Chp 4

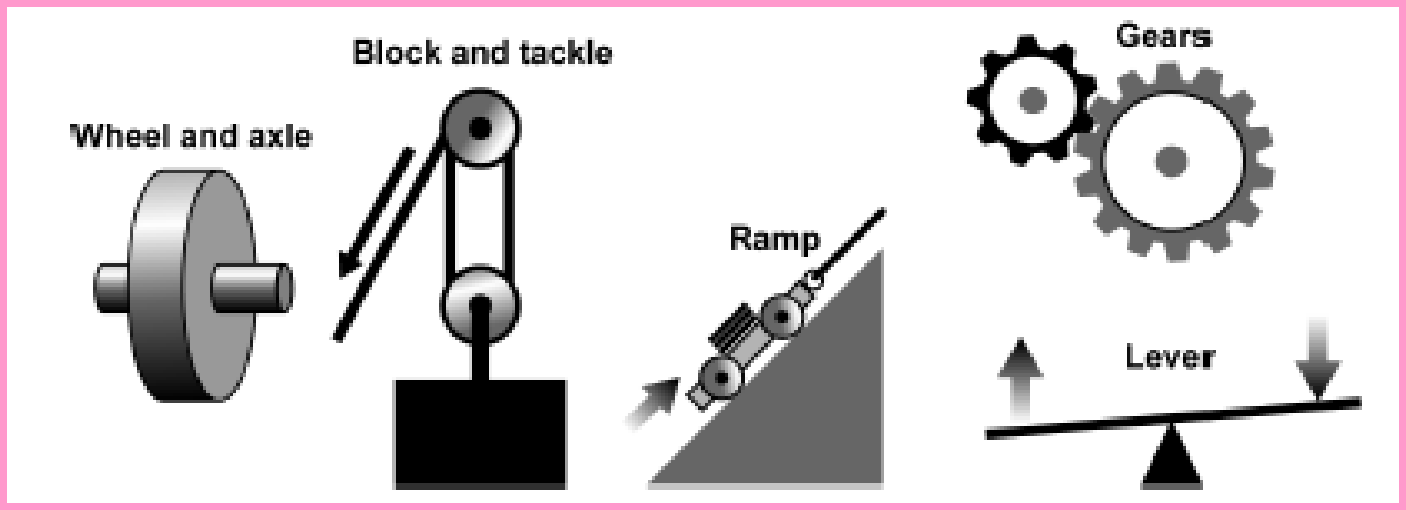
Machines

Machines

- A machine is a device with moving parts that work together to accomplish a task.
- Machines are designed to do something useful
- Input includes everything you do to make the machine work
- Output is what the machine does for you

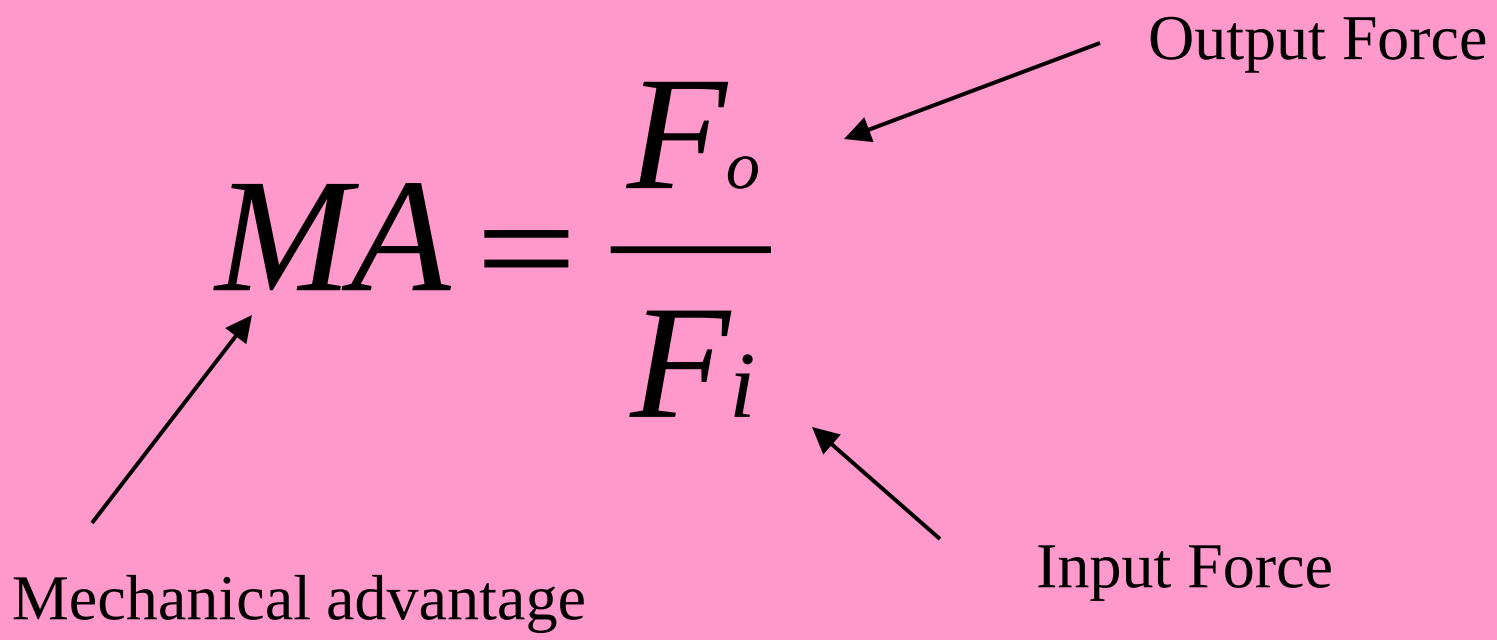
Simple machines

- A simple machine is a mechanical device that does not have a source of power and accomplishes a task with only one movement



Mechanical Advantage

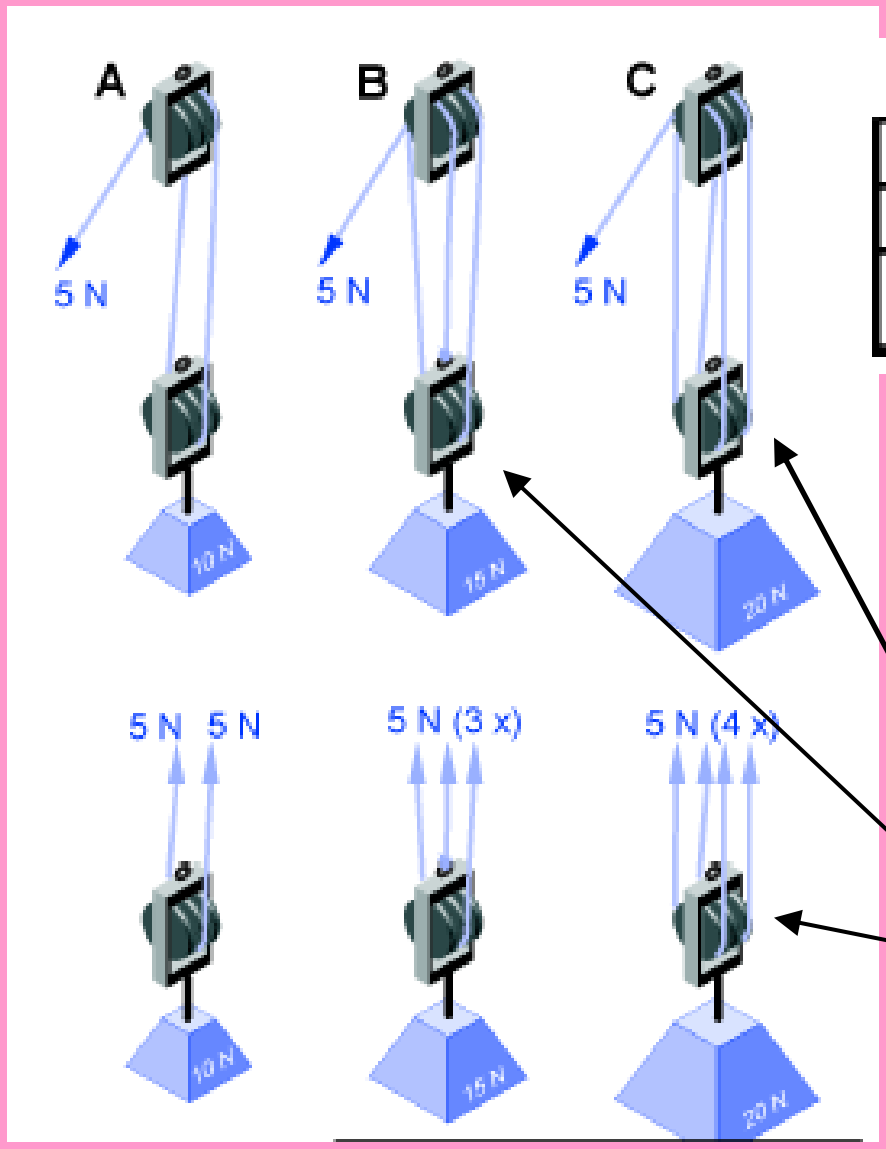
- Mechanical advantage is the ratio of output force to input force
- If mechanical advantage is greater than 1, the output force is bigger than the input force.
- A mechanical advantage smaller than one means the output force is less than the input force.



Example:
A mechanical advantage of 2 means that the output force is two times stronger than the input force

Pulleys

- The tension on a rope is a pulling force that acts along the direction of the rope
- The force on the rope is the same everywhere.
- You can arrange pulleys different ways to increase or decrease its mechanical advantage

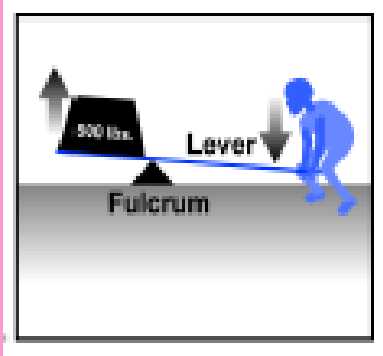


	A	B	C
Input force	5 N	5 N	5 N
Output force	10 N	15 N	20 N
Mechanical advantage	2	3	4

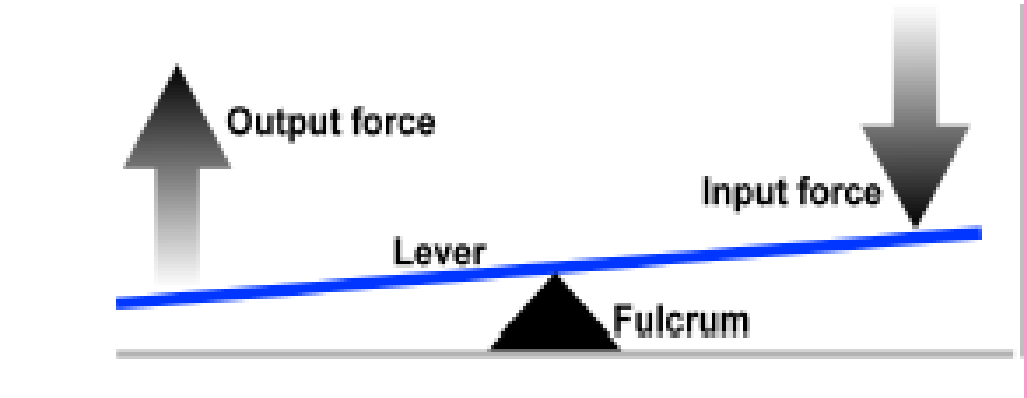
Mechanical advantage of a pulley equals the number of ropes around the moveable pulley

Moveable pulley

Levers

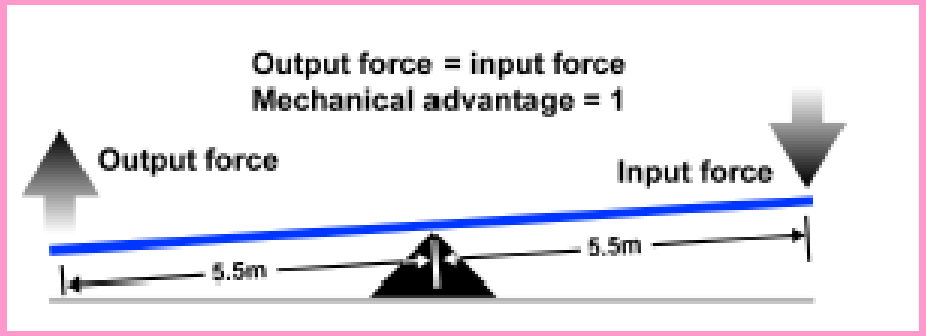


- A lever is a stiff structure that rotates around a fixed point called a fulcrum.
- The side of the lever where the input force is applied is called the input arm
- The side of the lever that moves objects is the output arm



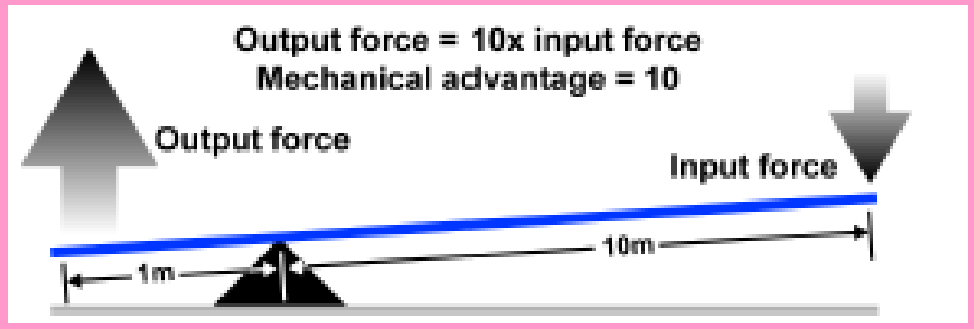
Mechanical Advantage of Lever

$$MA = \frac{Length_{input}}{Length_{output}}$$



$$MA = \frac{5.5}{5.5} = 1$$

$$MA = \frac{10}{1} = 10$$



Types of Levers

- There are three types of levers
- They are classified by the location of the input and output forces and the fulcrum
- The mechanical advantage is always the ratio of the lengths of the input arm over the output arm.