FIGURE 5.1 Hydraulic brake lines transfer the brake effort to each brake assembly attached to all four wheels.

FIGURE 5.2 Because liquids cannot be compressed, they are able to transmit motion in a closed system.
FIGURE 5.3 Hydraulic system must be free of air to operate properly.

FIGURE 5.4 A one-pound force exerted on a small piston in a sealed system transfers the pressure to each square inch throughout the system.

FIGURE 5.5 The amount of force \( F \) on the piston is the result of pressure \( P \) multiplied by the surface area \( A \).
FIGURE 5.6 The brake pad (friction material) is pressed on both sides of the rotating rotor by the hydraulic pressure of the caliper.

FIGURE 5.7 Mechanical force and the master cylinder piston area determine the hydraulic pressure in the brake system.

FIGURE 5.8 Hydraulic pressure is the same throughout a closed system and acts with equal force on equal areas.
FIGURE 5.9 Differences in brake caliper and wheel cylinder piston area have a major effect on brake application force.

FIGURE 5.10 The increase in application force created by the large brake caliper piston is offset by a decrease in piston travel.

FIGURE 5.11 A master cylinder showing the see-through reservoir and the location of the brake fluid level sensor with a cutaway showing the internal pistons.
FIGURE 5.12 Master cylinder with brake fluid level at the “max” (maximum) line.

FIGURE 5.13 The typical brake pedal is supported by a mount and attached to the pushrod by a U-shaped bracket. The pin used to retain the clevis to the brake pedal is usually called a clevis pin.

FIGURE 5.14 A cutaway of a master cylinder. The reservoir feeds both chambers and uses a fluid level switch that activates the red brake warning lamp if the brake fluid level drops too low.
FIGURE 5.15 Note the various names for the vent port (front port) and the replenishing port (rear port).

FIGURE 5.16 The vent ports must remain open to allow brake fluid to expand when heated by the friction material and transferred to the caliper and/or wheel cylinder.

FIGURE 5.17 As the brake pedal is depressed, the pushrod moves the primary piston forward, closing off the vent port.
FIGURE 5.18 The purpose of the replenishing port is to keep the volume behind the primary piston filled with brake fluid from the reservoir as the piston moves forward during a brake application.

FIGURE 5.19 When the brake pedal is released, the master cylinder piston moves rearward. Some of the brake fluid is pushed back up through the replenishing port, but most of the fluid flows past the sealing cup.

FIGURE 5.20 Rear-wheel-drive vehicles use a dual split master cylinder.
FIGURE 5.21 The primary outlet is closest to the pushrod end of the master cylinder and the secondary outlet is closest to the nose end of the master cylinder.

FIGURE 5.22 In the event of a primary system failure, no hydraulic pressure is available to push the second piston forward.

FIGURE 5.23 Front-wheel-drive vehicles use a diagonal split master cylinder.
FIGURE 5.24 Quick-take-up master cylinder can be identified by the oversize primary low-pressure chamber.

FIGURE 5.25 A brake pedal depressor like this can be used during brake service to block the flow of brake fluid from the master cylinder during service work on the hydraulic system.

FIGURE 5.26 Seepage at the booster indicates a leaking secondary (end) seal.
FIGURE 5.27 Pedal height is usually measured from the floor to the top of the brake pedal.

FIGURE 5.28 Pedal height is usually measured from the floor to the top of the brake pedal.

FIGURE 5.29 Brake pedal free play is the distance between the brake pedal fully released and the position of the brake pedal when braking resistance is felt.
FIGURE 5.30 Measure the unapplied distance between the brake pedal and the steering wheel.

FIGURE 5.31 Apply the brakes and measure the distance again.

FIGURE 5.32 Use a pry bar to carefully remove the reservoir from the master cylinder.
FIGURE 5.33 Piston assembly.

FIGURE 5.34 To reinstall the reservoir onto a master cylinder, place the reservoir on a clean flat surface and push the housing down onto the reservoir after coating the rubber seals with brake fluid.

FIGURE 5.35 Bleeding a master cylinder before installing it on the vehicle.
FIGURE 5.36 Installing a master cylinder. Always tighten the retaining fasteners and brake lines to factory specifications.