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Brakes

A **brake** is a [mechanical device](http://en.wikipedia.org/wiki/Machine) which inhibits motion, slowing or stopping a moving object or preventing its motion.

Most commonly brakes use [friction](http://en.wikipedia.org/wiki/Friction)(berze) between two surfaces pressed together to convert the [kinetic energy](http://en.wikipedia.org/wiki/Kinetic_energy) of the moving object into [heat](http://en.wikipedia.org/wiki/Heat), though other methods of energy conversion may be employed. For example [regenerative braking](http://en.wikipedia.org/wiki/Regenerative_braking) converts much of the energy to [electrical energy](http://en.wikipedia.org/wiki/Electrical_energy), which may be stored for later use. Other methods convert [kinetic energy](http://en.wikipedia.org/wiki/Kinetic_energy) into [potential energy](http://en.wikipedia.org/wiki/Potential_energy) in such stored forms as [pressurized air](http://en.wikipedia.org/wiki/Compressed_air_energy_storage) or pressurized oil. [Eddy current brakes](http://en.wikipedia.org/wiki/Eddy_current_brakes) use magnetic fields to convert kinetic energy into electric current in the brake disc, fin, or rail, which is converted into heat. Still other braking methods even transform [kinetic energy](http://en.wikipedia.org/wiki/Kinetic_energy) into different forms, for example by transferring the energy to a rotating flywheel.

Brakes are generally applied to rotating axles or wheels, but may also take other forms such as the surface of a moving fluid (flaps deployed into water or air). Some vehicles use a combination of braking mechanisms, such as drag racing cars with both wheel brakes and a parachute, or airplanes with both wheel brakes and drag flaps raised into the air during landing.

Since kinetic energy increases [quadratically](http://en.wikipedia.org/wiki/Quadratic_function) with [velocity](http://en.wikipedia.org/wiki/Velocity) (K=mv^2/2), an object moving at 10 m/s has 100 times as much energy as one of the same mass moving at 1 m/s, and consequently the theoretical [braking distance](http://en.wikipedia.org/wiki/Braking_distance), when braking at the traction limit, is 100 times as long. In practice, fast vehicles usually have significant air drag, and energy lost to air drag rises quickly with speed.

Almost all [wheeled](http://en.wikipedia.org/wiki/Wheel) [vehicles](http://en.wikipedia.org/wiki/Vehicle) have a brake of some sort. Even [baggage carts](http://en.wikipedia.org/wiki/Baggage_cart) and [shopping carts](http://en.wikipedia.org/wiki/Shopping_cart) may have them for use on a [moving ramp](http://en.wikipedia.org/wiki/Moving_ramp). Most [fixed-wing aircraft](http://en.wikipedia.org/wiki/Fixed-wing_aircraft) are fitted with [wheel brakes](http://en.wikipedia.org/wiki/Aircraft_disc_brake) on the [undercarriage](http://en.wikipedia.org/wiki/Landing_gear). Some aircraft also feature [air brakes](http://en.wikipedia.org/wiki/Air_brake_%28aircraft%29) designed to reduce their speed in flight. Notable examples include [gliders](http://en.wikipedia.org/wiki/Glider_aircraft) and some [World War II](http://en.wikipedia.org/wiki/World_War_II)-era aircraft, primarily some [fighter aircraft](http://en.wikipedia.org/wiki/Fighter_aircraft) and many [dive bombers](http://en.wikipedia.org/wiki/Dive_bombers) of the era. These allow the aircraft to maintain a safe speed in a steep descent. The [Saab B 17](http://en.wikipedia.org/wiki/Saab_17) [dive bomber](http://en.wikipedia.org/wiki/Dive_bomber) and [Vought F4U Corsair](http://en.wikipedia.org/wiki/Vought_F4U_Corsair) fighter used the deployed undercarriage as an air brake.

[Friction brakes](http://en.wikipedia.org/wiki/Vehicle_brake#Friction_brake) on [automobiles](http://en.wikipedia.org/wiki/Automobile) store braking heat in the [drum brake](http://en.wikipedia.org/wiki/Drum_brake) or [disc brake](http://en.wikipedia.org/wiki/Disc_brake) while braking then conduct it to the [air](http://en.wikipedia.org/wiki/Air) gradually. When traveling downhill some vehicles can [use their engines to brake](http://en.wikipedia.org/wiki/Engine_braking).

When the brake [pedal](http://en.wikipedia.org/wiki/Automobile_pedal) of a modern vehicle with [hydraulic brakes](http://en.wikipedia.org/wiki/Hydraulic_brake) is pushed, ultimately a [piston](http://en.wikipedia.org/wiki/Piston) pushes the [brake pad](http://en.wikipedia.org/wiki/Brake_pad) against the [brake disc](http://en.wikipedia.org/wiki/Disc_brake) which slows the wheel down. On the [brake drum](http://en.wikipedia.org/wiki/Brake_drum) it is similar as the cylinder pushes the [brake shoes](http://en.wikipedia.org/wiki/Brake_shoe) against the drum which also slows the wheel down.

In [cars](http://en.wikipedia.org/wiki/Automobile), the **parking brake**, also called**hand brake**, **emergency brake**, or **e-brake**, is a latching [brake](http://en.wikipedia.org/wiki/Brake) usually used to keep the vehicle stationary. It is sometimes also used to prevent a vehicle from rolling when the operator needs both feet to operate the clutch and throttle pedals. Automobile hand brakes usually consist of a [cable](http://en.wikipedia.org/wiki/Cable) directly connected to the brake mechanism on one end and to a lever or foot pedal at the driver's position. The mechanism is often a hand-operated [lever](http://en.wikipedia.org/wiki/Lever) (hence the *hand brake* name), on the floor on either side of the [driver](http://en.wikipedia.org/wiki/Driving), or a pull handle located below and near the steering wheel column, or a (foot-operated) [pedal](http://en.wikipedia.org/wiki/Automobile_pedal) located far apart from the other pedals.

Although sometimes known as an emergency brake, using it in any emergency where the footbrake is still operational is likely to badly upset the brake balance of the car and vastly increase the likelihood of loss of control of the vehicle, for example by initiating a rear-wheel skid. Additionally, the stopping force provided by using the handbrake is small and would not significantly aid in stopping the vehicle. The parking brake operates mostly on the rear wheels, which have reduced traction while braking but in some cases, parking brake operates on front wheel, as done in most Citroens manufactured since the end of World War II. The hand brake is instead intended for use in case of mechanical failure where the regular footbrake is inoperable or compromised. Modern brake systems are typically very reliable and equipped with [dual-circuit](http://en.wikipedia.org/wiki/Hydraulic_Brake#Component_specifics) hydraulics and low-brake-fluid sensor systems, meaning the handbrake is rarely used to stop a moving vehicle.

The most common use for a parking brake is to keep the vehicle motionless when it is [parked](http://en.wikipedia.org/wiki/Parking). Parking brakes have a [ratchet](http://en.wikipedia.org/wiki/Ratchet_%28device%29) [locking](http://en.wikipedia.org/wiki/Lock_%28security_device%29) mechanism that will keep them engaged until a release button is pressed. On vehicles with [automatic transmissions](http://en.wikipedia.org/wiki/Automatic_transmission), this is usually used in concert with a [parking pawl](http://en.wikipedia.org/wiki/Parking_pawl) in the transmission. Automotive safety expertsrecommend the use of both systems to immobilize a parked car, and the use of both systems is required by law in some places, yet many individuals use only the "Park" position on the automatic transmission and not the parking brake. It's similar with manual transmission cars: They are recommended always to be left with the handbrake engaged, in concert with their lowest gear (usually either first or reverse). The use of both systems is also required by law in some jurisdictions. However, when parking on level ground, many people either only engage the handbrake (gear lever in neutral), or only select a gear (handbrake released). If parking on a hill with only one system results in the car rolling and damaging the car or other property, insurance companies in some countries, for example in Germany, aren’t required to pay for the damages.

Hand brakes are also used to assist in hill starts on vehicles with [manual transmissions](http://en.wikipedia.org/wiki/Manual_transmission). Use of the handbrake frees both feet for use on the accelerator and clutch pedals, allowing the car to move off without rolling back at all.

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