FIGURE 67.1 Many light trucks and sport utility vehicles use a transfer case to provide engine torque to all four wheels and to allow a gear reduction for maximum power to get through mud or snow.

FIGURE 67.2 Cutaway of a manually-operated locking hub.
Manual locking hubs require that the hubs be rotated to the locked position by hand to allow torque to be applied to the front wheels. Automatic locking hubs enable the driver to shift to four-wheel drive from inside the vehicle.

If a four-wheel-drive vehicle must be towed, it should either be on (a) a flatbed truck or (b) a dolly.

When turning a corner, each wheel takes a slightly different path and rotates at a slightly different speed. Unlike a part-time four-wheel-drive system, which, when engaged, locks the front and rear axles together, a full-time system uses a center differential that allows for any speed differences between the front and rear sides, it can therefore be activated on any surface—slippery or dry.
FIGURE 67.6 A viscous coupling is a sealed unit containing many steel discs. One-half of these are splined to the input shaft, with every other disc splined to the output shaft. Surrounding these discs is thick, silicon-silicone fluid that expands when hot and effectively locks the discs together. A viscous coupling is completely sealed and replaced as an assembly if defective.

FIGURE 67.7 The center differential is the heart of a typical all-wheel-drive system. All-wheel-drive systems do not have a low range, and therefore the vehicle may not be able to go off road like a vehicle equipped with a four-wheel drive with a low range.

FIGURE 67.8 A typical transfer case is attached to the output of the transmission and directs engine torque to the rear or to the front and rear differentials.
FIGURE 67.9 An exploded view of a New Venture 241 transfer case.

FIGURE 67.10 (a) When one axle shaft is disconnected, both front wheels can rotate independently, reducing excessive tire wear. (b) In four-wheel drive mode, vacuum is applied to the front part and the opposite side is vented to atmospheric pressure retracting the shift motor stem. The shift fork and collar move into engagement with both axle shaft gears. Engine torque from the front differential can now be applied to both front wheels. When the transfer case is placed in two-wheel drive, the vacuum is applied to the other side of the diaphragm, and the shift collar retracts, unlocking the front axles.

FIGURE 67.11 A General Motors sport utility vehicle front axle showing the electric axle disconnect actuator.
FIGURE 67.12 The range shift selector on a Hummer H1 sport utility vehicle. This vehicle is always in four-wheel drive, but the driver can select neutral (N) or low range.

FIGURE 67.13 A typical planetary gear set used in a transfer case.

FIGURE 67.14 Cutaway of a planetary gear set transfer case.
FIGURE 67.15 Four-wheel drive/high-range torque flow in a NV231 transfer case. The sliding range clutch is shifted to the forward position by the range lever and fork, which connects the input gear to the output shaft and rear axle. The mode synchronizer sleeve is moved out of engagement from the drive sprocket to remove torque from the front axle.

FIGURE 67.16 Four-wheel drive/high-range torque flow in a NV231 transfer case. The range clutch position remains the same as in two-wheel drive/high-range, but the synchronizer sleeve is moved rearward and engages the drive sprocket clutch teeth. This action contracts the drive sprocket to the rear output shaft, thereby applying equal torque to both front and rear output shafts.

FIGURE 67.17 Four-wheel drive/low-range torque flow in a NV231 transfer case. The mode synchronizer assembly remains engaged and the range clutch is moved to the rearward position. The annulus (ring) gear is fixed to the case and the input (sun) gear drives the pinion gears, which walk around the stationary annulus gear and drive the planetary carrier and output shaft at a speed lower than the input gear.
FIGURE 67.18 A bevel gear-type interaxle differential.

FIGURE 67.19 A viscous coupling. Note that the unit is attached to the output shaft between the transfer case and the front differential. A typical viscous coupling in a sealed unit is serviced as a complete assembly.

FIGURE 67.20 (a) A standard Cardan U-joint used on the output driveshaft from the transfer case to the front differential assembly. (b) A Cardan type is used at the front drive wheels on a Jeep Wrangler.
FIGURE 67.21 Constant velocity (CV) joints are used on the front axles of many four-wheel-drive vehicles like this Chevrolet Blazer.

FIGURE 67.22 (a) An exploded view of a Dualmatic® manual locking hub. (b) A Warn® manual locking hub.