on a machine is multiplied by the machine is called **mechanical advantage**. A **wedge** is a type of simple machine that is like two inclined planes put together back to back. A lever consists of a bar, stick, rod, or plank, and a fixed point called a **fulcrum**. Two types of pulleys are **fixed** pulleys and movable pulleys.

## In Your Own Words (p. 20)

1. A simple machine is a tool that is used to make work easier. Simple machines work by changing the size or direction of a force. Examples of simple machines include a lever, a wedge, and a wheel and axle.
2. A lever is a simple machine that is made up of a bar and a fulcrum.
3. To say that one machine has greater mechanical advantage than another means that the machine multiplies the force exerted more than another machine.

## Identifying Simple Machines (p.21)

- |       |                |
|-------|----------------|
| lever | inclined plane |
| wedge | pulley         |
| screw | wheel and axle |

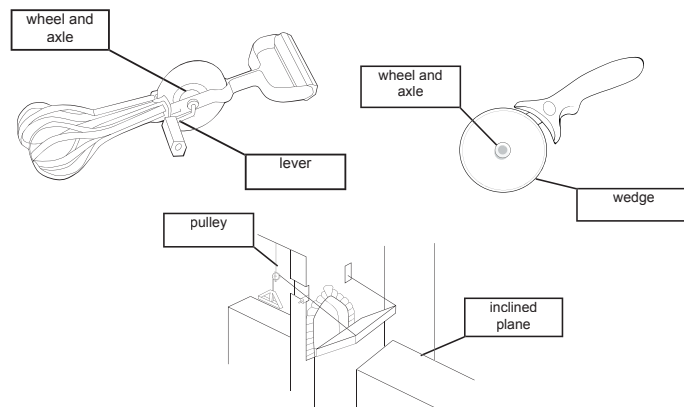
Object	Type of Simple Machine
The wheel on a bicycle	wheel and axle
A shovel	lever
An axe used for splitting logs	wedge
The rope system used to pull a flag up a flag pole	pulley
A jar lid	screw
A screw driver	lever
A saw used for cutting boards	wedge
The end of a garden hose where it connects to the faucet	screw
A hammer	lever
A ramp	inclined plane
A door knob	wheel and axle
The string system used to raise window blinds	pulley
A see-saw or teeter-totter	lever

## Lifting Heavy Objects More Easily (p.22-23)

1. The shorter board made the steepest inclined plane. It was hardest to pull the object up without using any inclined plane.
2. The shorter, steeper inclined plane required more effort. The large inclined plane had more mechanical advantage.
3. The advantage of inclined planes is that it takes less effort to move an object up them than lifting the object.
4. To make using inclined planes even easier, you could place the object on a wheel and axle and roll it up the inclined plane, eliminating a lot of friction.

## Dissecting Compound Machines (p.24-25)

1. Mechanical advantage is the amount a machine increases the force put into it.
2. A compound machine is a combination of two or more simple machines.
3. examples: a bicycle, a pencil sharpener



# Pre-Test

Name \_\_\_\_\_

Circle the best answer for each of the following questions.

1. Simple machines can make a job easier but they do not change the total amount of:  
**a. effort**                      **b. force**                      **c. work**                      **d. screws**
2. What can simple machines change the size or direction of?  
**a. work**                      **b. a force**                      **c. an object**                      **d. a ramp**
3. When two or more simple machines are put together, what is it called?  
**a. engine**                      **b. natural system**                      **c. wheel and axle**                      **d. compound machine**
4. The amount a simple machine increases the effort force is referred to as:  
**a. mechanical advantage**                      **b. effort**                      **c. push**                      **d. a job**
5. What type of simple machine consists of a bar and a fulcrum?  
**a. lever**                      **b. inclined plane**                      **c. screw**                      **d. wedge**
6. This type of simple machine is used in cars, trucks, and bicycles to help them roll:  
**a. screw**                      **b. wheel and axle**                      **c. pulley**                      **d. lever**
7. What type of simple machine consisting of a slanted flat slope helps make moving a heavy object up easier, but requires that the object is moved a longer distance?  
**a. wedge**                      **b. pulley**                      **c. inclined plane**                      **d. screw**
8. What type of simple machine consists of two inclined planes placed back to back?  
**a. axle**                      **b. wedge**                      **c. screw**                      **d. pulley**
9. Which item is an example of a wedge?  
**a. sledgehammer**                      **b. axe blade**                      **c. scale**                      **d. spoon**
10. What type of simple machine could be used to hold two pieces of wood together?  
**a. screw**                      **b. pulley**                      **c. wheel and axle**                      **d. inclined plane**

# Pre-Test

Name \_\_\_\_\_

**Write true or false next to each statement.**

- 11. \_\_\_\_\_ A bicycle is an example of a compound machine.
- 12. \_\_\_\_\_ Simple machines do not make the effort used to do a job easier.
- 13. \_\_\_\_\_ Inclined planes decrease the total amount of work done.
- 14. \_\_\_\_\_ Two or more simple machines can be put together to make a compound machine.
- 15. \_\_\_\_\_ There are three kinds of simple machines.

**Write a short answer for each of the following.**

16. What is a simple machine?

\_\_\_\_\_  
\_\_\_\_\_

17. What is a compound machine?

\_\_\_\_\_  
\_\_\_\_\_

18. List all six types of simple machines.

\_\_\_\_\_  
\_\_\_\_\_

19. What is a screw?

\_\_\_\_\_  
\_\_\_\_\_

20. Does a simple machine let you do less work? Explain your answer.

\_\_\_\_\_  
\_\_\_\_\_

# Post-Test

Name \_\_\_\_\_

Circle the best answer for each of the following questions.

1. What type of simple machine consists of two inclined planes placed back to back?  
**a. axle**                      **b. wedge**                      **c. screw**                      **d. pulley**
2. What type of simple machine could be used to hold two pieces of wood together?  
**a. screw**                      **b. pulley**                      **c. wheel and axle**      **d. inclined plane**
3. This type of simple machine is used in cars, trucks, and bicycles to make them roll:  
**a. screw**                      **b. wheel and axle**      **c. pulley**                      **d. lever**
4. When two or more simple machines are put together, what is it called?  
**a. engine**                      **b. natural system**      **c. wheel and axle**      **d. compound machine**
5. Which item is an example of a wedge?  
**a. sledgehammer**                      **b. axe blade**                      **c. scale**                      **d. spoon**
6. Simple machines make a job easier but they do not change the total amount of:  
**a. effort**                      **b. force**                      **c. work**                      **d. screws**
7. The amount a simple machine increases the effort force is referred to as:  
**a. mechanical advantage**                      **b. effort**                      **c. push**                      **d. a job**
8. What type of simple machine consisting of a slanted flat slope helps make moving a heavy object up easier, but requires people to move the object a longer distance?  
**a. wedge**                      **b. pulley**                      **c. inclined plane**      **d. screw**
9. What can simple machines change the size or direction of?  
**a. work**                      **b. a force**                      **c. an object**                      **d. a ramp**
10. What type of simple machine consists of a bar and a fulcrum?  
**a. lever**                      **b. inclined plane**      **c. screw**                      **d. wedge**



# Post-Test

Name \_\_\_\_\_

## Write true or false next to each statement.

- 11. \_\_\_\_\_ Simple machines do not make the effort used to do a job easier.
- 12. \_\_\_\_\_ Two or more simple machines can be put together to make a compound machine.
- 13. \_\_\_\_\_ There are three kinds of simple machines.
- 14. \_\_\_\_\_ A bicycle is an example of a compound machine.
- 15. \_\_\_\_\_ Inclined planes decrease the total amount of work done.

## Write a short answer for each of the following.

16. List all six types of simple machines.

\_\_\_\_\_  
\_\_\_\_\_

17. Does a simple machine let you do less work? Explain your answer.

\_\_\_\_\_  
\_\_\_\_\_

18. What is a screw?

\_\_\_\_\_  
\_\_\_\_\_

19. What is a simple machine?

\_\_\_\_\_  
\_\_\_\_\_

20. What is a compound machine?

\_\_\_\_\_  
\_\_\_\_\_

# Video Review

Name \_\_\_\_\_

**While you watch the video, answer these questions:**

**You Decide!**

1. Which tool would make this job easier?

---

---

**You Compare!**

2. What takes more work, throwing a baseball 10 meters or throwing a large rock 10 meters?

---

---

**You Decide!**

3. What is the simple machine?

---

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**You Predict!**

4. In what direction will the rock move when the rope is pulled downward?

---

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**After you watch the video, test your knowledge with these questions.**

1. A \_\_\_\_\_ machine is a tool that makes work easier.
2. This simple machine is a \_\_\_\_\_.
3. The fixed point on a lever is called the \_\_\_\_\_.
4. Ramps are a kind of \_\_\_\_\_ plane.
5. Examples of \_\_\_\_\_ include drill bits, bolts, and lids of jars.

# Vocabulary

Name \_\_\_\_\_

Use these words to fill in the blanks next to the sentences below.

Words

compound machine    inclined plane    lever    mechanical advantage    pulley  
screw    simple machines    wedge    wheel and axle    work

1. \_\_\_\_\_ The number of times the force exerted on a machine is multiplied by the machine.
2. \_\_\_\_\_ A type of simple machine made up of a bar, stick, plank, or rod, and a fixed point called a fulcrum.
3. \_\_\_\_\_ These make jobs easier by changing the size or direction of forces needed.
4. \_\_\_\_\_ A type of simple machine that consists of an inclined plane wrapped around a cylinder.
5. \_\_\_\_\_ A type of simple machine that looks like two inclined planes placed back to back.
6. \_\_\_\_\_ This is done when a force is used to push or pull an object causing it to move.
7. \_\_\_\_\_ A type of simple machine that is made up of a grooved wheel that holds a cable or rope.
8. \_\_\_\_\_ Two or more simple machines can be put together to create one of these.
9. \_\_\_\_\_ A type of simple machine in which turning a smaller circular object causes a larger circular object to turn.
10. \_\_\_\_\_ A type of simple machine that consists of a flat, slanted surface.

# Writing Activity

Name \_\_\_\_\_

fixed easier fulcrum mechanical advantage work simple machines wedge

Use the correct word(s) from above to complete the sentences in the following paragraph.

\_\_\_\_\_ are devices that make jobs easier by changing the size or direction of a force. \_\_\_\_\_ is done when a force causes an object to move. Simple machines are tools used to make work \_\_\_\_\_. The number of times a force exerted on a machine is multiplied by the machine is called \_\_\_\_\_. A \_\_\_\_\_ is a type of simple machine that consists of two inclined planes put together back to back. A lever consists of a bar, stick, rod, or plank, and a fixed point called a \_\_\_\_\_. Two types of pulleys are \_\_\_\_\_ pulleys and moveable pulleys.

## In Your Own Words

1. Describe the purpose of simple machines, and give an example of one.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. What is a lever?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. What does it mean to say that one simple machine has greater mechanical advantage than another?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# Identifying Simple Machines

Name \_\_\_\_\_

**Background:** People use simple machines all the time. A lot of the time, people use simple machines and don't even know it! You probably used several simple machines when you got ready for school this morning. When you woke up and brushed your teeth, the toothbrush worked as a lever. If you used a knife to slice bread for toast, you used a wedge. And if you rode in a car or bus, a wheel and axle were used to help the vehicle move. You might have even walked up an inclined plane to enter your school building!

**Directions:** First, write the names of the six types of simple machines.

\_\_\_\_\_

\_\_\_\_\_

The table below has a list of objects that are examples of devices which incorporate simple machines. Identify the type of simple machine each object contains. Then write your answers in the table.

Object	Type of Simple Machine
The wheel on a bicycle	
A shovel	
An axe used for splitting logs	
The rope system used to pull a flag up a flag pole	
A jar lid	
A screw driver	
A saw used for cutting boards	
The end of a garden hose where it connects to the faucet	
A hammer	
A ramp	
A door knob	
The string system used to raise window blinds	
A see-saw or teeter-totter	

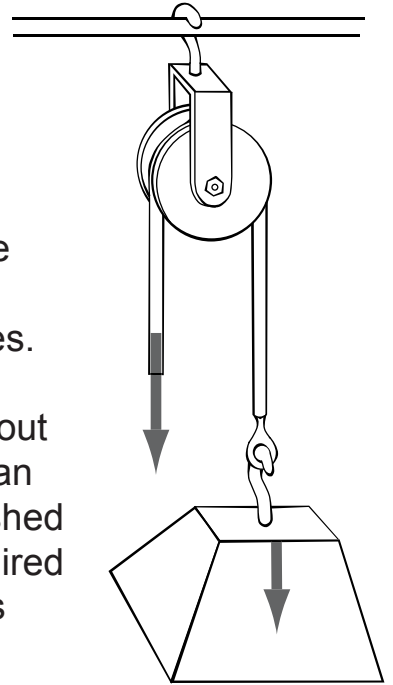
# Lifting Heavy Objects More Easily

Name \_\_\_\_\_

**Background:** Have you ever thought about how hard it can be to move heavy objects up to a higher location? Construction workers use cranes that have pulleys to lift heavy steel beams and concrete blocks. Maybe you have seen a crane lift construction materials at a building site. Pulleys are an important component of construction cranes.

Pulleys are not the only way to get heavy objects to higher locations. In fact, you can move heavy things without having to lift them at all. Another simple machine, called an inclined plane, consists of a slope that objects can be pushed up. Inclined planes change the direction of the force required to move the object, and require less force overall. Ramps are an example of an inclined plane.

In this activity, you will observe the force required to move an object up by lifting the object and by using inclined planes.



**Materials:** spring scale, long board (about 1.5 m), shorter board (about .75 m), heavy object such as a textbook, string

## Directions:

1. Set up an inclined plane with the longer piece of wood first. Lean the end of the long piece of wood on a chair. Set up the shorter piece of wood next to it in the same way.
2. Attach the object to a spring scale. Tie the spring scale to a piece of string so that it can be pulled using the string. The reading on the spring scale will tell you how much force it takes to pull the object up.
3. Measure the distance from the floor to the edge of the chair and record the answer. Put the object on the floor beside the chair. Slowly and smoothly pull the object up using the scale. When it is halfway up, read the force recorded on the spring scale. Record your observations in the table on the next page.

# Lifting Heavy Objects More Easily

Name \_\_\_\_\_

4. Measure the longer board and record the answer. Put the object at the bottom of the longer piece of wood. Pull the object up along the ramp. When it is halfway up, read the force recorded on the spring scale. Again, record your observations.
5. Finally, measure the shorter piece of wood and record the answer. Put the object at the bottom of the shorter piece of wood. Pull the object up the shorter board. When it is halfway up, read the force recorded on the spring scale. Record your observations.

	Force measured on spring scale
No inclined plane	
Long inclined plane	
Short inclined plane	

## Questions:

1. Which inclined plane was the steepest? Which way was hardest to pull the object up?
2. How did the effort needed to pull up the book compare on the two different inclined planes? Which inclined plane had more mechanical advantage?
3. What is the advantage to using inclined planes to lift heavy objects?
4. What other simple machine could you use to make using an inclined plane even easier?

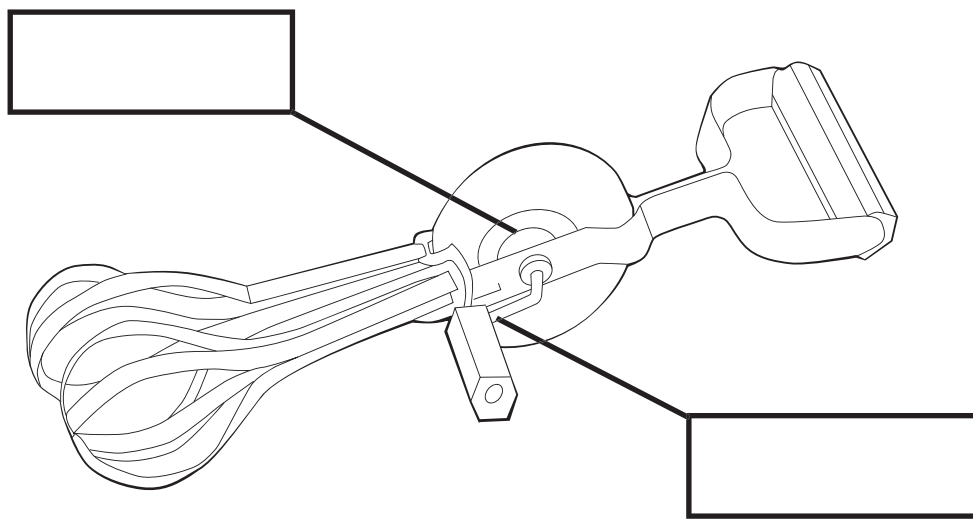
# Dissecting Compound Machines

Name \_\_\_\_\_

**Background:** Simple machines are devices that make work easier by changing the size or direction of a force. They can help make the effort of a task easier. Mechanical advantage is the number of times the force exerted on a machine is multiplied by the machine. In other words, mechanical advantage is how much the machine increases the force put into it.

Often, simple machines are put together to make compound machines. Compound machines are made up of two or more simple machines. Lots of tools people use everyday are compound machines. Compound machines can be broken down into their simple machine components. Scissors are an example of a compound machine. The blades are wedges, and the handles work as levers to move the blades.

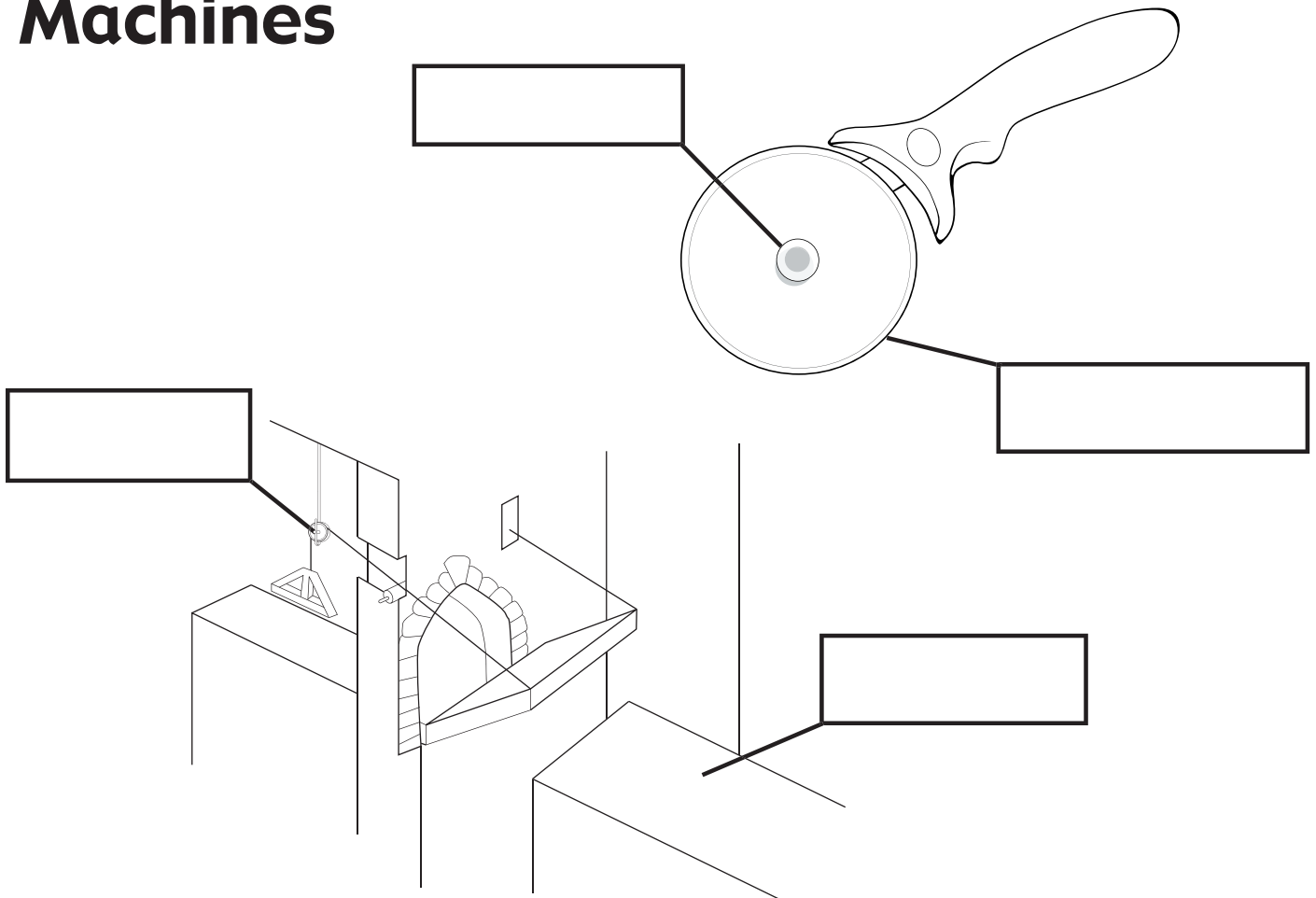
**Directions:** Look at the diagrams of compound machines below and on the next page. Identify each of the simple machines that make up these compound machines. Write the names of each simple machine in the boxes. Then answer the questions.





# Dissecting Compound Machines

Name \_\_\_\_\_



## Questions:

1. What is mechanical advantage?

2. What is a compound machine?

3. Name one or two other compound machines that you use everyday.