

**Work, Energy, and the Simple Machines: Compound Machines  
PRE-TEST**

**DIRECTIONS:** Write the answers to the following questions in the places provided.

1. To qualify as a machine, a tool or device must do one or more of the following things:
  - a.
  - b.
  - c.
2. What is a compound machine?
3. What is the Law of Conservation of Energy?
4. What force stops machines from being 100% efficient?
5. Scissors are an example of a compound machine. What simple machines are represented by a pair of scissors?
6. Name the six simple machines.
7. What simple machines are found in a wheelbarrow?
8. A shovel is a compound machine made up of what simple machines?
9. Why do motors and engines use oil and grease?
10. If a person is riding a bicycle they will change the chemical energy of the food they have eaten into \_\_\_\_\_ energy to pedal the bicycle.

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VIDEO QUIZ**

**DIRECTIONS:** At the end of the video presentation there will be a short video quiz. You can write your answers to the questions on this sheet.

True or False (Circle either True or False)

- 1. A compound machine is made up of two or more simple machines. True or False
- 2. Automobiles are about 90 percent efficient. True or False
- 3. A machine’s work output can’t be greater than it’s work input. True or False
- 4. Friction is a force that can make work easier. True or False

Multiple Choice

- 5. No machine is 100 percent efficient because some energy must be used to overcome  
a. speed    b. distance    c. friction    d. weight
- 6. The pivot point for a lever is called the \_\_\_\_\_  
a. resistance    b. fulcrum    c. effort    d. energy

Short Answer

- 7. Name the six simple machines. \_\_\_\_\_  
\_\_\_\_\_
- 8. To be considered a machine, a tool or device must do one or more of the following things:  
a. \_\_\_\_\_  
b. \_\_\_\_\_  
c. \_\_\_\_\_
- 9. Name some common compound machines from around the house or school.
- 10. What simple machines are found in a pencil sharpener?

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**FIND OUT MORE**

# Find Out More About

Archimedes led a very interesting life. Take a trip to the library or the Internet and find out more about his personal and professional life. Remember he lived over 2000 years ago and yet contributed an unbelievable amount of mathematical and scientific knowledge to the world.

Here are a few of his accomplishments to get you interested in finding out more.

He developed a device for lifting water from one level to another that is still in use today. It is used in some countries to irrigate farm land.

He began the science of hydrostatics, which deals with the pressure of liquids.

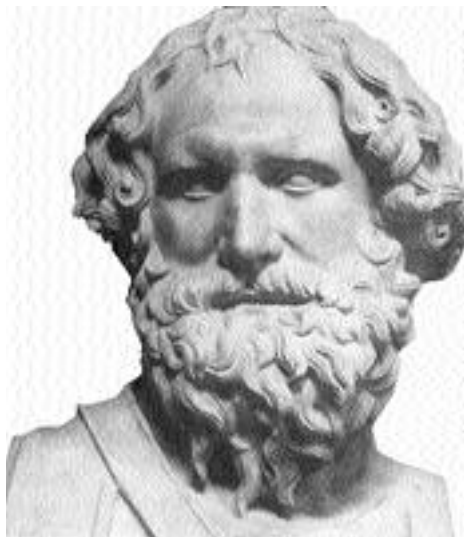
He discovered the principle of buoyancy.

He predicted eclipses of the sun and moon.

He discovered the principle of specific gravity.

He estimated the distances to the five planets they knew of during his life.

He invented war machines that defended the city of Syracuse from a massive Roman Army for three years.



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EXPERT CHALLENGE**

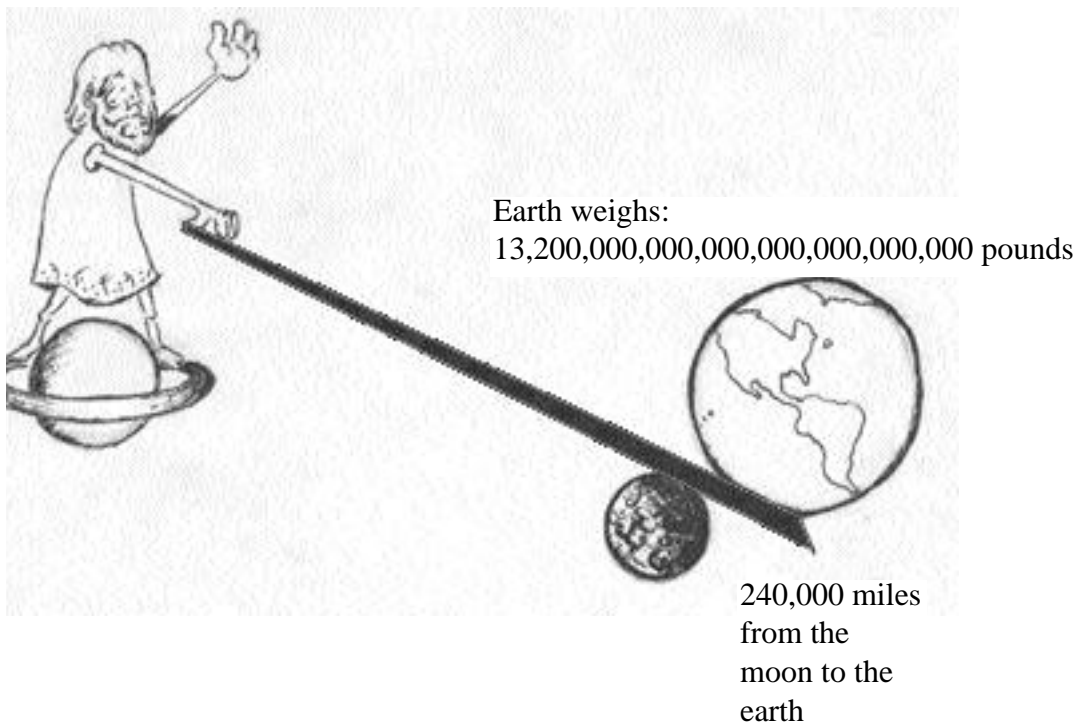
## Could Archimedes Have Moved the Earth?

Archimedes had once boasted to the king of Syracuse that if he had a place upon which to stand, and a lever long enough he could move the earth. The task set before you is not an easy one. In fact it may challenge your mathematical ability to its limit. This is not an activity for the weak of heart. Solve the following question using the information provided on this worksheet.

**QUESTION:** How long would the effort arm of the lever have to be if the moon at its mean distance from the earth is used as the fulcrum and Archimedes only wants to use a force of 100 pounds to move the earth?

(Hint: length of effort arm x effort = length of resistance arm x resistance)

$$L_e \times E = L_r \times R$$



## Work, Energy, and the Simple Machines: Compound Machines HOME HUNT

**Directions:** Find examples of simple machines in and around your home. Include a picture and a description of each. The description should tell what simple machine or machines are used in each device.

*Example:* Blender

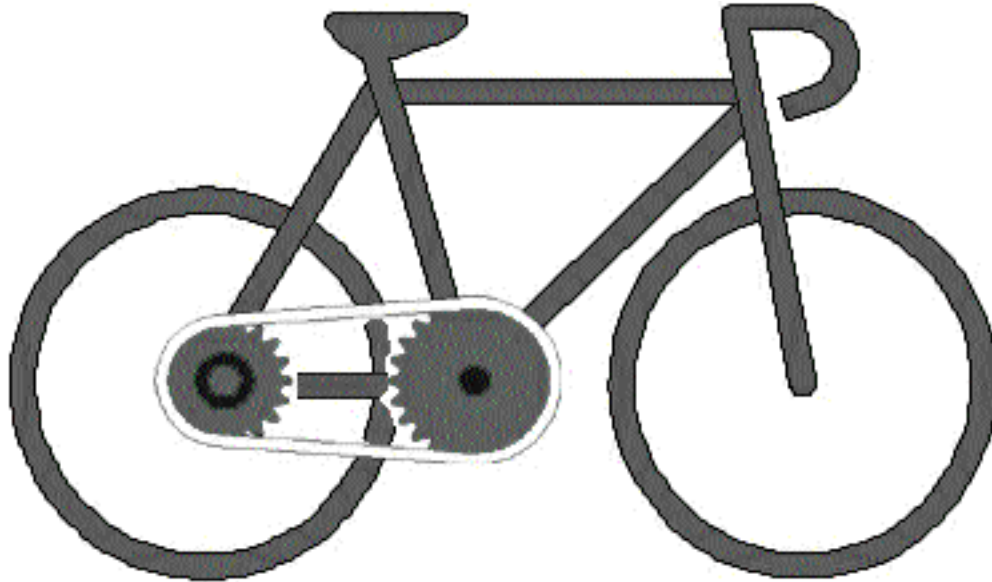
Wedges on the spinning blades to chop up food

Wheel and axles (gears) inside connected to electric motor to adjust speed of spinning blades.



### Work, Energy, and the Simple Machines: Compound Machines THE BICYCLE

A bicycle is a perfect example of a compound machine. There are many simple machines working together to make the bicycle a splendid means of transportation. Your job today is to take a spin on your bicycle and try to identify some of the simple machines that play a part in the bicycle's performance. Here is a picture of a bicycle that you can use as a reference. Write down the simple machines you find and then draw a line to its location on the bicycle.



Here is a picture of the way early bikes were constructed. Notice the large wheel in front and the small wheel in back. Why do you think these bikes were built like that? Today's bicycles still use a major idea associated with the early bikes. Look closely at the relationship of the large pedal wheel and the small wheel in the rear. How is that idea still used today?

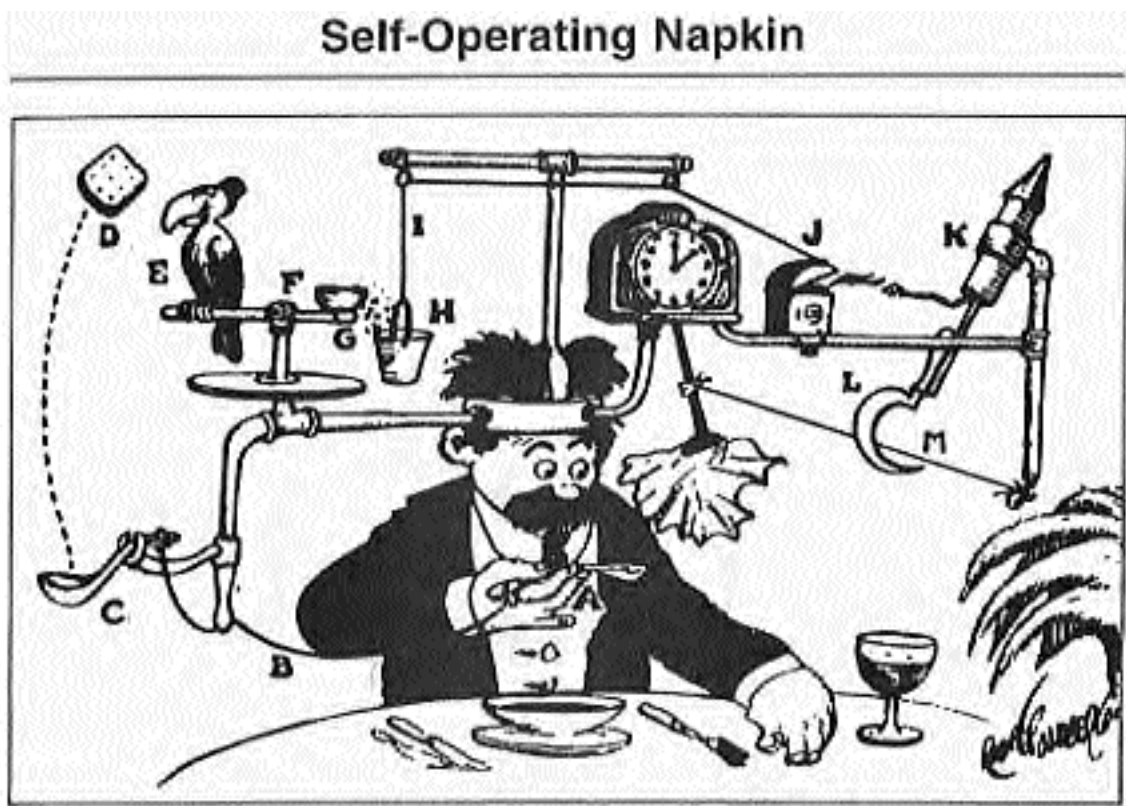


## Work, Energy, and the Simple Machines: Compound Machines

### RUBE GOLDBERG DESIGNS

Rube Goldberg was a Pulitzer Prize winning cartoonist, author, engineer, and sculpture. He lived from 1883 to 1970. His cartoons were published in newspapers from the early 1900's to the 1960's. He poked fun at the complicated inventions that appeared at the start of the 20th Century. He thought up complicated ways to accomplish simple everyday tasks or jobs. He often used simple machines or principles associated with simple machines to accomplish these tasks.

**DIRECTIONS:** Here is a copy of the Rube Goldberg cartoon discussed in the video. See if you can finish the directions listed below the illustration.



Rube Goldberg TM & © of Rube Goldberg, Inc.

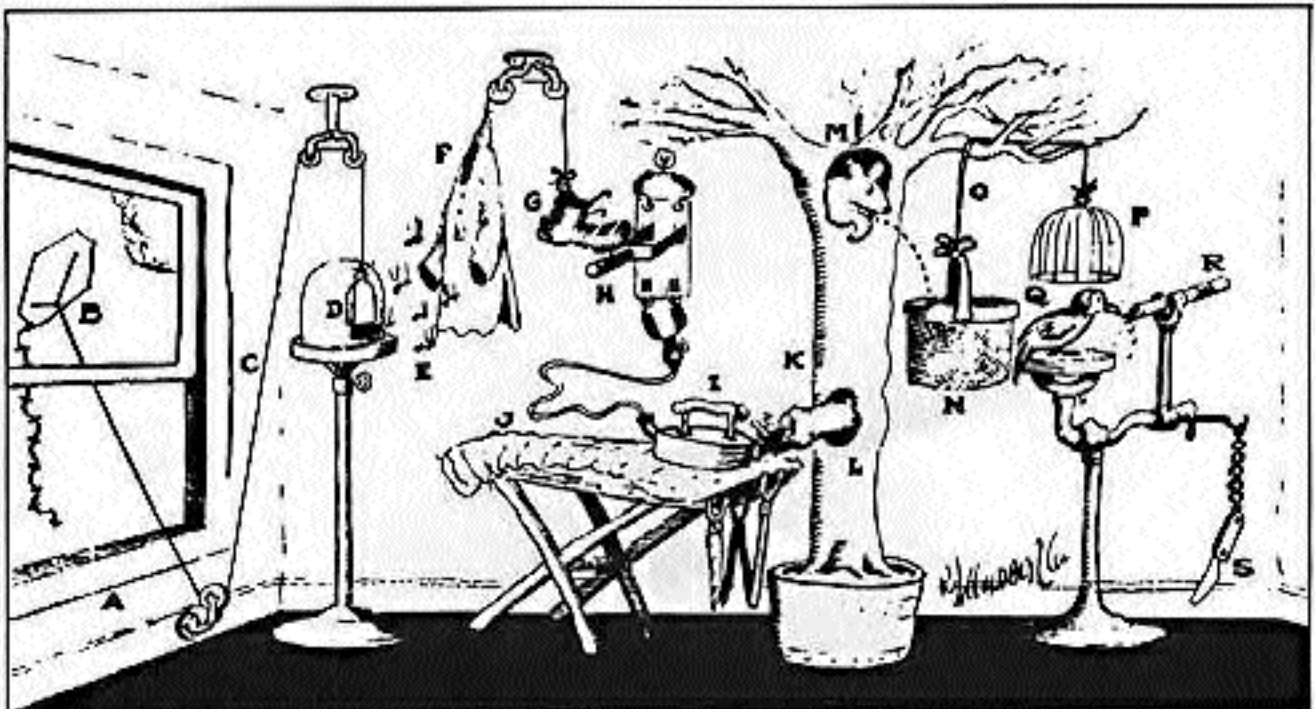
As you raise the spoon of soup(A) to your mouth it pulls string (B), thereby jerking ladle (C) which

### Work, Energy, and the Simple Machines: Compound Machines RUBE GOLDBERG DESIGNS 2

Here is a Rube Goldberg cartoon entitled “Pencil Sharpener.”

DIRECTIONS: Finish the description below the cartoon to explain what happens. Here are some words to use in that description:

*moths*      *electric switch*      *opossum*      *woodpecker*



Rube Goldberg TM & © of Rube Goldberg, Inc.

Rube Goldberg gets his think-tank working and evolves the simplified pencil sharpener. Open window (A) and fly kite (B). String (C) lifts small door (D)

Try creating one of your own Rube Goldberg machines. Here are some topics:

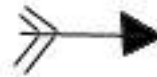
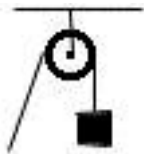
- \* Shut off alarm clock
- \* Wake up and make bed
- \* Automatic dishwasher
- \* Peel an apple
- \* Automatic garage door opener
- \* Your original idea



**Work, Energy, and the Simple Machines: Compound Machines**  
**POST-TEST**

DIRECTIONS: Answer the following questions in the space provided.

1. Give a definition for the term machine.
2. What is a compound machine?
3. What is meant by the efficiency of a machine?
4. Here are illustrations of each of the six simple machines. Write their name under each illustration.



5. What simple machines can be found with the following common objects?
  - a. pencil sharpener
  - b. shovel
  - c. wheelbarrow
  - d. scissors
  - e. bicycle