

Machines

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Machines

- ▶ A Machine is a device that is used to either:
 - (a) multiply our force, or
 - (b) change the direction of our force
 to help us do work (or transform energy).
- ▶ We do WORK ($W=Fd$) on a machine and the machine does WORK ($W=Fd$) for us.
- ▶ We provide the INPUT WORK and the machine gives us OUTPUT WORK.

Lever

- ▶ The lever is a simple machine made with a stiff structure that is free to move about a fixed point called a fulcrum.

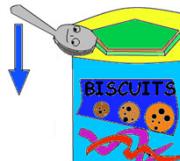
Parts of a Lever

- ▶ Fulcrum – The pivot point on a lever.
- ▶ Effort Arm – the part of the lever in which the effort force is applied.
- ▶ Resistance arm – the part of the lever that exerts the resistance force.



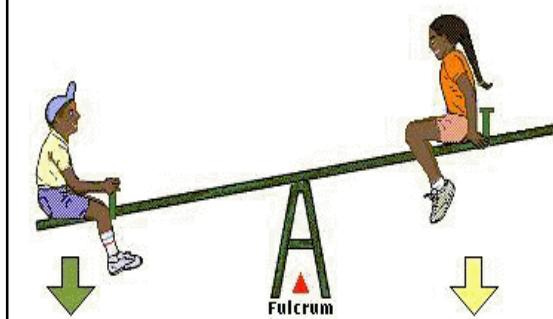
First Class Lever

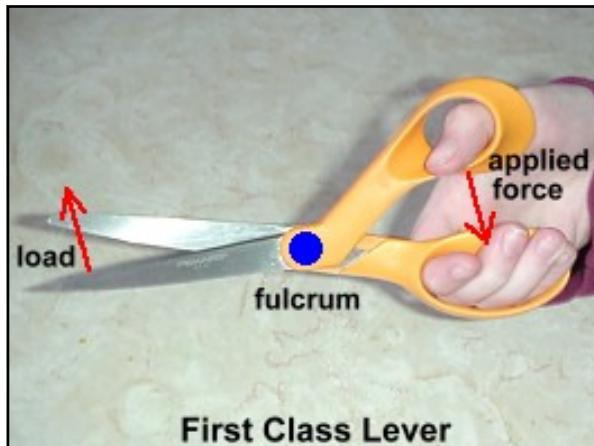
- ▶ The first class lever is the one with the fulcrum in the center. Also notice the lever changes the direction of force. As the handle of the spoon goes down, the lid goes up.



First Class Levers

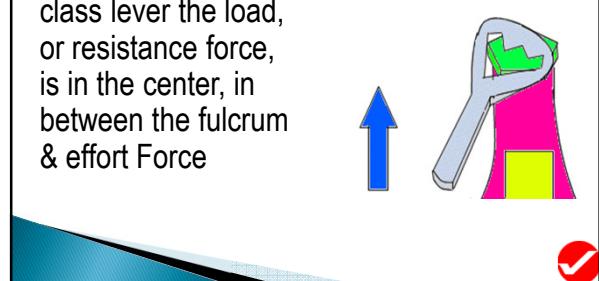
In a first class lever, the fulcrum is placed between the effort and the load.



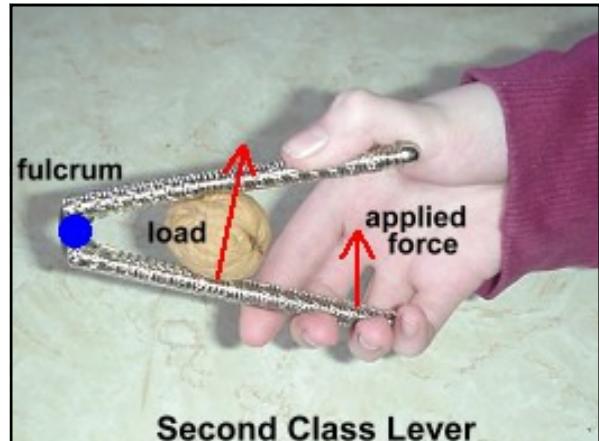
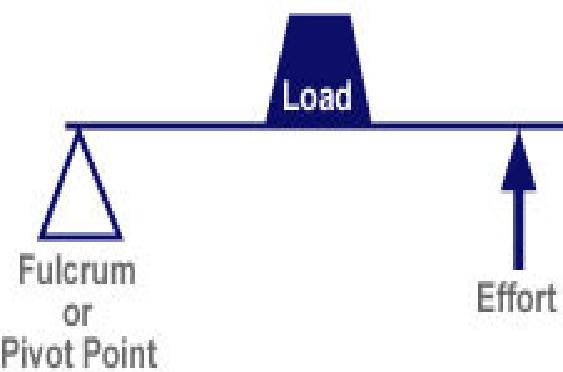


Second Class Lever

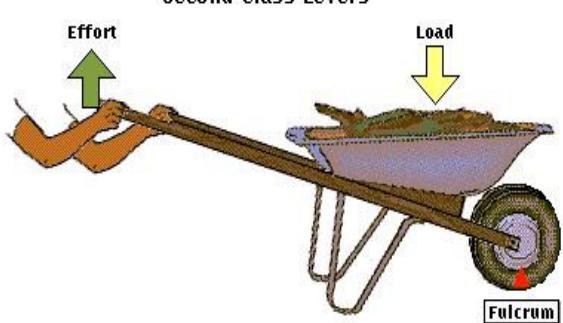
- For the second class lever the load, or resistance force, is in the center, in between the fulcrum & effort Force



Class 2 Lever

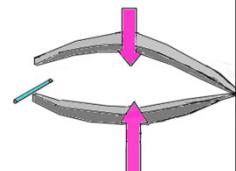


Second Class Levers

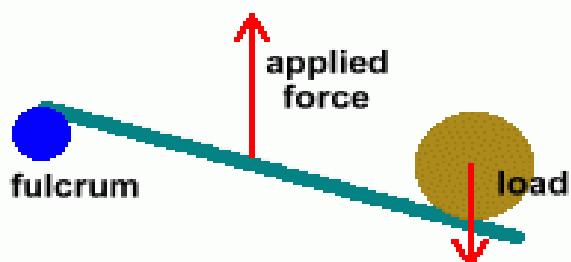


Third Class Lever

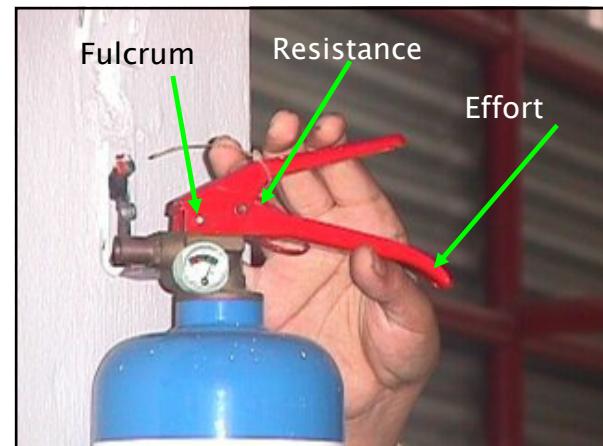
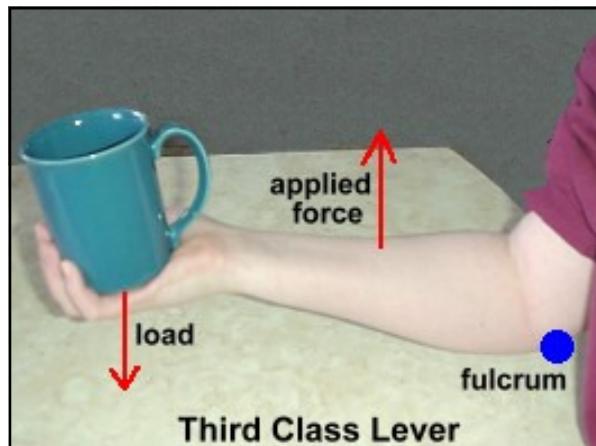
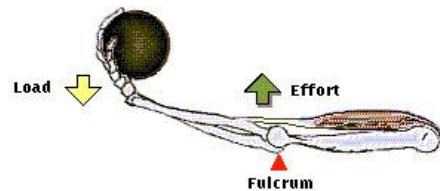
- The third class lever has the input force in the center. No matter how close or how far the load is from the fulcrum, the input force used to lift the load, has to be greater than the output force!



Third Class Lever



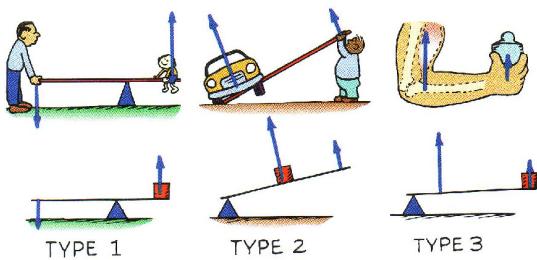
Third Class Levers



Lever Review

- ▶ Levers have fulcrums, resistance arms, effort arms.
- ▶ First Class Lever = EFR
- ▶ Second Class Lever = FRE
- ▶ Third Class Lever = FER

Types of Levers



Levers Review

- ▶ 1st = RFE
- ▶ 2nd = FRE
- ▶ 3rd = FER



Pulley

- ▶ A pulley is a grooved wheel with a rope, chain, or cable running in the groove.

How Pulleys Work?

- ▶ Ropes and strings are tension (stretch) forces.
- ▶ Tension force is pulling force that always acts along the direction of the rope.
- ▶ Never pushing forces.

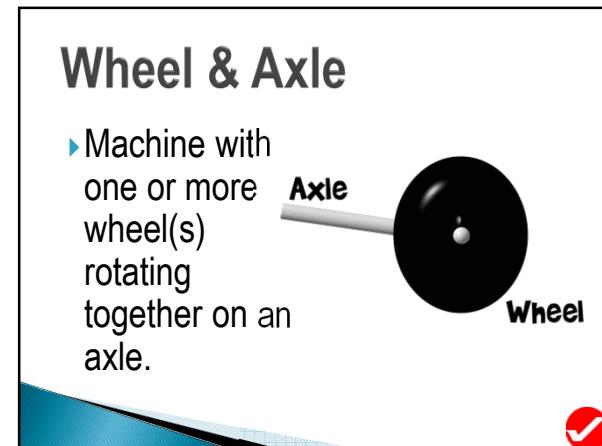
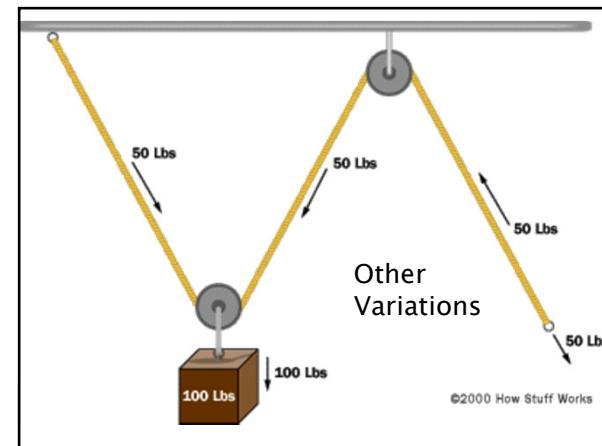
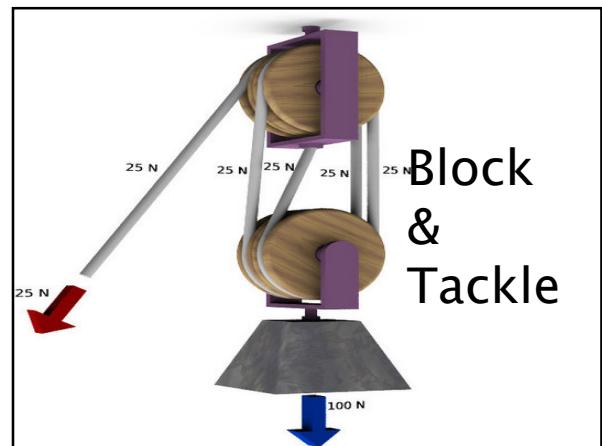
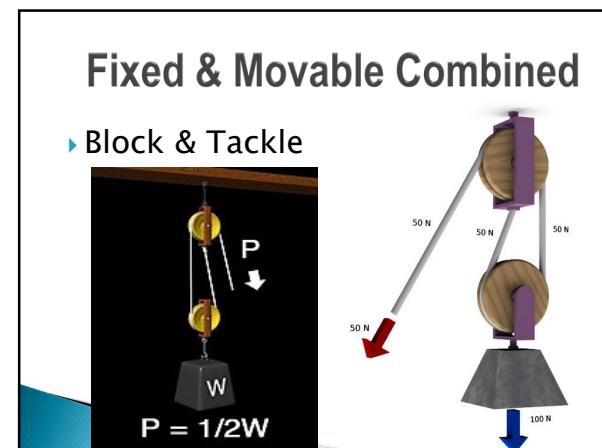
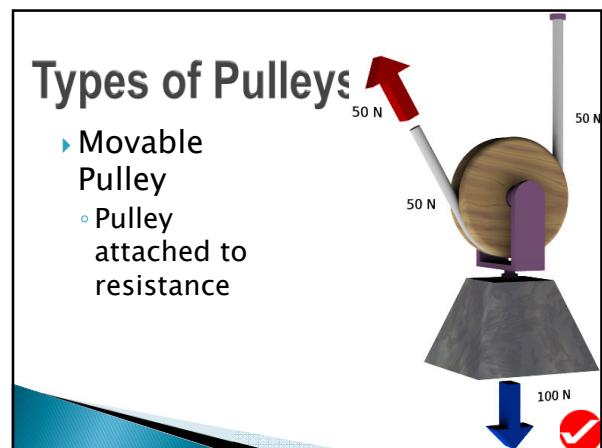
Pulley

- ▶ Every part of the rope in a pulley has the same tension, from the beginning to the end.

Types of Pulleys

- ▶ Fixed Pulley

Flag Pole





Wheel & Axe (FAN)

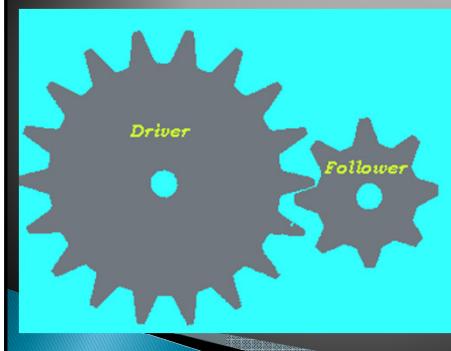


Wheel & Axle - Gears

❑ Gears are a modified wheel & axle. The teeth contact each other and transfer movement



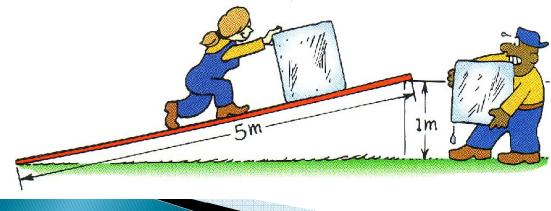
Gears



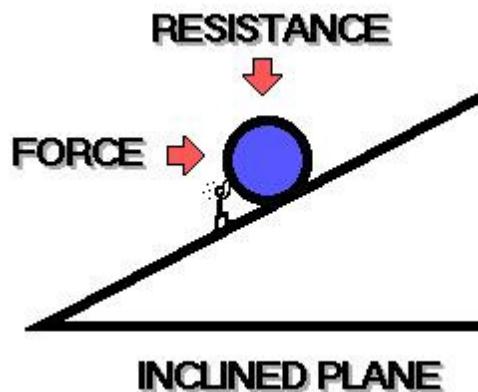
Inclined Plane

Inclined Plane

- An inclined plane is a sloping surface that reduces the amount of force required to do work.



Inclined Plane



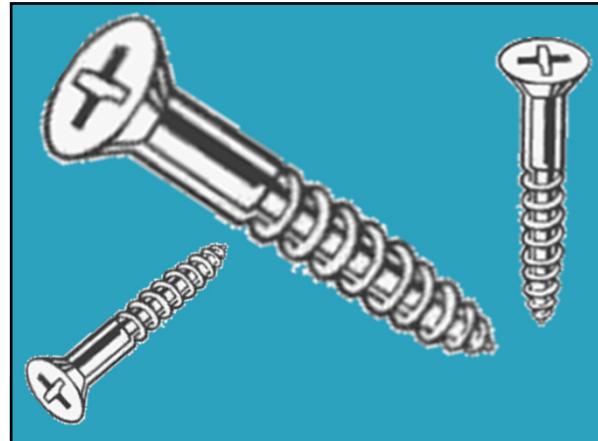
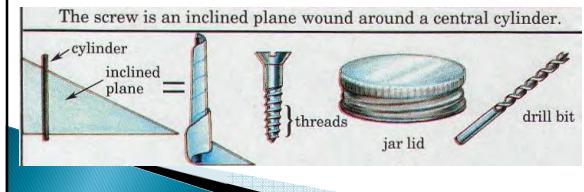
Wedge



Screw

Screw

- An inclined Plane wrapped around a cylindrical post.



Compound Machine

- Any object that uses a combination of two or more simple machines.



Simple Machines Review

- Lever
- Pulley
- Inclined plane
- Wedge
- Screw
- Wheel & Axle
 - Gears

We use machines to help us make work easier by letting us apply a smaller force for a longer distance.

The mechanical advantage is the amount a machine multiplies our input force to make a larger output force.

