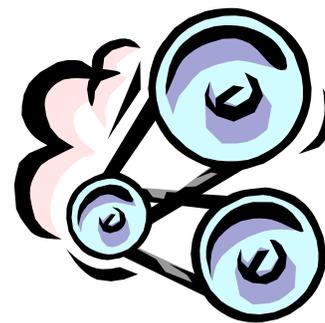


ELEMENTARY/INTERMEDIATE Activity: Simple Machines-Pulleys

Concepts

- Simple machines make work easier.
- A pulley is a simple machine.
- Mechanical advantage is a ratio of output force to input force.



Time

Ten to fifteen minutes

Materials

2 Brooms 25 feet strong cord/rope 3 volunteers

Background

A pulley is a simple machine used to change the direction and/or the magnitude of an applied force.

Elevators operate using motors and pulleys and are designed to move people up and down inside buildings. However, the first elevator was built to *hide* someone—the King of France. In 1743 an elevator was built in the majestic Palace of Versailles for King Louis XV. The elevator was operated by hand and moved the king secretly between the floors of the palace.

When two or more pulleys are connected together, they lift a heavy load with less force than if only one pulley is used. A combination of pulleys working together is known as a compound pulley or a block and tackle system.

The mechanical advantage of a pulley is equal to the number of rope lengths supporting the load. Mechanical advantage is a ratio of the output force compared to the input force. The greater the mechanical advantage is for a system, the greater the output force is compared to the input force, and the easier it is to do the work. In the demonstration below, the more times the rope is wrapped around the broomsticks, the greater the mechanical advantage is for the puller. However, the trade-off in a compound pulley is that while the lengths of rope equally share the weight of the load, making the effort easier, you must pull on the rope a greater distance to move the load.

Procedure

1. Assign two “strong” volunteers as broomstick holders and a “weak” one as the rope puller.
2. Broom holders should stand five to six feet apart, extending their arms towards each other with the broomsticks parallel to the floor at waist level.
3. Tie one end of the rope to the middle of one of the broomsticks.
4. Wrap the rope around the middle of the other broomstick and give the free end to the rope puller. The rope puller should stand so that the rope will be pulled perpendicular to the length of the broomsticks.
5. Have the two broomstick holders try as hard as they can to prevent the broomsticks from coming together as the rope puller pulls on the rope. Can the single rope puller draw the two broomsticks together? Note: Be careful of pinching fingers between the broomsticks.
6. Repeat a few more times, wrapping the rope around the broomsticks additional times for each trail. How much more difficult is it for the holders with each new trial? How much easier is it for the puller?

