

I've Got the Power

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Grade Level:

3

Time Allotment:

2-45 minute blocks

Overview:

Students will understand that work is completed by the use of simple machines. Students will be able to name the six types of simple machines and explain simplistically how they function. Students will use and identify examples of the types of simple machines. Students will then explain how their simple machine operates.

Subject Matter:

Science – Force, Motion, and Energy

Learning Objectives:

- The student will review the definitions of key concepts including work, force, and machines.
- The student will define simple machine.
- The student will be able to identify the six types of simple machines including lever, screw, pulley, wheel and axle, inclined plane, and wedge.
- Students will identify objects within their surroundings as being a type of simple machine.
- Students will use simple machines to complete a task.
- Students will demonstrate and explain how simple machines function using concepts such as fulcrum, force, and load.

Virginia Standards of Learning

Science 3.2 The student will investigate and understand simple machines and their uses.

- 3.2a Key concepts include types of simple machines (lever, screw, pulley, wheel and axle, inclined plane, and wedge);
- 3.2b how simple machines function;
- 3.2d examples of simple machines found in the school, home, and work environment.

Media Components:

- ***Simple Machines: A First Look*** – United Streaming Video – <http://www.unitedstreaming.com>

- Windows Media Player or Real Time Player
- Edheads – Simple Machines – Interactive website - <http://www.edheads.org/activities/simple-machines/index.htm>

Materials:

Per Class

- Computer with projection device and speaker

Per Student:

- Simple machines notes pages
- One small block of wood
- One nail

Lever Kit: (Place all materials including the Kit direction sheet into a box.)

- Two small blocks of wood (Cut a 2 X 4 into 4 inch sections)
- Two small nails
- Two hammers
- Self-Adhesive Labels (Two with “Load/Resistance”, Two with “Force”, Two with “Fulcrum”)
- Lever Kit Direction Sheet (Attached at end of lesson)

Inclined Plane Kit: (Place all materials including the Kit direction sheet into a box. This kit is demonstrated in the video *The Simple Machines: A First Look*)

- One wooden block with a hook screwed into the end. (a cup hook or C hook can be used.)
- One rubber band (medium thickness works best)
- Two books (medium thickness)
- 1-24” 1 X 4 board
- 1-36” 1 X 4 board
- 1 ruler
- One Inclined Plane Kit direction sheet (attached)

Pulley Kit: (Place all materials including the Kit direction sheet into a box.)

- One small pulley
- One rope to fit the pulley
- Two thick rubber bands
- One wooden block (a book can be used for lifting instead of a block)
- One S hook
- One Pulley Kit direction sheet (attached)

Screw Kit: (Place all materials including the Kit direction sheet into a box.)

- One block of wood
- One small hinge
- One screw driver

- Two small screws
- One screw jack
- One block of wood 1 X 12 X 12
- One Screw Kit direction sheet (attached)

Wedge Kit: (Place all materials including the Kit direction sheet into a box.)

- Two fist size balls of clay
- One non sharp butter knife
- One nail
- One block of wood
- One hammer
- One Wedge Kit direction sheet (attached)

Wheel and Axle Kit: (Place all materials including the Kit direction sheet into a box.) This activity is demonstrated in the video *Simple Machines: A First Look*.

- Two rubber bands (same thickness)
- One small S hook
- Ten pencils (unsharpened)
- One book (about one inch thick)
- One ruler
- One Wheel and Axle Kit direction sheet

Prep for Teachers:

- The video *Simple Machines: A First Look* should already be downloaded from United Streaming. The video should be cued and ready to be viewed.
- For day two all kits should be compiled and ready for the culminating activity. The teacher may want to decide how the students should be grouped for the culminating activity.
- The EdHeads website should already be bookmarked and ready to use with the projection device and speakers turned OFF. The website also has excellent teacher's guides that can be printed and distributed to students. You may want to preview the website to practice and to see what vocabulary it offers.

Day One

Introductory Activity:

Ask: "Students, what do you think of when I tell you we are going to do some work?" (*Accept student responses*) **Ask:** "Well, let's suppose you are at home and your mom, dad, or grandmother says that you are going to do some work. What do you think you might be in for?" (*Accept student responses*) **Ask:** "Okay then, let's pretend we are construction workers or people who build houses and your boss says 'We are really going to do some work today.' What do you think he means?" (*Accept student responses*)

Say: “Well, even though you thought of different kinds of work, it all means the same. Work is moving something from one place to another. When we are doing schoolwork, we are putting ideas from our minds onto paper. At home if we are doing work for our parents we might be putting the dirty clothes from the floor into the basket, and if we are a construction worker we might be taking a nail out of a box and hammering it into a board. Now we are going to do a little work in here. I would like for each small group of three to take the wooden block and nail that is at your table and insert the nail into the wood. I’ll give you a minute or so to complete the task.” Note: Students are NOT given a hammer or any tool. After completing this activity students will realize that machines (tools) make our work easier.

Say: “All right now students, hold up your nailed blocks of wood. Who was successful in completing the task?” (*Look around the room at the nailed wood results.*) **Ask:** “Why was this job so difficult?” (*Accept student responses*) **Ask:** “What machine would make putting the nail into the block of wood much easier?” (*a hammer*) **Ask:** “No matter what the ‘work’, what would make it much easier?” (*Machines*)

Say: “That’s right! Machines will make our work easier. Today we are going to learn about six different simple machines that make our work easier. We will be able to explain how these simple machines work and we’ll also be able to identify some examples of these simple machines. Let’s get started.”

Learning Activities:

Say: “As we discover a type of simple machine, I would like for you to record the name of the simple machine, do a quick drawing of the machine, and give two examples of the machine. To help us discover all this information, we’ll use segments from the video, ***Simple Machines: A First Look*** downloaded from United Streaming. I have at your tables a note sheet already created for you. We’ll later add these completed sheets to your notebook.” **Note to teacher:** Depending on the levels of the students, notes may need to be recorded on the board or overhead projector.

Provide a focus for media interaction: **Say:** “The first type of simple machine we are going to discuss is the lever. Watch this segment of the video and be able to tell me why we use levers and what three parts make up a lever.” **Start** video at 2:29 where you see the words “The Lever”. **Pause** video at 3:28 where the word “force” appears on the screen.

Ask: “What is the reason we use the simple machine, the lever?” (*To make lifting easier*) **Ask:** “What are the three parts of a lever?” (*The load, the fulcrum, and the force*) **Say:** “Did everyone catch all three of those parts? Let’s listen to that segment again and make sure everyone heard the three parts of a lever.” **Replay** video at 2:29 where you see the words “The Lever” and **Pause** video at 3:28 where the word “force” appears on the screen.

Ask: “What again are the three parts of the lever?” (*The load, the fulcrum, and the force*) **Ask:** “Why do we use levers?” (*To make lifting easier*) **Ask:** “Can anyone think of some examples of levers?” (*Accept student responses*) **Say:** “As we discover more examples we will continue to record them on our notes page.”

Focus: **Say:** “Our second type of simple machine is the inclined plane. In this next portion of the video you will see a man trying to lift a heavy box into a truck. He of course can’t do it. He solves his problem by using an inclined plane. When I stop the video, be able to tell me the definition of an inclined plane.” **Fast Forward and Start** video at 6:33 where you see the words “Inclined Plane”. **Pause** video at 7:05 where the man is pushing the box up the board.

Say: “The man solved his lifting problem by using a board on the truck. This method is called an incline plane. What definition did the narrator of the video give to the term incline plane?” (*A flat surface with one end higher than another*) **Focus:** “What do you think is the reason we might use an inclined plane?” (*Accept student responses*) **Say:** “Let’s listen to the next segment of the video and see if our predictions are correct.”

Start video at 7:00 where the man is beginning to move the box and **Pause** video at 7:13 where the box is in the truck. **Ask:** “So why do we use incline planes?” (*It makes it possible to move something from a lower place to a higher place with less effort.*) **Ask:** “Can you think of some examples of incline planes that we have here in our school or maybe when you drive in the mountains?” (*stairs, truck ramp, roads, etc.*) **Say:** “Let’s go to our notes and add this information. As we discover more inclined planes, we’ll add them to our list.”

Focus: **Say:** “The third type of simple machine is the wedge. This simple machine is used often in our daily lives. Watch this clip and tell me the purpose of the wedge and also some examples of wedges.” **Start** video at 8:50 where you see the words “The Wedge” and **Pause** video at 9:55 where the knife is cutting the cheese. **Ask:** “What is the purpose of a wedge?” (*To make it easier to push things apart*) “What are some examples of wedges?” (*Ax, knife, chisel, screw driver, etc.*) **Say:** “Make sure you have added this information to your notes page. We are halfway there. We’re ready for the fourth kind of simple machine.”

Focus: **Say:** “The fourth kind of simple machine is the screw. Watch the next section of the video and be able to tell me the definition of a screw.” **Fast Forward and Start** video at 10:12 where you see the words “The Screw”. **Pause** the video at 10:35 where the boy is holding up the wrapped piece of paper. **Ask:** “What is the definition of a screw?” (*An inclined plane wrapped around a post*) **Focus:** **Ask:** “How are screws used?” (*Accept student responses*) **Say:** “Let’s watch the next section and see if our predictions are correct.” **Start** video at 10:35 where the boy is holding up the wrapped piece of paper and **Pause** at 11:13 where the woman has raised the car with the jack. **Ask:** “Were our predictions correct?” (*Accept student responses*) **Say:** “Yes, screws are used to hold things together and we also see that they can be used to lift things! Let’s add this information to our notes page.”

Focus: **Say:** “Soon, I want to move my heavy dresser to the other side of the house. None of the simple machines so far would really help me. Dragging it would be way too difficult. Watch the next segment and be able to tell me what simple machine would make my job less difficult.” **Fast forward and Start** video at 12:03 where you first see the small, toy, four-wheeler. **Pause** video at 12:15 where the toy has been lifted and now is back in place. **Ask:** “What simple machine would help me move my dresser?” (*Wheel and axel*) **Ask:** “Can you think of any examples of wheel and axel that we can add to our notes page?” (*Accept student responses*) **Say:** “Let’s add this information to our notes.”

Focus: **Say:** “Finally, our last simple machine! In the next clip the narrator will describe a pulley. She will tell you what a pulley looks like and how it works. Be able to tell me what it looks like and how the pulley operates.” **Fast Forward** and **Start** video at 13:25 where you see the words “The Pulley”. **Pause** video at 13:47 where the girl has lifted the weight. **Ask:** “Can someone describe a pulley for me?” (*A wheel with a groove in it and a rope that fits into the groove*) **Ask:** “How does the pulley work?” (*Makes it easier to move something by changing the direction of the pull*) **Focus:** **Say:** “That was a lot of information. Let’s listen to that segment again and make sure we all heard the definition of a pulley and how the pulley operates.” **Replay** video at 13:24 where you see the words “The Pulley” and **Pause** video at 13:47 where the girl has lifted the weight. **Ask:** “Describe again the pulley for me.” (*A wheel with a groove in it and a rope that fits into the groove*) **Ask:** “Again, how does a pulley work?” (*It makes it easier to move something by changing the direction of the pull.*) **Say:** “Where have you seen pulleys in our community?” (*Accept student responses, flagpole, clothesline, etc.*) **Say:** “Let’s add the final information to our notes page.”

Culminating Activity:

Day Two

***Note to teacher:** Students will be divided into six groups, one for each type of simple machine. Each group will receive a simple machine kit that includes all materials for that kit as well as a direction sheet.

Say: “Students we are going to continue our exploration of simple machines. Each group has a simple machine kit in front of you. I’d like for you and your group members to open the kit and take out the direction sheet. I’d like for you to read the direction sheet softly together. You will have twenty minutes to complete the exploration. Your group will each come forward and tell the rest of the class what kit you completed, what your job was, how you completed your job, and what the result was. Make sure that everyone in your group is an active participant! You may get started.”

***Note:** Allow students enough time to complete the kit. It may take more or less than twenty minutes depending on the level of the class.

Say: “Okay class, it looks as though everyone has had time to complete their kit explorations. We will now present our explorations to the rest of the class. Make sure that your group tells us the type of simple machine, what your job was, how you completed your job, and what your results were. We may also need to ask you some questions. Let’s get started.”

***Note to teacher:** Orally complete all of the simple machine kits. Make sure that students participate by asking direct questions or opinions about the job, process, or results.

Say: “Students we are now going to look at a fun website that I found that helps us explore simple machines. Turn your attention to the board.” Turn on projector with the Ed Heads website already cached. (<http://www.edheads.org/activities/simple-machines/index.htm>)

Click on the icon that says, “Click here to start”. A new window will open. To work with simple machines click on the House. Make sure the speakers are on to get the full affect. Choose the room that the student would like to go into first. Listen to the directions and click Start. Have the students tell you where they think the simple machines are located. Continue through the website until you and the students have gone through all four rooms. This activity can also be done individually depending on the computer lab situation in your school.

Cross-Curricular Extensions:

Math

- Students could steadily increase angle on an incline plane by using longer boards. With each pull of a weight, the students will compare the length of the board with the length of the rubber band used to pull the weight up the plane. Results can be compared and graphed.
- Students could bring in a variety of wedges. Students could use protractors to measure the angles of the wedges.

Technology

- In small groups students could create a website that describes the six simple machines.
- Students could use a graphic organizing program to map out the six simple machines; including definitions and examples.
- Students could create a movie that demonstrates each of the six simple machines. The movie could be shown to other classes.
- Other websites might include:
 1. Simple Machine Scavenger Hunt - <http://www.stephenscountyschools.com/webs/dharrison/SimpleMachines.htm>
 2. Inventor’s Toolbox - <http://www.mos.org/sln/Leonardo/InventorsToolbox.html>
 3. Simple Machines - <http://sln.fi.edu/qa97/spotlight3/>
 4. The Essence of Simple Machines - <http://www.cosi.org/onlineExhibits/simpMach/sm1.html>

English/Literature/Writing

- Students could create a book that describes the six simple machines. Each section of the book could include drawings, cut out pictures, descriptions, uses, and examples. Books could be shared with other classmates.
- Students could read and report on books that have to do with simple machines including:
 1. How Do You Lift a Lion?. By Robert Wells, illustrated by the author. Albert Whitman & Company: Morton Grove, 1996. ISBN 0-8075-3419-6.
 2. Seesaws, Nutcrackers, Brooms: Simple Machines That Are Really Levers. By Christopher Lampton, illustrated by Carol Nicklaus. The Millbrook Press: Brookfield, 1991. ISBN 1-878841-22-X.
 3. Sailboats, Flagpoles, Cranes: Using Pulleys as Simple Machines. By Christopher Lampton, illustrated by Carol Nicklaus. The Millbrook Press: Brookfield, 1991. ISBN 1-56294-026-0.

4. Bathtubs, Slides, Rollercoaster Rails: Simple Machines That Are Really Inclined Planes. By Christopher Lampton, illustrated by Carol Nicklaus. The Millbrook Press: Brookfield, 1991. ISBN 1-878841-44-0.

Community Connections:

- Students could visit a construction site and have a guide show them how simple machines are used in constructing the building.
- A carpenter could visit the classroom, bringing some of his/her tools to demonstrate how simple machines are being used.

Lever Kit

Materials:

Look in your kit and make sure all of the following materials are there for you.

- Two small blocks of wood
- Two small nails
- Two hammers
- Two "load or resistance" labels
- Two "force" labels
- Two "fulcrum" labels

Job:

Your job is to demonstrate how a hammer can be used as a lever. You will label the parts of the level as you complete the process two times.

Process:

1. Hammer the nail partially into the wood. (Almost but NOT all the way!)
2. Turn the hammer around and act as though you are going to pull the nail out. This is a lever!
3. Label the force. What part of this is going to provide the force to pull the nail out?
4. Label the load or resistance. What part of this is being pulled out? What are you trying to lift out?
5. Label the fulcrum. Where is the lever (hammer) resting?
6. Now go ahead and pull the nail out. Complete the process a second time.

Results:

Explain how the hammer can be used as a lever. Why does this simple machine make the job easier?

Names of members of Lever Kit Group:

Wedge Kit

Materials:

Look in your kit and make sure all of the following materials are there for you.

- Two balls of softened clay
- One NON sharp butter knife
- One nail
- One block of wood
- One hammer

Job:

Your job is to demonstrate why a wedge is a simple machine.

Process:

1. Take one ball of clay and divide it in half with your hands. Describe how it looks.
2. Take the second ball of clay and divide it in half using the butter knife. Describe how it looks.
3. The nail is also used as a wedge. Look at the point. Hammer the nail into the block of wood.

Results:

Explain how the wedge "knife" makes it easier to push things apart. Explain why a nail is considered a wedge. How does it's point help the splitting process?

Names of members of Wedge Kit Group:

Screw Kit

Materials:

Look in your kit and make sure all of the following materials are there for you.

- One block of wood
- Two Screws
- One small hinge
- One screw jack
- One 12" X 12" sq. of wood
- One screw driver

Job:

Your job is to demonstrate how a screw can hold things together and also be used to lift.

Process:

1. Place the hinge on the block of wood. Use the screwdriver to screw the screws into the hinge to hold it in place.
2. Place the 12" X 12" square of wood onto the screw jack. One student sits on the square while another student holds their hand to help him/her balance.
3. Use the jack to lift the student.

Results:

Explain how the screw holds things together. Explain why using a screw might hold tighter than a nail. Explain how the screw jack helped make lifting the student easier.

Names of members of Screw Kit Group:

Wheel and Axel Kit

Materials:

Look in your kit and make sure all of the following materials are there for you.

- Two rubber bands
- One S hook
- Ten pencils
- One book
- One ruler

Job:

Your job is to demonstrate and explain how the wheel and axel make moving things much easier.

Process:

1. Take one rubber band and wrap it around the book.
2. Take the S hook and hook it onto that rubber band. Hook the other rubber band to the other end of the S hook.
3. Pull the book across the table. Measure the length of the rubber band.
Record length here: _____
4. Place the ten pencils on the table a few inches apart. Place the book on top of the pencils. Pull the book across the pencils.
5. Measure the length of the pencils as you pull the book across. Record the length here: _____

Results:

Explain why the rubber band is longer in one situation than the other. What are the pencils acting like? Explain how wheels and axels make moving objects easier.

Names of members of Wheel and Axel Kit Group:

Pulley Kit

Materials:

Look in your kit and make sure all of the following materials are there for you.

- One small pulley
- One rope (to fit the pulley)
- One small block
- Two rubber bands
- One S hook

Jobs:

Your job is to demonstrate how a pulley can be used to lift heavy items.

Process:

1. Take the block of wood and wrap the two rubber bands around it. One on one side and one on the other side making a T shape.
2. Place one side of the S hook onto the rubber bands where they meet in the center.
3. Tie one end of the rope to the other end of the S hook.
4. Place the other end of the rope around the pulley's groove.
5. Have one student hold the pulley up. Have another student pull the untied end of the rope to lift the block.

Results:

Explain how a pulley helps to lift heavy objects. Think of situations where a pulley might be helpful in lifting heavy objects.

Names of members of Pulley Kit Group:

Inclined Plane Kit

Materials:

Look in your kit and make sure all of the following materials are there for you.

- One block with a hook attached to the end
- One rubber band
- Two books
- One short inclined plane board
- One longer inclined plane board
- One ruler

Job:

Your job is to demonstrate how an inclined plane can make a lifting job easier.

Process:

1. Hook the rubber band onto the block with the hook. Use your finger to lift the block.
2. Measure the length of the rubber band. Record length here: _____
3. Lay the short inclined plane onto the two books. Using the rubber band pull the block up the short inclined plane.
4. Measure the length of the rubber band. Record the length here: _____
5. Lay the longer inclined plane onto the books. Using the rubber band pull the block up the longer inclined plane.
6. Measure the length of the rubber band. Record the length here: _____

Results:

Which situation had the longest rubber band? What does the length of the rubber bands show? How does an inclined plane make a lifting job easier?

Names of members of the Inclined Plane Kit Group:

Notes Pages

Simple Machine	Description	Drawing	Examples

Simple Machine	Description	Drawing	Examples