SIMPLE MACHINES

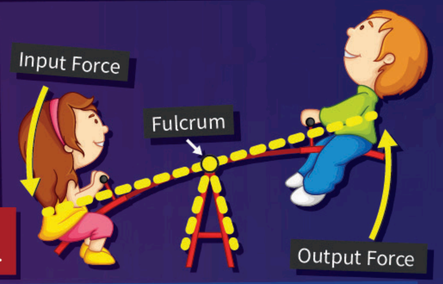
Would you love to be an inventor, the creator of the next big thing? Most of us would love too but not many of us have the imagination to come up with THE IDEA. Well guess what! Kids have amazing imaginations so how about putting yours to good use… who knows you could be creating the next big thing!

There are 6 basic simple machines; the lever, the wheel and axle, the inclined plane, the wedge, the pulley, and the screw. Several of these simple machines are related to each other. But, each has a specific purpose in the world of doing work.

THE LEVER

The lever is a long tool such as a pole or a rod put under an object to lift it. The lever is more efficient when combined with a fulcrum. The fulcrum is another object, perhaps a rock, used as a brace for the lever to push down against. The location of the fulcrum helps determine how well the lever will perform. The closer the fulcrum is to the object being lifted, the easier it is for the person to lift the object.

Levers are all around us. Some examples of levers are: the claws of a hammer (for removing nails), crowbars, hinges and a see-saw.



THE INCLINED PLANE

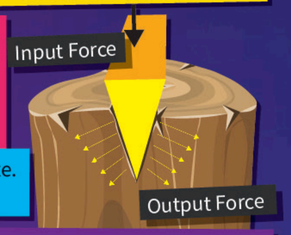
The inclined plane is simply a ramp. This allows things to go from a low place to a higher place. Or vice versa. It takes less work to move an object up a ramp than it does to lift that object up the vertical distance. Gravity makes it easier to move an object down a ramp than up that ramp.

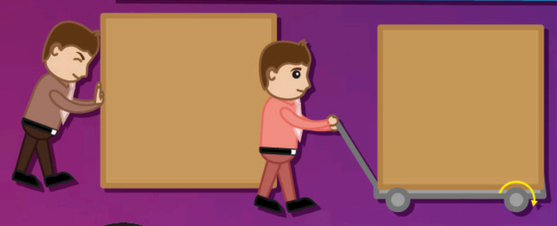
Ramps are used in wheelchair ramps and to get heavy equipment in and out of the back of trucks. But a modified version of a ramp is also found in stairs, escalators and ladders.

THE WEDGE

Some people might see the wedge as just an inclined plane, however, the use of a wedge is actually different. The wedge is used to separate an object. This is needed to cut, tear or break something in two. A wedge can also be used to keep things together or secure things from movement.

Some examples of wedges that are used for separating might be a shovel, a knife or an axe. But wedges can also hold things together as in the case of push pins, nails or a doorstop.

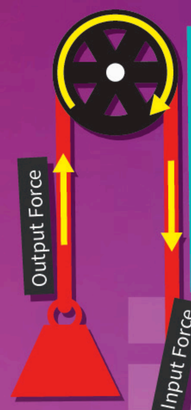




THE WHEEL AND AXLE

The wheel has always been considered a major invention in the history of mankind. But it really would not work as well as it does had it not been for the axle. An axle is a rod or pole centered in the wheel that allows the wheel to turn around it. The wheel then spins in a balanced circle to be used as transportation on a bike or to turn the hands of a clock. Gears are a form of the wheel and axle.

Wheels are found where things turn in a circle such as an electric fan, a motor and any wheel such as on a car, on your skateboard, or on a bicycle.



THE PULLEY

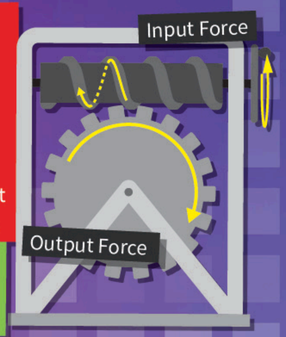
The pulley is actually a version of a wheel and axle that is combined with a rope, chain or other cord to allow moving something up and down or back and forth. The pulley can be combined with other pulleys to reduce the amount of work necessary to lift huge amounts of weight.

Pulleys are used in things as simple as window blinds to things as big as cranes. Elevators also use pulleys to move the car up and down.

THE SCREW

The screw is really a twisted inclined plane. It allows movement from a lower position to a higher position but at the same time it moves it in a circle. That makes it take up less horizontal space. A screw can also act to hold things together or turn a cog.

Some examples of the uses of a screw are in a jar lid, a bolt, a light bulb and bottle caps.



HOW LEVERS WORK!

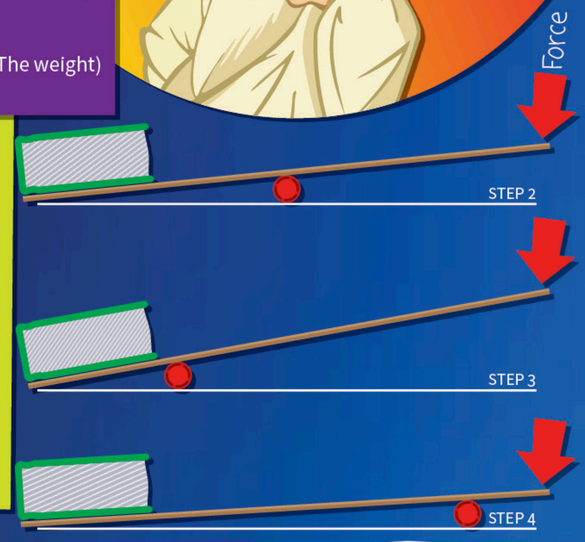
Ancient Greek philosopher and mathematician Archimedes once famously said "Give me a lever and a place to stand and I will move the earth." Try this super simple experiment to measure the effectiveness of a lever.

WHAT YOU'LL NEED

- A wooden ruler (The lever)
- A thick marker (The fulcrum)
- A small book or phone (The weight)
- Sticky tape

WHAT TO DO:

1. Place your marker on to a table, you may need to tape is down to stop it moving around. Lay the ruler over the marker so that the fulcrum as at the halfway point on the ruler.
2. Place the weight on one end of the ruler and push down on the other end with one finger. Take now of how much force it takes to lift the weight.
3. Move the ruler so that the end with the weight is closer to the fulcrum. Did you notice a difference? Does it take more or less force to lift?
4. Move the ruler again so that the weight is further from the fulcrum and you only have 1–2 cm of space to push down on. How was it different this time?



COGS & GEARS

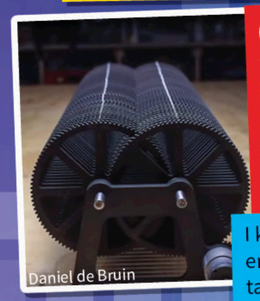
Gears – sometimes called cogs or sprockets – are a form of wheel, but instead of being a smooth circle, they have teeth that slot together allowing them to interact with other gears.

From the largest of ships to the smallest of watches, gears have proved to be a crucial part of human technology for over a thousand years. Gears are primarily used to change the speed, torque, and direction of a power source.

IN THIS EXAMPLE, THE GEARS PERFORM MULTIPLE FUNCTIONS.

1. As gear 1 turns clockwise, gear 2 will turn counter-clockwise, this effect is used in cars to engage reverse and change the direction that the wheels spin.
2. Because of the size difference, for every one time that gear 1 turns, gear 2 will turn two-thirds*. Imagine that a motor was attached to gear 1 turning it at a speed of 3000rpm (revolutions per minute), gear 2 will then be turning at 2000rpm. Conversely if you were to attach that motor to gear 2, then gear 1 would be spinning at 4500rpm.
3. The change in speed between the two gears also results in a change in torque or rotational force. This is the purpose of gears in a car or on a mountain bike. The lower gears will produce more torque and less speed to help you get moving, while higher gears will make less torque but spin faster.

*This number is found by dividing the number of teeth on the powered gear by the number of teeth on the driven gear. (12÷18=.66 or two-thirds)


Daniel de Bruin

GOOGOL TO 1 GEAR!

This interesting looking contraption was made using 100 reduction gears. What does it do? Simply put, each large gear is directly connected to a smaller gear which then turns the next at one-tenth of the speed. Times that by 100 and what that means is that for the last gear to make one full rotation, the first gear will need to turn 1 googol (1 followed by 100 zeroes) times!

I know what your thinking, 'what would happen if you turned it from the other end, would the first one move super fast?' Nothing would happen! It would take so much energy to turn that it is impossible to even move it a fraction.