Children's Museum of Houston

Pre/Post Classroom Activities

An Introduction to Simple Machines

Rationale

How Does It Work brings physical science to life through exploration of everyday phenomena by working with simple and compound machines. Questions can be posed and answered through investigations in this exhibit. Children learn that methods, models, and conclusions built from these investigations can change as new observations are made.

TEKS Objectives (Science)

4.1A: Demonstrate safe practices during field and laboratory investigations.
4.2: The student uses scientific inquiry methods during field and laboratory investigations.
4.5A: Identify and describe the roles of parts in nonliving systems-simple and compound machines.
4.5B: Predict and draw conclusions about what happens when pat of a system is removed.

Background

In grades K-2, children learn to use certain simple tools and they begin to understand that these tools help them complete tasks more easily. In this lesson, children will be able to observe and identify simple machines in their environment, and explain how simple machines surround them in their everyday lives. A machine is a tool used to make work easier. Simple machines are simple tools used to make work easier. Compound machines have two or more simple machines working together to make work easier. Children will later be able to further explore simple machines in their visit to the How Does It Work exhibit.

Vocabulary

Simple machines, compound machines, inclined plane, wedge, screw, lever, wheel and axle, pulley, work, force, pivot, fulcrum

Inclined Plane 	Wedge 	Screw 
Lever 	Wheel and Axle 	Pulley 

Materials (per group of students)

- Simple machine station cards
- Juice can
- 3- 2 feet boards
- 12-13 heavy books
- 2 thread spools
- 50 feet of string
- 2 round pencils
- Paperclips
- Message
- 2 roller skates
- 2 rubber bands the same size
- Yard stick
- Spring scale
- Large nails without and without points
- Hammers
- Rulers
- 6" wood block
- Same size screws with different sized threads
- Screwdriver
- Masking tape

Procedure

Set Up: After an introduction to Simple Machines, students will be ready to explore, identify, and describe different types of simple machines. This activity is best if completed in small groups of 2-4 students. Set up stations with each of the different types of simple machine materials.

1. Lever Station: juice can, board, books
2. Pulley Station: 2 thread spools, 40 feet of string, 2 round pencils, paperclips, message
3. Wheel and Axle Station: 2 roller skates, 2 rubber bands the same size, yard stick
4. Inclined Plane Station: board, 10 books, string, spring scale
5. Wedge Station: large nails without and without points, hammers, board, rulers
6. Screw Station: 6" wood block, same size screws with different sized threads, screwdriver, masking tape
7. Students will work as a group to complete the activities on each simple machine station card. Students will record responses by completing activities from each station card in their science journals.
8. Volunteers from each group will present their responses from each station and explain to the class how these simple machines are used to make work easier for people.
9. Make sure students record all observations and discussions in their science journals.

Questions to ask

- Think about the simple machine at each station. What would life be like without having these machines in your life?
- How does using these machines help people reduce the amount of work you have to apply in completing a task?
- What happens if a part of the machine is taken away? How does that does that affect your success in the task at hand?
- Think about other machines that you use at home. Do any of them have one or more simple machine attached to help you complete a task? If so, which machines and how do they help you?

Extensions

Ask students to think about other simple machines that they use at home or other places in their community and write a journal about how those machines help them in their daily lives.

Resources

- How Do You Lift a Lion? by Robert E. Wells. Provides a simple introduction to the use of levers, pulleys, and wheels to move heavy objects.
- Experiments with Simple Machines by Salvatore Tocci, Robert Gardner, Susan Virgilio. Describes various kinds of simple machines, showing how they can be made out of easily obtainable objects and detailing experiments that show how they make tasks easier to perform.
- Sensational Science Projects with Simple Machines by Robert Gardner. The experiments in this book will show how simple machines work and explain some elementary principles of physical science. All you need are some simple materials, most of which can be found around your home, school, or neighborhood.
- Ancient Machines: From Wedges to Waterwheels by Michael Woods, Mary B. Woods. Discusses the invention of six simple machines in various ancient civilizations from the Stone Age to the fall of the Roman Empire.

Websites

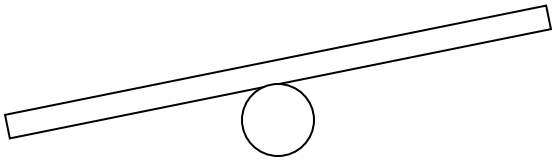
- BrainPop: http://www.brainpop.com/technology/simplemachines/. In these movies about the different types of simple machines, Tim and Moby explain how these machines help us to do things more easily.
- Pieces of Science: http://www.fi.edu/pieces/knox/automaton/simple.htm. Provides descriptions for the six different simple machines, and goes on to explain how automatons and robots work.
- Edheads: http://www.edheads.org/activities/simple%2Dmachines/. Edheads in a resource that provides science lesson plans for teachers to use. In this lesson, students will be able to react with an animation about common household machines and then complete a scavenger hunt to identify simple machines and compound machines that are used in their everyday lives.

Lever Station

Levers have 3 parts. The part where the lever is supported is called the FULCRUM. The part from the fulcrum to the weight you want to lift is called the WEIGHT ARM. The part from the fulcrum to where you are pushing or pulling is called the FORCE ARM.

Question:
Is a weight easier to move when the force arm is longer, shorter, or the same length as the weight arm?

Materials:
Juice can, board, books



Procedure:
1. Make a lever using the board and juice can as shown.
2. Put four books on one end of the lever. This will be the weight you need to lift.
3. Adjust the board on the fulcrum to make the force arm shorter than the weight arm.
4. Add books one at a time to the force arm. Record how many books it takes to move the weight arm.
5. Repeat steps 3 and 4 with a longer force arm and a force arm the same length (the fulcrum, juice can will be in the center.)

Results:
1. Is a weight easier to move with a shorter, longer, or same length force arm?
2. Is that what you thought?
3. What did you learn?

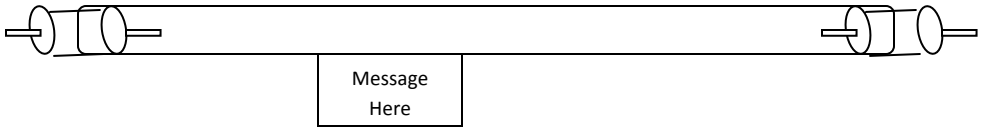
Pulley Station

A PULLEY lets us change the direction of the force we use to do work. This lets use force less to do the same amount of work.

Question:
Can you use a pulley to help you send messages across the room?

Materials:
2 thread spools, 40 feet of string, 2 round pencils, paperclips, messages

Procedure:
1. Place the pencils through the thread spool centers. Tie the ends of the string together to make a loop. Have one person hold the ends of one pencil (allowing the spool to turn freely. Have one person hold the other spool. Wrap the string around the spools to create a pulley system.
2. Write a message, attach it to the pulley with a paper clip. Have a third person pull the string to move the message.



Results:
1. Did your message travel across the classroom by pulley?
2. Is that what you thought would happen?
3. What did you learn?

Wheel and Axle Station

A WHEEL and AXLE help us turn something more easily or move something across a surface more easily. That is, with a wheel and axle, you use less force.

Question:
Which needs less force to be moved, a roller skate on its side or on its wheels?

Materials:
2 roller skates, 2 rubber bands the same size, yard stick

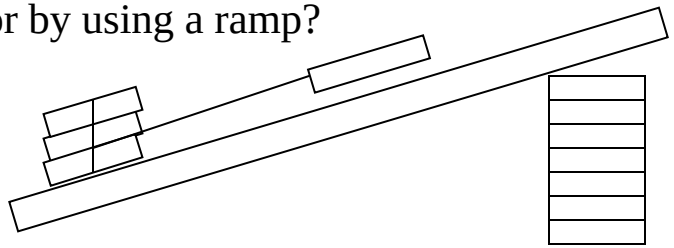
Procedure:
1. Attach rubber bands to the roller skates.
2. Measure the length of the rubber bands before you pull.
3. Put the skate on its side. Measure the rubber band during the pull.
4. Pull the skate on wheels. Measure the rubber band during the pull.

Results:
1. Which skate needed less force to be moved?
2. Is that what you thought?
3. What did you learn?

Inclined Plane Station

An INCLINED PLANE (or ramp) is a flat surface with one end higher than the other end. An inclined plane lets us raise heavy things without having to lift straight up.

Question:
Which is the easier way to lift 3 books-straight up, or by using a ramp?



Materials:
Board, 10 books, string, spring scale

Procedure:
1. Tie 3 books together. Stack 7 books in a pile.
2. Lift the 3 books to the top of the seven book pile with a spring scale. Record the weight.
3. Use the board and seven books to make an inclined plane.
4. Pull the 3 tied books up the ramp with the spring scale. Record the weight.

Results:
1. Which was the easiest way- straight up or using the ramp?
2. Is that what you thought?
3. What did you learn?

Wedge Station

A WEDGE is like two incline planes (ramps) put back-to-back. But, there is a difference in how they work. The wedge moves through the material, while the material is moved over an inclined plane. A wedge is used to split, cut, or go through materials such as wood, metals and other hard materials. A nail is one example of a wedge.

Question:
What is easier to pound into a board, a nail with a point (wedge) or a blunt nail?

Materials:
Large nails without and without points, hammers, board, rulers

Procedure:
1. Measure the nails and record.
2. Hammer the nail with the wedge five times. Measure the part of the nail you can see and record.
3. Hammer the nail without the wedge five times. Measure the part of the nail you can see and record.

Results:
1. Which nail was easier to pound?
2. Is that what you thought?
3. What did you learn?

Screw Station

A SCREW is used to hold things together. It has a line that goes around it called THREAD (actually a twisting inclined plane).

Question:
What type of screw takes more turns to go into a block of wood - one with more or less thread?

Materials:
Wood block, same size screws with different sized threads, screwdriver, masking tape

Procedure:
1. Wrap a screwdriver handle with a piece of masking tape. Make a mark on the tape. YOU WILL COUNT ONE TURN EACH TIME THE MARK COMES BACK TO THE PLACE IT STARTED.
2. Place the screw driver into the slot of one screw. Watch where the mark is and start turning the screw to the right.
3. Count how many turns it takes to get the screw all the way into the wood.
4. Repeat for the other screw or screws.

Results:
1. Which screw took more turns to go all the way into the wood?
2. Is that what you thought would happen?
3. What did you learn?