Motion & Design

Simple Machines

**Simple machines** are tools that are used to make work easier. They…

* Have few or no moving parts.
* Use energy to work.
* Can work with one movement.
* Allow users to put forth less mechanical effort to move an object.
* Allows users to push or pull with less effort over increased distances.
* Change the amount, speed, or direction of forces.
* Two groups:
	+ **Inclined Planes**
		- Ramps
		- Wedges
		- Screws
	+ **Levers**
		- 1st, 2nd, and 3rd Class Levers
		- Wheels & Axles
		- Pulleys

**Compound** or **complex machines** are two or more machines working together.

* Most of the machines we use today are compound machines.

Vocabulary:

* **Work** – occurs when an applied force causes an object to move in the direction of the force.
* **Energy** – ability to cause change; can change the speed, direction, shape, or temperature of an object.
* **Load** – the weight being lifted by the simple machine.
* **Effort** – force placed on the simple machine to move the load. Also called applied force or input force.
* **Mechanical Advantage (MA)** – amount of effort saved when using machines.

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| **Simple Machine** | **Illustration** | **Function** | **Examples** |
| **Ramp**OR**Inclined Plane** |  | Moves objects from LOW to HIGH and vice versa.* Allows less effort than lifting directly upward.
* The shallower the ramp, the less force needed. (However, this increases the distance covered.)
 | * Ramp
* Slanted Road
* Path Up a Hill
* Slide
 |
| **Wedge** |  | Pushes two objects apart.* Made up of two inclined planes. The planes together make a sharp edge which can split or push objects apart.
* Can be used as a lifting device.
* Can be round (like the tip of a nail).
* The narrower the wedge, the easier it is to drive in and push objects apart.
 | * Knife
* Axe
* Teeth
* Forks
* Nails
 |
| **Screw** |  | Inclined plane that winds around itself. Used to lower and raise and/or hold objects together.* The width of the thread is like a ramp. The distance between the threads depends on the slope of the inclined plane (the steeper the slope, the wider the thread). Screws with less distance between the threads are easier to turn.
 | * Jar Lids
* Light Bulbs
* Stools
* Clamps
* Jacks
* Wrenches
* Spiral Staircases
 |
| **Lever** |  | A board or bar that rests on a turning point. Used to lift or move loads.* FULCRUM – turning point
* LOAD – weight to be moved…
* APPLIED FORCE/EFFORT/INPUT FORCE – force used to move the lever.
* By changing the position of the fulcrum, you can gain extra power with less effort. (The closer the object is to the fulcrum, the easier it is to move.)
* Most common simple machine.
 | * 1st Class
* 2nd Class
* 3rd Class
 |
| *1st Class Lever* |  | Fulcrum is between the effort/force and load.* Effort, FULCRUM, Load
 | * See-saw
* Scissors
* Pliers
* Crowbar
 |
| *2nd Class Lever* |  | Load is between force and fulcrum.* Effort, Load, FULCRUM
 | * Wheelbarrow
* Nutcracker
 |
| *3rd Class Lever* |  | Force is between resistance and fulcrum.* Load, Effort, FULCRUM
 | * Bent Arm
* Fishing Rod
 |
| **Wheel & Axle** |  | Wheel with a rod (axle) through its center. Used to lift or move loads.* An axle is a rod that goes through the wheel and allows the wheel to turn.
 | * Cars
* Roller Skates
* Door Knobs
* Gears
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| **Pulleys** |  | Cord wraps around a wheel. Used to move objects (esp. heavy) to hard-to-reach places, up down, or sideways.* As the wheel rotates, the cord moves in either direction.
* Works with gravity to be easier for user.
* Saves effort when you have more than one pulley working together.
* Increase the number of pulleys, increase the distance that the rope must be pulled.
* Types of Pulleys:
	+ Fixed
	+ Movable
	+ Single
	+ Combination
 | * Flag Poles
* Sailboat
* Blinds
* Crane
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