FIGURE 23.1 Using soapy water from a spray bottle is an easy method to find the location of an air leak from a tire.

FIGURE 23.2 Chart showing the relationship between tire inflation pressure and load capacity of the tire.
FIGURE 23.3 Note that a drop in inflation pressure has a major effect on fuel economy.

![Graph showing the relationship between inflation pressure and fuel economy.](image)

FIGURE 23.4 Note that if a tire is underinflated by 5 PSI, the life expectancy is reduced by 20% and by about 40% if the inflation pressure is less than specified by 10 PSI.

![Graph showing the percentage of tire wear life.](image)

FIGURE 23.5 A temporary inflation pump that uses 12 volts from the cigarette lighter to inflate the tire.

![Diagram of a tire and a temporary inflation pump.](image)
FIGURE 23.6 Many vehicle manufacturers include an aerosol can of sealer on vehicles that are not equipped with a conventional spare tire.

FIGURE 23.7 Most shops that use nitrogen inflation install a green tire valve cap to let others know that nitrogen, rather than air, has been used to inflate the tire.

FIGURE 23.8 Excessively worn tire showing the belt material on the inside edge. This tire requires replacement.
FIGURE 23.9 A bulge in a tire as a result of either an injury to the sidewall, such as contact with a curb, or an internal fault in the tire.

FIGURE 23.10 Wear on the outside shoulder only is an indication of an alignment problem.

FIGURE 23.11 A display at a Lexus dealer used to show customers a visual representation of what a tire looks like at various tread depth amounts.
FIGURE 23.12 Always tighten wheel lug nuts (or studs) in a star pattern to ensure even pressure on the axle flange, brake rotors or drums, and the wheel itself.

FIGURE 23.13 Most manufacturers recommend using hand tools rather than an air impact wrench to remove and install lock-type lug nuts to prevent damage.

FIGURE 23.14 A torque wrench being used to tighten lug nuts on a pickup truck.
FIGURE 23.15 A torque-limiting adapter (torque stick) used with an air impact wrench still requires care to prevent overtightening.

FIGURE 23.16 This wheel was damaged because the lug nuts were not properly torqued.

FIGURE 23.17 The method most often recommended is the modified X method.
FIGURE 23.18 A tire runout gauge being used to measure the radial runout of a tire.

FIGURE 23.19 To check wheel radial runout, the dial indicator plunger tip rides on a horizontal surface of the wheel, such as the bead seat.

FIGURE 23.20 To check lateral runout, the dial indicator plunger tip rides on a vertical surface of the wheel, such as the wheel flange.
FIGURE 23.21 The most accurate method of measuring wheel runout is to dismantle the tire and take dial indicator readings on the inside of the wheel rim.

FIGURE 23.22 Cleaning the bead seat of an alloy wheel using an abrasive pad.

FIGURE 23.23 When installing a tire-pressure monitoring system sensor, be sure that the flat part of the sensor is parallel to the center section of the rim.
FIGURE 23.24 Many new tires have painted dots placed there at the tire manufacturer.

FIGURE 23.25 Always check the wording on tires and install them correctly to insure that the tire performs as designed.

FIGURE 23.26 Note the difference in the shape of the rim contour of the 16 inch and 16 1/2 inch diameter wheels.
FIGURE 23.27 Rendered (odorless) animal fat is recommended by some manufacturers of tire changing equipment for use as a rubber lubricant.

FIGURE 23.28 A wheel balancer detects heavy spots on the wheel and tire, and indicates where to place weight to offset both static and dynamic imbalance.

FIGURE 23.29 An assortment of wheel weights designed to fit different shaped rims.
FIGURE 23.30A Using a rim gauge can be a little tricky as the shape may appear to match several patterns on the rim gauge. This “AW” shape is not a good match.

FIGURE 23.30B Using the gauge shape for “MC” appears to be a perfect match to their rim flange.

FIGURE 23.31 Stick-on weights are used from the factory to balance the alloy wheels of this vehicle.
FIGURE 23.32 Wheel weight pliers are specially designed to remove and install wheel weights.

FIGURE 23.33 A tire balancer that can also detect radial and lateral force variation and instruct the operator where to rotate the tire to achieve the best ride, or indicate a bent wheel.

FIGURE 23.34 Liquid tire stop leak was found in all four tires. This liquid caused the tires to be out of balance.
FIGURE 23.35 A pin plate adapter that is designed to support the wheel/tire assembly on a tire balancer instead of using a centering cone.

FIGURE 23.36A A hubcentric plastic ring partially removed from an aftermarket wheel.

FIGURE 23.36B A hubcentric plastic ring left on the hub when removing a wheel.
**FIGURE 23.37** A tire should only be repaired if the hole is within the tire puncture repair area.

**FIGURE 23.38** A stitching tool being used to force any trapped air out from under the patch.

**FIGURE 23.39** A rubber plug being pulled through a hole in the tire. The stem is then cut off flush with the surface of the tire tread.
A typical tire-changing machine showing the revolving table and movable arm used to remove a tire from the wheel.

The foot-pedal controls allow the service technician to break the tire bead, damp the wheel (rim) to the machine, rotate the tire/wheel assembly, and still have both hands free.

Using a tire valve removal tool, unscrew the valve core using extreme caution because the valve is under pressure and can be forced outward and cause personal injury.
The valve core removed from the tire valve. Allow all of the air in the tire to escape.

A bead breaker is being used to separate the tire from the bead seat of the wheel. Repeat as needed to break the bead on both sides of the wheel.

After breaking the beads from both sides of the tire, install the wheel/tire assembly flat onto the machine and, using the foot-pedal control, lock the wheel to the changer.
To remove the tire from the wheel, position the arm of the changer against the rim of the wheel and lock in position.

The tire tool (flat bar) is placed between the bead of the tire and the wheel. Using tire lubricant can help prevent damage to the tire.

The foot-pedal that causes the table to rotate is depressed and the tire is removed from the wheel.
Reposition the tire tool to remove the lower bead of the tire from the wheel.

As the table of the tire changer is rotated, the tire is released from the wheel and can be lifted off the wheel.

Before installing a tire, inspect and clean the bead seat.
Before installing a new tire, most experts recommend replacing the tire valve, being installed here, using a tool that pulls the valve through the hole in the wheel.

Apply tire soap or rubber lubricant to both beads of the tire.

Rotate the tire on the wheel and position the arm so that the tire will be guided onto the rim as the wheel is rotated.
Repeat for the upper bead.

Inflate the tire, being careful to not exceed 40 PSI. Experts suggest that a tire be in a cage during the initial bead seating inflation to help prevent personal injury if the wheel or tire fails.

Install the tire valve core and inflate the tire to specifications.
The source of the leak was detected by spraying soapy water on the inflated tire. Needle-nose pliers are being used to remove the object that caused the flat tire.

A part of a razor blade was found to be the cause of the flat tire.

A reamer is being used to clean the puncture hole.
This technician is using two open-end wrenches to hold the tire beads apart if a tire bead spreader is not available.

The surrounding area is being buffed using an air-powered die grinder equipped with a special buffing tool specifically designed for this process.

After using a vacuum on all debris and rubber after buffing, apply rubber cement to the area.
The brush included with the rubber cement makes the job easy. Be sure to cover the entire area around the puncture.

Peel off the paper from the adhesive on the patch. Insert the tip of the patch through the puncture from the inside of the tire.

Use a pair of pliers to pull the plug of the patch through the puncture.
This view of the patch is from the inside of the tire.

To be assured of an airtight patch, the adhesive of the patch should be "stitched" to the inside of the tire using a serrated roller called a stitching tool.

A view of the plug from the outside of the tire after metal covering used to pierce the puncture is removed from the patch plug.