Raising a thought-provoking question is a good way to assess the overall depth of understanding. A couple of suggestions are listed below:

1. List some machines you use at home and school and discuss what types of simple machines they are made of.
2. Discuss the advantages/disadvantages involved in traveling a long, gently sloped path up a mountain instead of a steep climb. Ask students to compare this to the use of simple machines.

## Follow-up Activities

- Investigate levers using rulers as lever arms, pencils as fulcrums and pennies as weight. Ask students to demonstrate how changing the placement of the fulcrum in relation to the weight to be lifted changes the amount of force needed to do work.
- Ask students to find pictures of machines in magazines and cut them out. Have them sort the pictures into compound and simple machines.
- Have children work in groups of three to design and build a machine for a specific purpose that consists of a number of simple machines.
- Have the class make a list of all the levers and inclined planes that they encounter in the course of a week. After going over the list, have students write a story describing a day without the help of simple machines.

## Internet Resources

Periodically, Internet Resources are updated on our web site at www.LibraryVideo.com

- **www.fi.edu/qa97/spotlight3/**
  These pages from the excellent Franklin Institute web site, "Spotlight on Simple Machines" show how simple machines make work easier and list many classroom demonstrations.
- **www.galaxy.net/~k12/machines/**
  This Marvelous Machines web site lists a series of simple machine experiments designed for use in the third grade.
- **www.science-tech.nmstc.ca/english/schoolzone/machines4.cfm**
  The Canadian National Museum of Technology presents a number of excellent "Science Seesaw and Simple Machines" activities for students in elementary school.



TEACHER'S GUIDE

## Suggested Print Resources


- Burton, Virginia Lee. *Mike Mulligan and More: A Virginia Lee Burton Treasury.* Houghton Mifflin, Boston, MA; 2002.
- Hodge, Deborah. *Simple Machines.* Kids Can Press, Ltd., Tonawanda, NY; 2000.
- Levine, Shar and Leslie Johnstone. *First Science Experiments: Mighty Machines.* Sterling Publishing Company, New York, NY; 2006.



**TEACHER'S GUIDE CONSULTANT**

**Conrad M. Follmer**

25 years as a K–5 Science & Math Coordinator for a Pennsylvania public school system, currently an independent consultant to elementary schools.


**TITLES**

- ALL ABOUT ELECTRICITY
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- ALL ABOUT PROPERTIES OF MATTER
- ALL ABOUT SIMPLE MACHINES
- ALL ABOUT SOLIDS, LIQUIDS & GASES
- ALL ABOUT SOUND
- ALL ABOUT WAVES




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TEACHER'S GUIDE

Physical Science for Children™

# All About Simple Machines

**Grades K–4**

This guide is a supplement, designed for educators to use when presenting this program in an instructional setting.

**Before Viewing:** Research in learning suggests that it is important for the teacher to discover what the students know — or think they know — about a topic, at the start of a new unit, so that their accurate conceptions can be validated and reinforced, and their misconceptions identified and corrected. Therefore, after reviewing the pre-viewing discussion questions provided for your class, create an "Everything We Know About…" list. Preview key vocabulary words and have students raise additional questions they hope will be answered by this program. Most importantly, students should be told that as "science detectives" they must listen closely, so that after viewing the program, they will be able to tell whether or not the facts/beliefs they put on their list were scientifically accurate.

**After Viewing:** After a brief discussion about the program, challenge your "science detectives" to prove or disprove the accuracy of the facts they put on their "Everything We Know About…" list. Discuss what else they learned and use the follow-up questions and activities to inspire further discussion. Encourage students to research the topic further with the Internet and reading resources provided.

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## Program Summary

Every day, people use all sorts of machines to get work done and to make life a little easier. We have bulldozers and trucks to help us move heavy loads from one place to another. But what did ancient people do before these things were invented? They used simple machines! Simple machines have very few moving parts, or no moving parts at all. They enable us to use less effort to push or pull an object or make moving the object easier by changing the direction in which the force must be applied. They can be found almost anywhere work is being done. There are six simple machines that make it easier for us to push or pull something.

One type of simple machine is a lever — a rigid bar that balances on a fixed point called a fulcrum. A seesaw is a good example of a lever. The fulcrum is the balance bar. If a child sits on a seesaw close to the fulcrum in the middle, it takes very little force to lift the child by pressing down on the other end of the seesaw.

A wheel and axle is another type of lever that consists of a round wheel connected to a post called an axle. When the wheel is turned, the axle goes along for the ride, along with anything else attached to the wheel and axle. The wheel is one of the greatest inventions of all time, making work much easier for humans over the centuries. It is hard to look around and not see examples of this simple machine in our lives.

A pulley is another simple machine used for lifting heavy loads. A pulley is a special wheel with a rope wrapped around it. When the rope is pulled on one end, the object attached to the other end of the rope can be lifted. When several pulleys are used together, people are able to move things that they could never have lifted with just their hands. On sailboats, heavy sails are lifted with pulleys.

Another common simple machine that makes work easier is an inclined plane — a flat surface that is slanted on an angle. One example of an inclined plane is a ramp. It is much easier to push a lawnmower up a sloped ramp than it is to lift it straight up into a truck by hand. You can also put two small ramps together to form a point at one end to create a simple machine called a wedge. A knife and the front of a boat are both examples of wedges. A screw is another simple machine; it is a long inclined plane wrapped around a core. Just as it is easier to climb a mountain going around a gentle, long winding path than by climbing a steep slope straight up to the top, it takes less force to turn a screw into wood because the distance is greater.

We are surrounded by simple machines that make our lives easier. When simple machines are combined, they create useful compound machines. A great example of a compound machine is a bicycle, which uses a number of wheel and axles, levers and pulleys connected together.



## Vocabulary

The following words are included for teacher reference or for use with students. They are listed in the order in which they appear in the show.

**force** — A push or a pull on an object that causes a change in motion.

**work** — Pushing or pulling something over a distance.

**simple machines** — Devices with few moving parts that can be used to reduce the effort needed to do work; the six basic simple machines are the lever, the wheel and axle, the pulley, the inclined plane, the wedge and the screw.

**lever** — A simple machine that consists of a rigid bar turning on a fixed point called a fulcrum. Downward motion at one end of the lever results in upward motion at the other end.

**fulcrum** — The fixed balancing point of a lever. An example of a fulcrum is the middle bar of a seesaw.

**wheel and axle** — A simple machine that applies force to a fixed bar called an axle that is attached to a wheel. This type of simple machine makes pulling or pushing heavy loads much easier.

**pulley** — A simple machine that is made of a rope wrapped around a wheel that can turn; it is used for lifting heavy things.

**inclined plane** — A simple machine that uses a ramp to make it easier to move things by increasing the distance that they move.

**wedge** — A simple machine that tapers to a thin edge and can be used for cutting things.

**screw** — A simple machine consisting of a central core with a groove wrapped around it. Screws are useful for holding things together.

**compound machines** — Machines that combine two or more simple machines to get work done.

## Pre-viewing Discussion

Before students generate their list of "Everything We Know About…" this topic, stimulate and focus their thinking by raising these questions so that their list will better reflect the key ideas in this show:

1. What is a "machine"?

2. Why do we use machines to get work done?

After the class has completed their "Everything We Know About…" list, and before watching the show, ask them what other questions they have that they hope will be answered during this program. Have students listen closely to learn if everything on their class list is accurate and to hear if any of their own questions are answered.



## Focus Questions

You may wish to ask your class the following questions to assess their comprehension of key points presented in the program:

1. How do machines help make our lives easier?
2. What are forces?
3. What is work? How do we know if work has been done?
4. Is moving a book from your desk to the table doing work? Explain.
5. What are simple machines?
6. How do simple machines help us do work?
7. How long have people been using simple machines?
8. What is a lever?
9. How can a lever be used to lift a heavy boulder?
10. What is a fulcrum?
11. Why do levers need a balancing point?
12. Where is the balancing point, or fulcrum, of a seesaw?
13. How do seesaws make lifting things easier?
14. How can a hammer be used as a lever?
15. What are some parts of your body that are used as levers when playing sports?
16. How does a wheel and axle work as a simple machine?
17. What is a pulley?
18. How do pulleys make moving things easier?
19. Why is using a ramp easier for moving a lawnmower into a truck than lifting it by hand?
20. How is a wedge like an inclined plane? What is an example of a wedge?
21. How are wedges used to make jobs easier?
22. Is a knife a simple machine? Explain.
23. How is a screw like a winding mountain road?
24. What are compound machines?
25. What is an example of a compound machine?

## Follow-up Discussion

The most important part of this segment is to examine both the facts and beliefs generated by the class in their "Everything We Know About…" list. Research indicates that students will retain their previous misconceptions — in preference to the new information — until they actively recognize and correct their own errors. Because of this, it is important to lead students to the correct ideas while identifying and correcting any misconceptions from the class list. After reviewing the list, encourage students to share the answers they got to the questions raised before viewing the program.

***(Continued)***