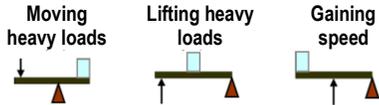


SIMPLE MACHINE - LEVER

Lever – is a rigid bar or plank that can rotate around a fixed point called a pivot, or **fulcrum**. Levers are used to reduce the force need to do a particular task. The **fulcrum** supports the load. The force exerted on the lever to make it move is called the **effort force**. The mass of the object lifted by the lever is called the **load**.



The distance between the fulcrum and the effort force is called the **effort arm**. The distance between the fulcrum and the load is called the **load arm**.



SIMPLE MACHINE – WHEEL and AXLE

The **Wheel and Axle** is a combination of two wheels of different diameters that turn together - a lever that rotates in a circle around a center point or fulcrum.



A longer motion on the wheel produces a more powerful motion on the axle, thus giving it a **mechanical advantage**.



(Steering wheel in a car)

SIMPLE MACHINE – INCLINED PLANE

Inclined plane - or ramp, makes it easier to move a load higher than it is, but, it has to be moved over a much longer distance. An inclined plane makes it possible to lift heavy objects using a smaller force (examples: loading ramp, wheelchair access ramp)



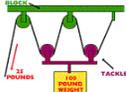
A **switchback** in the mountains is an application of how an inclined plane can be useful and practical.

SIMPLE MACHINE - PULLEY

A **Pulley** consists of a wire, rope, or cable moving on a grooved wheel. One or more combinations of wheels and ropes can be fixed in place or moveable. Pulleys help you lift larger loads.



A complex combination of fixed and movable pulleys is called a **block and tackle**.

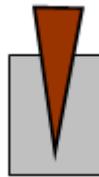


Depending on the number of pulleys used, a block and tackle can have a large mechanical advantage.

SIMPLE MACHINE - WEDGE

Wedge is similar in shape to an inclined plane, but is used in a different way (and can only be used in one direction). It is forced into an object to split it apart.

The wedge increases the force applied to the object, but it moves a greater distance into the object than it splits apart.



Examples: axe blade, a knife, a pin

SIMPLE MACHINE - SCREW

A **Screw** is a cylinder with a groove cut in a spiral on the outside. (It is actually an inclined plane that winds around itself) It helps you increase the force you use.

It can be used to convert rotational (turning) motion to linear motion (movement in a straight line). It moves objects in a straight line very slowly.



Examples: jar lids, light bulbs, and spiral staircases

COMPLEX MACHINE

Several simple machines all working together in a system are called **complex machines**.

A **system** is a group of parts that work together to perform a function. A wheel and axle can be also be used to increase the speed (bicycle wheels) for a **speed advantage**.

As time passed, people expected more and more difficult tasks to be completed by machines. Machines became more complex. Power sources had to be developed to run these complicated machines.

Over the last two centuries - coal, oil and electricity powered complicated machines were developed to do work in large factories. The **industrial revolution** used these large complicated machines to mass-produce goods for use by consumers.

BICYCLE

The **bicycle** is a good example of a complex machine because it is a system for moving a person from one place to another. Within the bicycle are groups of parts that perform specific functions, such as braking or steering. These groups of parts are called **subsystems**. Each subsystem in a complex machine contains a simple machine and usually has just one function.



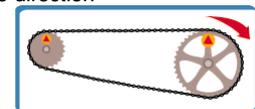
The subsystems of a bicycle are:

- Wheel and axle
- Drivers & Gears
- Frames & Materials
- Brakes & Steering
- Aerodynamic design

SUBSYSTEMS TRANSFER FORCE

The subsystems in a mechanical device play a role in how energy is transferred within the system.

A **linkage** is the part of the subsystem that transfers your energy from one part of the machine to another.. Chains or belts form a direct link between two wheels – one that drives the motion and the other will follow in the same direction



Machines that are more complex than a bicycle move much larger loads. A special type of linkage is needed. It is called a **transmission**. It transfers energy from the engine to the wheels.