Teachers, please copy both sides of this page for your students to take home.

POW! Physics on Wheels

Dear Students and Parents,

We hope you enjoyed your recent day of science exploration and investigation with Pacific Science Center's *Physics on Wheels* van. The Science On Wheels program, which began operating in 1974, is an interactive outreach program that travels to schools across the state of Washington.

The *Physics on Wheels* van provides students with hands-on science experiences. Students participate in a lively assembly, explore an interactive exhibit area and receive a 45-minute hands-on lesson. Our goal is to foster an interest in science, technology and mathematics.

We encourage you to talk about our visit and investigate the activities below. They require few materials and are easy to do. Remember, your child and his or her friends may become our next physicists. We hope you enjoy doing these activities together!

~Science On Wheels Teachers

Lever Lift

Materials

- ruler
- pencil
- object to use as the load you are lifting (something that can rest on one end of the ruler, such as a flat pink eraser)

Simple machines, like levers, help us do work. If you are trying to lift a heavy load, a lever will help you by decreasing the amount of force it takes you to lift a load. The lever will let you use less muscle power. The activity below will help you feel how much a lever can help and how to set up a lever to make it as helpful as possible.

Procedure

- Lay the pencil on a desk or table top and place the ruler across the pencil, so the pencil and ruler look like a "+". The pencil should be right under the center of the ruler so the ruler is balanced. The point where the ruler balances on the pencil is the fulcrum of your lever.
- Hold the object you are lifting in your hand and try to remember how heavy it feels. Now place the object on one end of the ruler. This section of the lever is referred to as the load. The opposite end of the ruler or lever is called the effort.
- Push down on the effort end of your lever with your finger. As you push down the load will lift. How heavy does it feel lifting your load with the lever? Does it feel the same or different from when you just lifted it in your hand?
- Move the pencil so that it is closer to the load end of the ruler. Now push down on the effort and see how heavy the load feels as it is lifted up.
- Move the pencil closer to the effort end of the lever. How heavy does your load feel now that the fulcrum is far from the load?
- Try repeating the steps above with a heavier load.

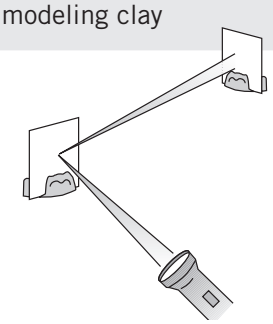
What's going on?

Your lever, or simple machine, gives you a "mechanical advantage." It helps you to do a job, such as lifting, by decreasing the physical effort you have to put into it. When the fulcrum of a lever is closer to the load, less effort is required to lift the load. However, if you pay close attention, you may also notice that the closer the fulcrum is to the load, the further down you have to push the effort end.

Light Relays

Materials

- 3 or more small mirrors
- light source (lamp or flashlight)
- modeling clay



Light travels in a straight line unless it is refracted (as with a lens) or reflected (as with a mirror). In this activity you will use mirrors to make a single beam of light follow a relay course that you set up. This activity works best with two or more people.

Procedure

- Choose a location for your relay course. Pick a start and a finish point.
- Attach a small piece of clay to each mirror to help it stand upright.
- Place the light source at the start and one mirror at the finish. You will know you have successfully completed the course if you see the image of your light source in the mirror at the finish point at the end of the activity.
- Set up all of the mirrors in your relay course with the light source off. You must estimate where the mirrors need to be placed, and at what angle, so the light will reflect from mirror to mirror to get to the finish point.
- For extra challenges, use many mirrors or try placing mirrors around corners.

Aiming And Catching Sound Waves

Sound travels in waves. Waves of sound push along the air molecules around us until they reach our ears. Sound waves can be bounced or reflected off of some surfaces. When this happens in a large space, like a canyon, we hear an echo. The sound bounces off the canyon walls and into our ears. In the following activity you will use two cardboard tubes to aim sound waves at a wall and bounce them back into your ears.

Materials

- at least one partner to help handle materials
- radio
- 2 cardboard tubes
- bare wall space

Procedure

- Turn your radio on low and place it near a wall with the speaker facing the wall.
- Each partner should have a cardboard tube. Partner A should place one end of his or her tube against one of the radio speakers and point the other end toward the wall. The tube should be pointing to the wall at an angle, rather than straight on.
- Partner B should put one end of his or her tube up to one ear and point the other end toward the wall at an angle. The open ends of the two partners' tubes should be fairly close together, only 2-4 cm apart (1-2 inches).
- If both tubes are aimed just right, the music or voices from the radio will sound louder to the partner holding the tube to his or her ear. If the sound is not louder, try moving the tubes a little until a difference is noticed.
- Repeat the activity, this time trading jobs so that both partners get a chance to hear the difference in loudness.

What's going on?

Normally, sound waves spread out as they travel from the object that made them to your ear. The more they spread out, the fainter they will sound. In this experiment, the sound waves coming from the radio travel straight down the first tube and bounce off the wall into the second tube. The sound is directed by the second tube right to your ear, and therefore sounds louder. The sound waves do not have a chance to spread out as much as normal because they are being captured and aimed by the tubes.

Resources

Find these books at your local library or bookstore:

101 Physics Tricks, by Terry Cash, 1991

175 More Science Experiments to Amuse and Amaze your Friends, by Terry Cash, Steve Parker and Barbara Taylor, 1989

200 Illustrated Science Experiments for Children, by Robert J. Brown, 1987

Physics for Every Kid, by Janice VanCleave, 1991

Physics for Kids: 49 Easy Experiments with Acoustics, by Robert W. Wood, 1991

Credits

Science On Wheels Staff:
Laura Hamilton, Barbara Johnson
Zeta Strickland, Catherine Valiant

Graphic Designer: Katie Dresel

200 Second Avenue North • Seattle, WA 98109
206-443-2001 • pacificsciencecenter.org

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