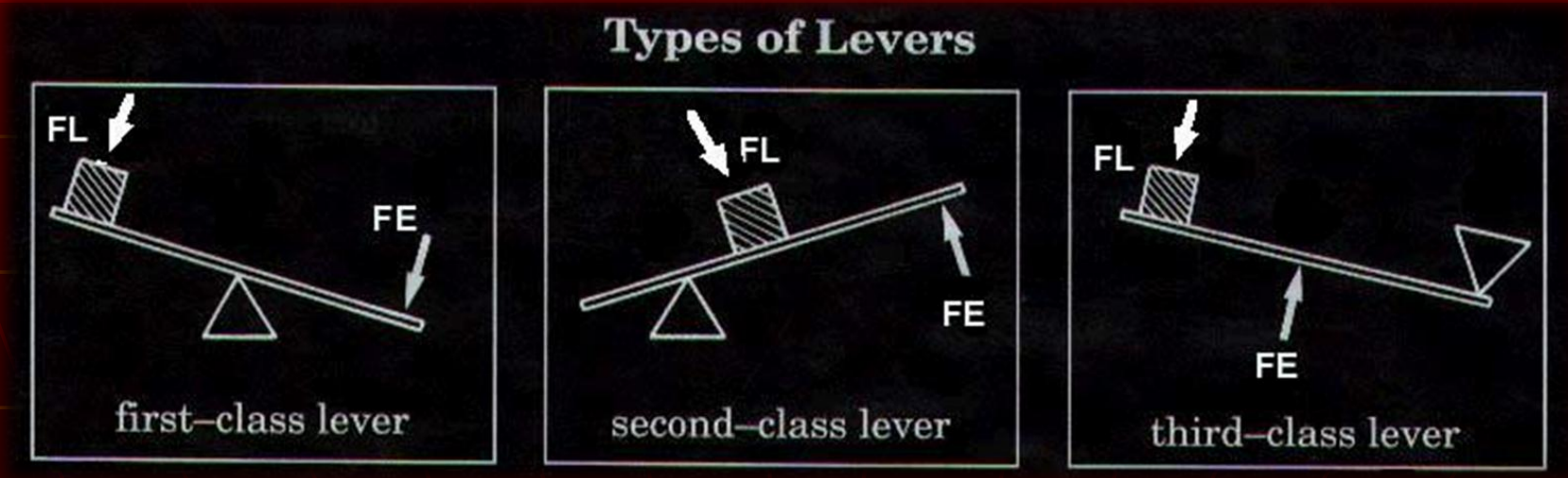
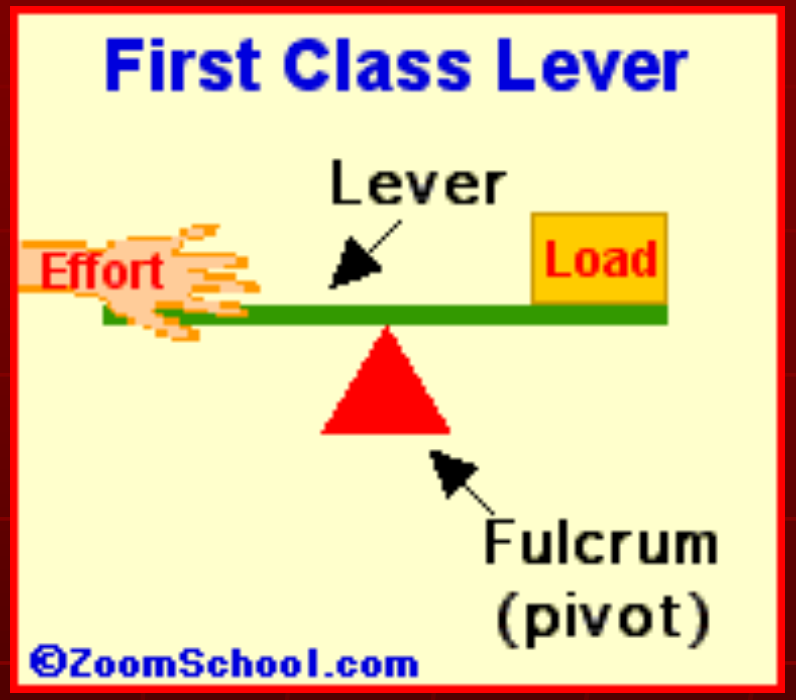
Lever

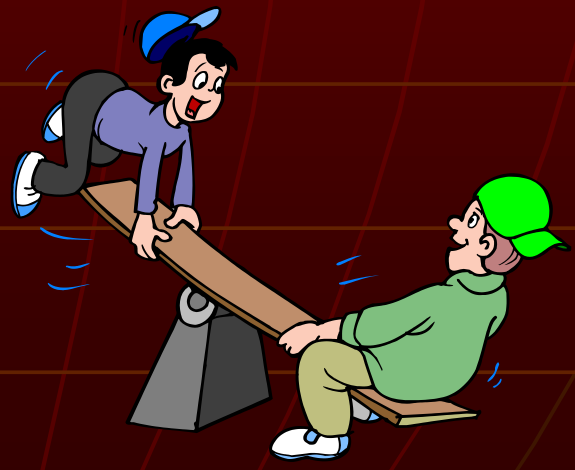
- A lever is a solid bar that rotates, or turns, around a fixed point.
- The fixed point is called a **fulcrum**.
- A lever can multiply the input force and change the direction of the force.
- The way in which a lever changes an input force depends on the position of the fulcrum.



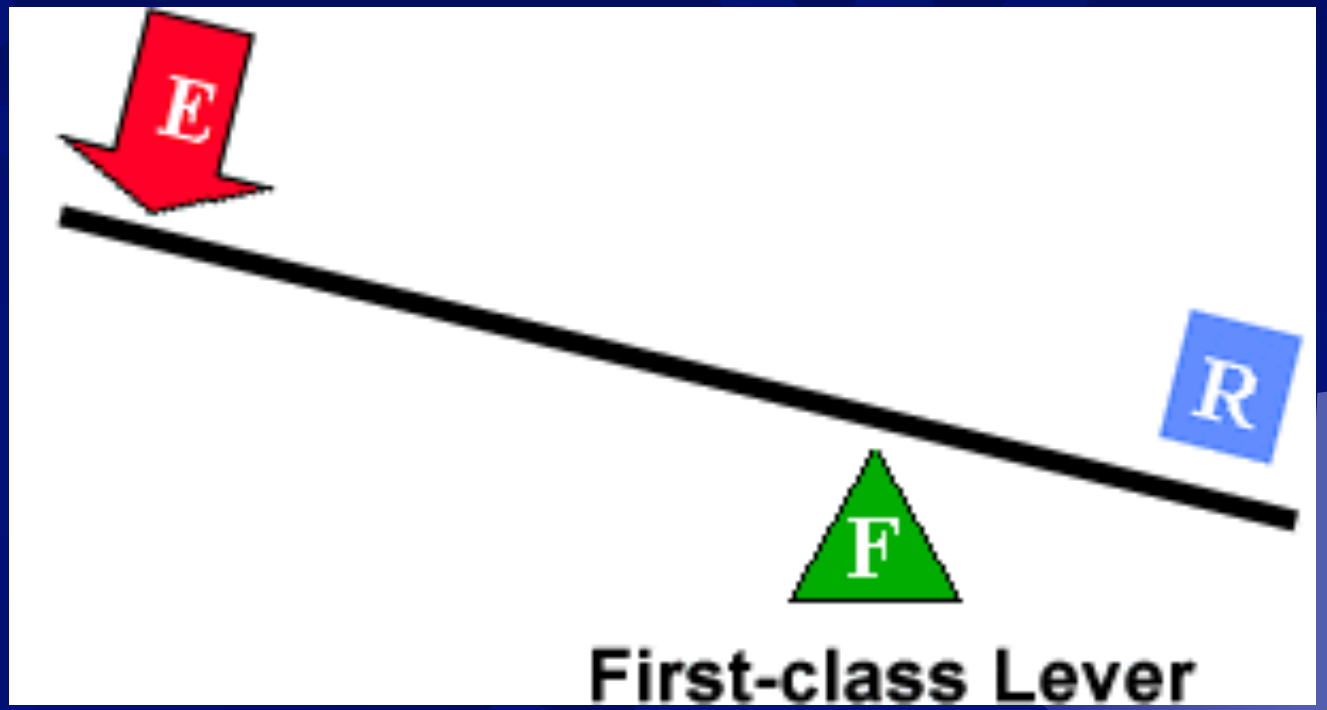
First Class Lever

- Common examples of first-class levers include crowbars, scissors, pliers, tin snips and seesaws.





First Class Lever

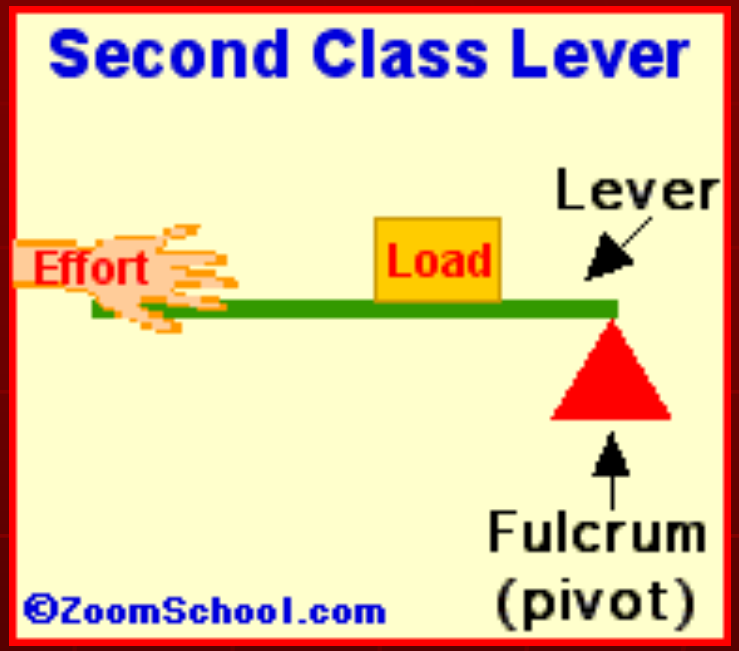


Fulcrum is between EF (effort) and RF (load)
Effort moves farther than Resistance.
Multiplies EF and changes its direction

The mechanical advantage of a lever is the ratio of the length of the lever on the applied force side of the fulcrum to the length of the lever on the resistance force side of the fulcrum.

Second Class Lever

- Examples of second-class levers include nut crackers, wheel barrows, doors, and bottle openers.



Second Class Lever

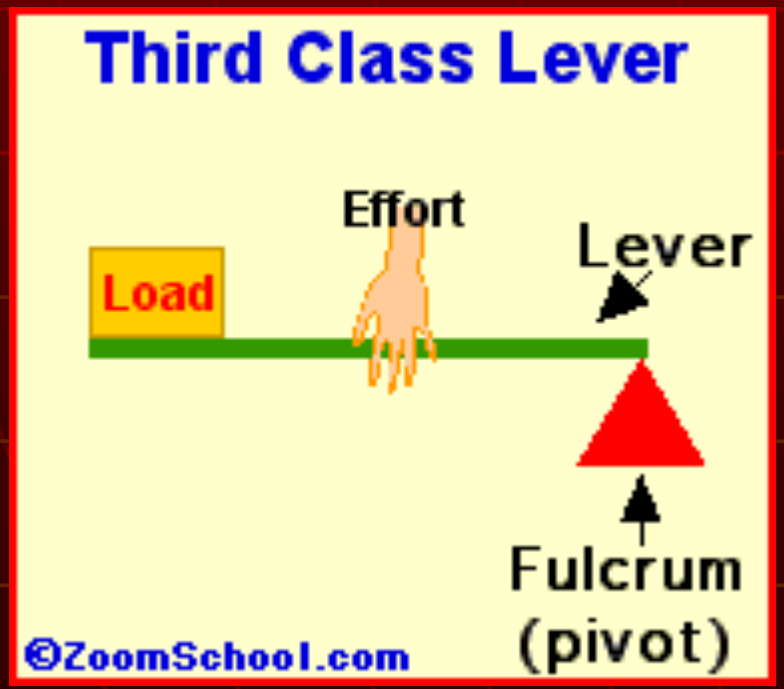
RF (load) is between fulcrum and EF
Effort moves farther than Resistance.

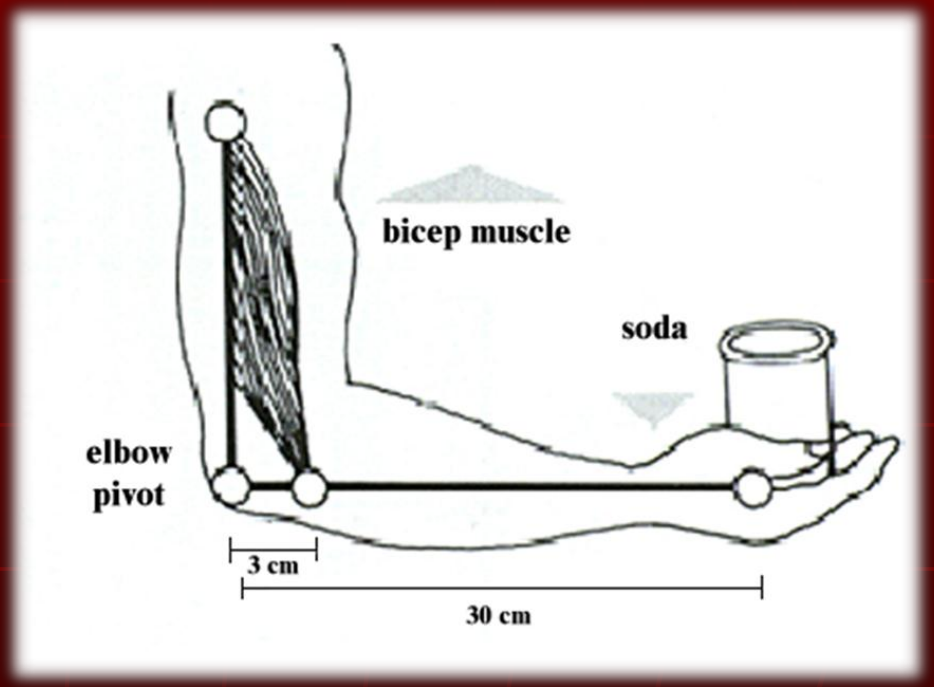
Multiplies EF, but does not change its direction

The mechanical advantage of a lever is the ratio of the distance from the applied force to the fulcrum to the distance from the resistance force to the fulcrum.

Third Class Lever

- Examples of third-class levers include tweezers, arm hammers, and shovels.





Third Class Lever

EF is b

Does not multiply force

Resistance moves farther than Effort.

Multiplies the distance the effort force travels

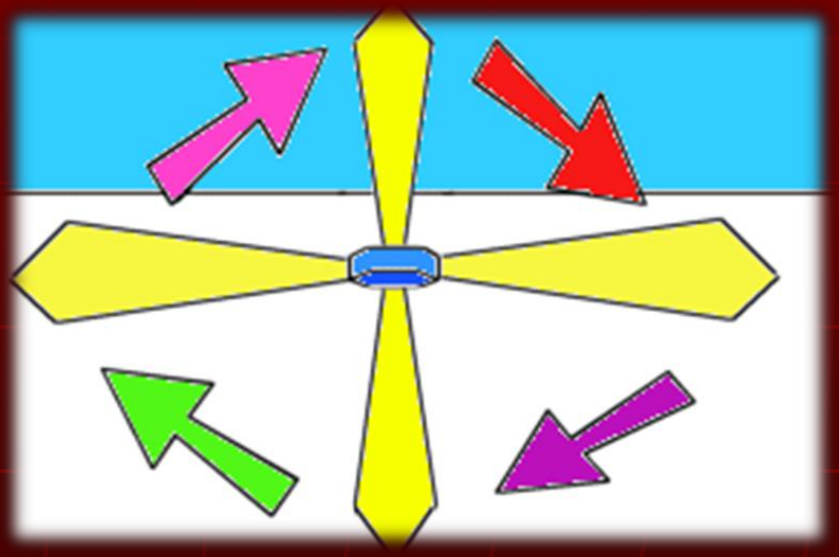
The mechanical advantage of a lever is the ratio of the distance from the applied force to the fulcrum to the distance of the resistance force to the fulcrum

Wheel & Axle

- The wheel and axle act like a rotating collection of levers.
- The axle is like a fulcrum.
- When the axle turns the wheel, there is greater distance and therefore less force that needs to be applied from the axle.

Wheel & Axel

- The axle is stuck rigidly to a large wheel.
- Fan blades are attached to the wheel. When the axel turns, the fan blades spin.



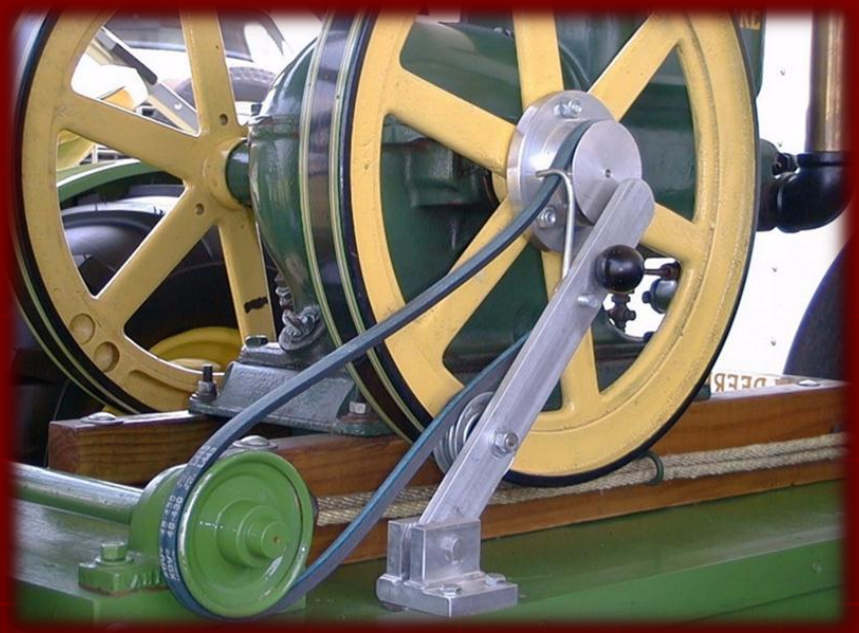
Wheel and Axel

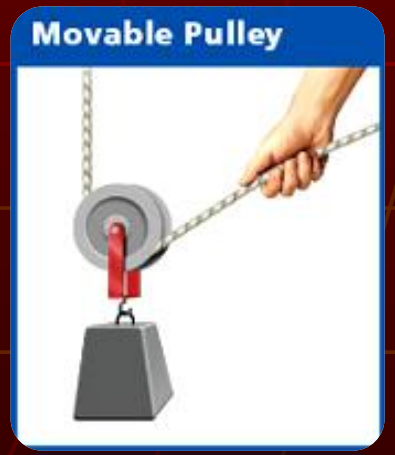
- The mechanical advantage of a wheel and axle is the ratio of the radius of the wheel to the radius of the axle.

- In the wheel and axle illustrated above, the radius of the wheel is five times larger than the radius of the axle. Therefore, the mechanical advantage is 5:1 or 5.
- The wheel and axle can also increase speed by applying the input force to the axle rather than a wheel. This increase is computed like mechanical advantage. This combination would increase the speed 5 times.

Pulleys

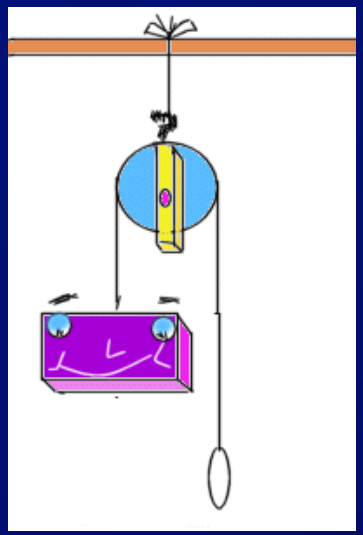
- Pulleys are wheels and axles with a groove around the outside
- The single pulley makes work easier by changing the direction of the force
- A pulley needs a rope, chain, or belt around the groove to make it do work





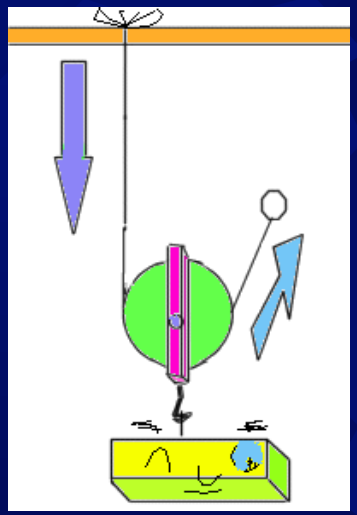
Diagrams of Pulleys

Fixed pulley:



A fixed pulley changes the direction of a force; however, it does not create a mechanical advantage.

Movable Pulley:



The mechanical advantage of a moveable pulley is equal to the number of ropes that support the moveable pulley.