



Brake System Fundamentals

Matthew Whitten
Brookhaven College



Functions



- ❑ The brake system is the most important system on a vehicle.
 - ❑ It has four basic functions
 - Slowing a moving vehicle
 - Bring a vehicle to a stop
 - Hold a vehicle stationary when stopped
 - Allow directional control during emergency maneuvers. (ABS, Activ-trac)
 - ❑ Changing or holding a vehicle's kinetic.
-



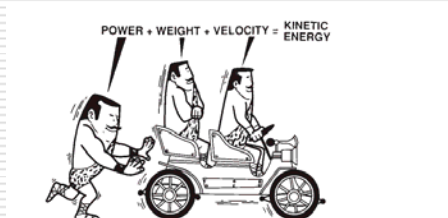
Components of braking

- Energy
 - Kinetic
 - Friction
 - Kinetic
 - Static
 - Power
 - Changing kinetic energy to heat
 - Hydraulic pressure
-



Kinetic energy

- Definition:
 - The energy of motion
- The amount of energy a vehicle possesses depends on:
 - Power
 - Velocity
 - Weight
- All components together = kinetic energy.





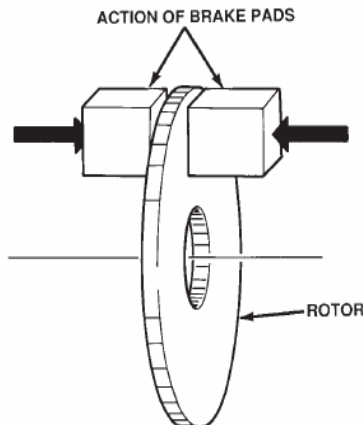
Calculate Kinetic energy.

- What is the kinetic energy of a 4 kilogram ball moving at 10 meters per second?

- $KE = \frac{1}{2} mv^2$
- $KE = .5 (4) (10)^2$
- $KE = (2) (100)$
- $KE = 200 \text{ joules}$



Friction



- Definition: The force that resists motion between the surfaces of two objects or forms of matter.
 - The resistance of the rotor to spin when pressure is applied to the pads.
-



Friction

- Types:
 - Kinetic
 - Static
 - Kinetic friction is the friction between an object and a surface while the object is MOVING with respect to that surface
 - Static friction is the force that acts when there is no relative motion between the surfaces of two objects.
-



Measure of Friction

- Measure of Friction.
 - Coefficient of friction: A numerical value that expresses the amount of friction between two objects
 - The coefficient of friction equals the force required to move the object divided by the weight force of the object
 - $U_s = ff / F_N$
-



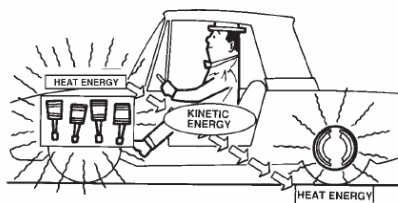
Do Brakes produce power?

- ❑ Yes.
 - Power is the rate at which something changes its state of energy.
 - In the case of brakes they accelerate the vehicle in the opposite manner of the engine.
 - ❑ IE. If a vehicle can accelerate 0mph to 60mph in 12 seconds and can slow down 60mph to 0mph in 3 seconds, we can assume that the brakes are 4 times more powerful than the engine.
-



Conversion of energy

- ❑ Once a vehicle is in motion it will stay in motion until another force acts upon it.
- ❑ The opposing force must eliminate the kinetic energy by converting it.
- ❑ What form of energy do brake systems convert the kinetic energy to?
 - HEAT





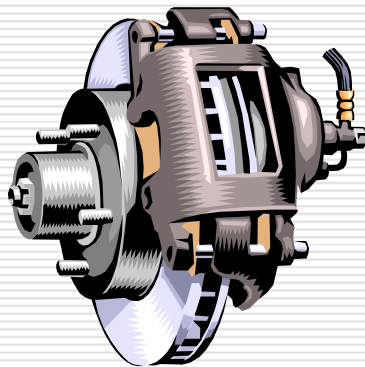
Hydraulic Pressure

- ❑ Modern braking systems use hydraulic brake actuation.
- ❑ This method allows for increased mechanical advantage during the application of the brakes.



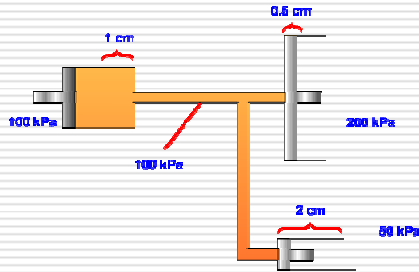
Hydraulic Principles

- ❑ A wheel cylinder or caliper piston's output force is equal to the hydraulic system pressure multiplied by the area of the piston.
- ❑ $F = P \times A$





Hydraulics



- Increasing the size of the output piston
 - Increases output force
 - Decreases output travel
- Disc brakes require more output force than drum brakes



Hydraulics

