SIMPLE MACHINES

A young girl is lifted by a seesaw. A seesaw is one example of a lever.

Imagine being strong enough to lift your teacher into the air. Picture doing it with just the strength you already possess. If you think it's impossible, it's not! If you've ever played on a seesaw with someone bigger than you, you've already seen how you can lift someone heavier into the air! You probably found that the closer your friend sat to the center support bar, the easier it became to raise him or her. Even though your friend may have been heavier than you, you could lift him or her because you had the help of a *simple machine*. A seesaw may not seem like a machine to you, but it is. A seesaw is a *lever*, and a lever is a simple machine.

Machines are devices for doing work. We use machines to help us every day. We can build houses and furniture using power tools or clean our clothes in washing machines. We can drive cars or fly in planes. Those kinds of machines are *complex*. Complex machines are often powered by motors. Motors have many parts, and some of those parts are simple machines.

Sometimes we may want to lift, push, or pull objects, or we may need to break or cut them. Some of these jobs require a lot of *force*. When we use simple machines, we gain a *mechanical advantage* by increasing the amount of force we can bring to bear on an object.

When we talk about how simple machines operate, we use the word *effort* to describe the amount of force we apply to the machine. Simple machines help us in two ways. We can apply less effort over a greater distance, or we can apply more effort over a shorter distance. Simple machines provide a gain in effort or a gain in distance. In addition, some simple machines change the direction of effort. Effort is measured in *newtons*. The newton is the metric unit of force.

There are six simple machines. They are the *lever*, the *wheel and axle*, the *pulley*, the *inclined plane*, the *wedge*, and the *screw*. The lever is a beam that pivots at a fixed point. The wheel and axle is a wheel or bar (such as a crank) that rotates around an axis. The pulley is a grooved wheel that turns on an axle and holds a cord or rope. The inclined plane is a tilted flat surface or ramp. The wedge is two inclined planes back to back. The screw is an inclined plane spiraled around an axis.

These six machines have been used for thousands of years. The wedge, inclined plane, and lever are the oldest known machines. Stone Age people used wedges to split wood and shape flint. Early farmers used wedges as plows to till soil. Using wedges in the form of chisels, ancient Egyptians cut massive stones to build the pyramids. They dragged the stones up inclined planes and moved them into position with levers. The

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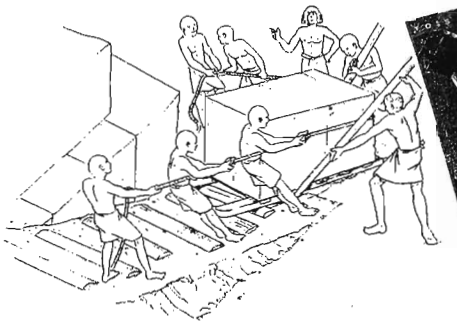

The ancient Egyptians moved heavy weights using levers and inclined planes.

Egyptians used the lever in other ways, too. The *equal-arm balance* is a kind of scale that they used some 7,000 years ago.

The Romans moved building stones with cranes that were operated with pulleys. The effort needed to do the work was provided by slaves walking inside a wheel-shaped treadmill. Monument builders also used pulleys to construct monuments and temples. A pulley in use appears in Syrian artwork dating from the 8th century B.C.E. In the 3rd century B.C.E., the Greek mathematician Archimedes used the screw to lift water from a lower level to a higher level. In the 1st century B.C.E., a Roman engineer named Vituvius made the water wheel practical. This wheel-and-axle machine ground grain into flour.

Simple machines still help us today, both as parts of complex machines and alone. A broom is a lever. A doorknob is a wheel and axle. Pulleys operate many windows and garage doors. Some driveways are inclined planes. Some doorstops are wedges. A thermos cap is a screw. Sometimes one simple machine is combined with others. An example is the hand-held can opener. Each of its handles is a lever, and the turning knob is a wheel and axle. The blade cuts using the principle of the wedge. Look around and see if you can find other simple machines that are used alone or in combinations.

Archimedes

Archimedes was a Greek inventor and mathematician who lived from 287 to 212 B.C.E. He was one of the first to study the way levers work. He realized that the longer he made the arm of the lever, the greater the load he could move. He is thought to have said that with a place to stand and a long enough lever, he could move the Earth.

name _____ class _____

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- How could you lift your teacher into the air using just one hand?

- What are the six types of simple machines?

1- 4-

2- 5-

3- 6-

- How did the Romans move heavy stones?

bob