After studying this chapter, you will be able to:

- Identify common automotive hand tools.
- List safety rules for hand tools.
- Select the right tool for a given job.
- Maintain and store tools properly.
- Use hand tools safely.
- Correctly answer ASE certification test questions referring to hand tools.

Professional auto technicians invest thousands of dollars on tools, and for good reason. It is almost impossible to do even the simplest auto repair without using some type of tool. Tools serve as extensions to parts of the human body. They increase the physical abilities of fingers, hands, arms, legs, eyes, ears, and back. A well-selected set of tools speeds up repairs, improves work quality, and increases profits.

This chapter will cover the basic hand tools commonly used in the shop. Specialized hand tools are covered in later chapters. Use the index to locate these tools as needed.

**Tech Tip!**

It is very frustrating trying to fix a vehicle without the right tools. It can be like trying to "fight a forest fire with a squirt gun"—impossible! Invest in a complete set of quality tools.

**Tool Rules**

There are several basic tool rules that should be remembered. These are as follows.

- Purchase quality tools—With tools, you usually get what you pay for. Quality tools are lighter, stronger, easier to use, and more dependable than off-brand, bargain tools. Many manufacturers of quality tools provide guarantees. Some are for the lifetime of the tool. If the tool fails, the manufacturer will replace it free of charge. This can save money in the long run.
- Keep tools organized—A technician has hundreds of different tools. For the tools to be located quickly, they should be neatly arranged. There should be a place for every tool, and every tool should be in its place. If tools are just thrown into the toolbox, time and effort are wasted "digging and searching" instead of fixing the vehicle.
- Use the right tool for the job—Even though several different tools may be used to loosen a bolt, usually one will do a better job. It may be faster, grip the bolt better, be less likely to break, or require less physical effort. A good technician knows when, where, and why a particular tool will work better than another. Keep this in mind as you study automotive tools.
- Keep tools clean—Wipe tools clean and dry after each use. A greasy or oily tool can be dangerous! It is very easy to lose a grip on a dirty tool, cutting or breaking a finger or hand.
- Tool Storage

A toolbox stores and protects a technician's tools when not in use. There are three basic parts to a typical toolbox, Figure 3-1. These include:

- A large lower roll-around cabinet.
- An upper tool chest that sits on the roll-around cabinet.
A small carrying tray. This is usually placed in the upper tool chest.

The lower roll-around cabinet holds the bulky, heavy tools. Large power tools are normally kept in this part of the box. Extra storage compartments can be bolted to the sides of the roll-around cabinet.

Commonly used tools are normally placed in the upper tool chest. Being near eye level, tools can be easily seen and reached without bending. This saves time and energy, and increases production.

The small carrying (tote) tray is for holding frequently used tools that are carried to the job. For example, if a technician frequently does brake repairs, all the special brake tools can be kept in the tray and taken to the vehicle more easily.

Toolbox Organization

Related tools are normally kept in the same toolbox drawer. For example, various types of hammers may be stored in one drawer and all screwdrivers in another. Small or delicate tools should not be kept with large, heavy tools to prevent damage. Tool holders help organize small tools. These include small clip or magnetic racks, cloth or plastic pouches, or socket trays. They are often used to protect tools and to keep them organized by size. Holders also allow a full set of tools to be taken to the job.

Warning!

Never open several toolbox drawers at one time. If you do, the heavy toolbox might flip over. Serious injury can result since a toolbox can weigh up to 1000 pounds. Close each drawer before opening the next.

Wrenches

Wrenches are used to install and remove nuts and bolts. Wrench size is determined by measuring across the wrench jaws. Refer to Figures 3-2 and 3-3. Wrenches come in both conventional (inch) and metric (millimeter) sizes. The size is stamped on the side of the wrench. Here are a few wrench rules to follow.

- Always select the right size wrench. It must fit the bolt head snugly. A loose-fitting wrench will round off the corners of the bolt head.
- Never hammer on a standard wrench to break loose a bolt. Use a longer wrench with more leverage or a special slug wrench. A slug wrench is designed to be used with a hammer.
- When possible, pull on the wrench. Then, if the wrench slips, you are less likely to hurt your hand. When you must push, use the palm of your hand and keep your fingers open.

Conventional

Figure 3-2. Conventional tool sizes are given in fractions of an inch. The measurement is the width of the jaw opening. As shown here, these sizes are not the same as bolt sizes. (Deere & Co.)

Metric

Figure 3-3. Metric wrench sizes given in millimeters. The measurement is the width of the jaw opening. The wrench size is not the same as the bolt size. (Deere & Co.)
Never use a steel bar or pipe to increase the length of a wrench for leverage. Excess force can bend or break the wrench.

To be able to select the right wrench for the job, you must learn the advantages and disadvantages of each type. These advantages and disadvantages are covered in the next sections. Study the material carefully.

**Open-End Wrenches**

An open-end wrench has an open, or split, jaw on both ends. Each end is a different size and set at an angle. Figure 3-4A. This angle allows the open-end wrench to turn bolts and nuts with little wrench swing space. The wrench can be turned over between each swing to get a new "bite" on the bolt head. An open-end wrench has weak jaws. It should not be used on extremely tight nuts or bolts. Its jaws will flex outward and round off the bolt head.

**Box-End Wrenches**

Box-end wrenches are completely closed on both ends. They fully surround and grip the head of a bolt or nut, Figure 3-4B. A box-end wrench will not round off bolt heads as easily as an open-end wrench. Box-end wrenches are available with either 6- or 12-point openings. A 6-point opening is the strongest configuration. It should be used on extremely tight, rusted, or partially rounded bolt or nut heads.

**Combination Wrenches**

A combination wrench has a box-end jaw on one end and an open-end jaw on the other, Figure 3-4C. Both ends are usually the same size. A combination wrench provides the advantage of two types of wrenches for the price of one.

**Line Wrenches**

A line wrench, also called a tubing wrench or flare nut wrench, is a box-end wrench with a small opening or split in the jaw, Figure 3-4D. The opening allows the wrench to be slipped over fuel lines, brake lines, or power steering lines and onto the fitting nut. A line wrench prevents damage to soft fittings.

**Socket Wrenches**

A socket is a cylinder-shaped, box-end tool for removing or installing bolts and nuts. See Figure 3-5. One end fits over the fastener. The other end has a square hole that fits on a handle used for turning.

A socket's drive size is the size of the square opening for the ratchet or tool handle. As pictured in Figure 3-6,
sockets come in four drive sizes: 1/4", 3/8", 1/2", and 3/4". They also come in four different points: 4-point, 6-point, 8-point, and 12-point.

If a small drive size is used on very large or tight fasteners, the socket or handle can be broken. A large drive may be too awkward for small nuts and bolt heads. Generally, a 1/4" drive socket and handle should be used on bolt and nut heads 1/4" and smaller. A 3/8" socket set is adequate on bolt head and nut sizes between 1/4" and 5/8". A 1/2" drive is strong enough to handle bolt or nut heads from 5/8" to 1". A 3/4" drive is for bolts and nuts with a head size larger than 1".

**Socket Handles**

Socket handles fit into the square opening in the top of the socket. Several types are shown in Figure 3-7. A ratchet is the most commonly used and versatile socket handle. It has a small lever that can be moved for either loosening or tightening bolts. A flex bar, or breaker bar, is the most powerful and strongest socket handle. It should be used when breaking loose large or extremely tight bolts and nuts. A speed handle is the fastest hand-operated socket handle. After a bolt is loosened, a speed handle will rapidly spin out the bolt.

Extensions are used between a socket and its handle. See Figure 3-8A. They allow the handle to be placed farther from the workpiece, giving you room to swing the handle and turn the fastener. A universal joint is a swivel that lets the socket wrench reach around obstructions, Figure 3-8B. It is used between the socket and drive handle, with or without an extension. Avoid putting too much bend into a universal joint, or it may bind and break.

![Figure 3-7. Various socket handles. A—Ratchet. B—Breaker bar or flex handle. C—Speed handle. D—T-handle. E—Torque wrench. F—Flexible driver.](image)

![Figure 3-8. A—An extension moves the socket away from the handle for more clearance. B—A universal joint allows the socket to be turned from an angle.](image)
Other Wrench Types

An adjustable wrench, or Crescent wrench, has jaws that can be adjusted to fit different size bolt and nut heads, Figure 3-9A. It should be used only when other type wrenches will not fit. An adjustable wrench is a handy tool to carry for emergencies. It is like having a full set of open-end wrenches.

A pipe wrench is an adjustable wrench used to grasp cylindrical objects. See Figure 3-9B. The toothed jaws actually dig into the object. For this reason, never use it on parts that will be ruined by marks or nicks.

An Allen wrench is a hexagonal (six-sided) shaft-type wrench. Figure 3-9C. It is used to turn set screws on pulleys, gears, and knobs. To prevent damage, make sure the Allen wrench is fully inserted in the fastener before turning.

There are several other types of wrenches. These are shown in Figure 3-9.

Screwdrivers

Screwdrivers are used to remove or install screws. They come in many shapes and sizes. A standard screwdriver has a single blade that fits into a slot in the screw head. See Figure 3-10A. A Phillips screwdriver has two crossing blades that fit into a star-shaped screw slot, Figure 3-10B. A Reed and Prince screwdriver is similar to a Phillips, but it has a slightly different tip shape.
Figure 3-10C. Torx and clutch head are special types of screwdrivers and are shown in Figures 3-10D and E.

Offset and stubby screwdrivers are good in tight places, Figures 3-11A and B. For example, a stubby screwdriver is needed for loosening screws inside a glove box. Starting screwdrivers hold the screw securely until started in its hole. Figure 3-11C. They prevent the screw from being dropped and lost. A scratch awl looks like a screwdriver, but it has a sharp, pointed tip, Figure 3-12D. It is used for marking sheet metal and other parts. An impact driver can be used to loosen extremely tight screws. When struck with a hammer, the driver exerts powerful turning and downward forces. This is shown in Figure 3-12.

When selecting a screwdriver, pick one that is wide and thick enough to completely fill the screw slot. If the screwdriver is too large or too small, damage to the screwdriver or screw may occur. Most screwdrivers are not designed to be hammered on or pried with. Only heavy-duty screwdrivers with a full shank can withstand light hammering and prying.

**Pliers**

Pliers are used to grip, cut, crimp, hold, and bend various parts. Different pliers are helpful for different situations. Several types of pliers are pictured in Figure 3-13. Never use pliers when another type tool will work. Pliers can nick and scar a part.

Combination pliers, or slip-joint pliers, are the most common pliers used by an automotive technician. The slip joint allows the jaws to be adjusted to grasp different size parts. Figure 3-13A. Rib joint pliers, also called channel lock pliers or water pump pliers, open extra wide for holding very large objects, Figure 3-13B.

Needle nose pliers are excellent for handling extremely small parts or reaching into highly restricted areas, Figure 3-13C. Do not twist too hard on needle nose pliers, or the long thin jaws can be bent.

Diagonal cutting pliers are the most commonly used cutting pliers, Figure 3-13D. Their jaw shape allows them to cut items flush with an adjacent surface. Diagonal cutting pliers are often used to cut off cotter pins, wires, and plastic ties.
Locking pliers, or vise grips, clamp onto and hold a part, Figure 3-13E. This frees both hands to do other tasks. Because of their clamping power, vise grips can sometimes be used to unscrew fasteners with stripped or rounded heads. However, never use them on undamaged nuts or bolts. Snap ring pliers have sharp, pointed tips for installing and removing special clips called snap rings. A pair of snap ring pliers is shown in Figure 3-13F.

Hammers

Various types of hammers are used for operations that involve striking a tool or part. It is important to use the right hammer and to use it properly. Several hammers are shown in Figure 3-14. The following are some general rules governing hammers:

- Select the right size hammer. If a large part is struck by a small hammer, the hammer can fly backwards dangerously. If the hammer is too large, however, it may damage the part.
- Always check that the hammer head is tight on the handle. If not, the head may fly off and cause injury or damage.
- Use a brass, plastic, or dead blow hammer on parts and tools that can be damaged by a steel hammer. Use a steel hammer only when maximum driving force is required.
- Grasp the hammer near the end of the handle and strike the part or tool squarely.

A ball peen hammer is the most common type of hammer used in automotive work, Figure 3-14A. It has a flat face for general striking. It also has a round end for shaping metal parts, such as sheet metal or rivet heads.

A sledge hammer has a very large head. Figure 3-14B. It is usually the heaviest hammer and produces powerful blows. A sledge hammer is sometimes used to free frozen parts.

The brass has a soft, heavy head and is useful when scarring the surface of a part must be avoided, Figure 3-14C. The relatively soft head deforms to protect the part surface from damage.

A plastic or rawhide hammer is light and has a soft head. Figure 3-14D. It is used where light blows are needed to prevent part breakage or damage to surfaces on small and delicate parts.

A rubber mallet has a head made of solid rubber, Figure 3-14E. It will rebound, or bounce, upon striking and is not effective on solid metal parts. It is recommended on many sheet metal or plastic parts, such as garnish molding and wheel covers.

A dead blow hammer has a plastic-coated, metal face and is filled with small metal balls called lead shot. The extra weight prevents a rebound of the hammer when striking. The plastic coating prevents surface damage.

Chisels and Punches

Chisels are for cutting off damaged or badly rusted nuts, bolts, and rivet heads. There are various chisel shapes. Figure 3-15. Use common sense when selecting a chisel shape.

Punches also come in several configurations. See Figure 3-15. A center punch is frequently used to mark parts for reassembly and to start a hole before drilling. Look at Figure 3-16. The indentation made by a center
punch will keep a drill bit from moving when first starting to drill.

A starting punch, or drift punch, has a shank tapered all the way to the end. It is strong and can withstand moderate blows. It is used to drive pins, shafts, and metal rods partway out of a hole. A pin punch has a straight shank and is lighter than a starting punch. It is used after a starting punch to push a shaft or rod the rest of the way out of a hole.

An aligning punch has a long, tapered shaft and is handy for lining up parts during assembly. An aligning punch can be inserted into holes in mating parts and then wiggled to match up the holes. Never use an aligning punch as a center punch. Its tip is too soft and would be ruined.

Remember these chisel and punch rules:

- Use the largest punch or chisel that will work. If a small punch is used on a very large part, the punch can rebound and fly out with tremendous force. The same is true for chisels.
- Keep both ends of a chisel or punch properly ground and shaped. A chisel's cutting edge should be sharp and square. A starting punch or a pin punch should also be ground flat and square. A center punch should have a sharp point.
Then use drill bit  

Center punch first  

![Figure 3-16. A center punch makes a small indentation in metal parts. This can then be used to start a drill bit. (Florida Dept. of Voc. Ed.)](image)

- After prolonged hammering, the top of a chisel or punch can become deformed and enlarged. This is called mushrooming. A mushroomed chisel or punch is dangerous! Grind off the mushroom and form a chamfer, as shown in Figure 3-17.

- When grinding a chisel or punch, grind slowly to avoid overheating the tool. Excessive heat will cause the tool to turn blue, lose its temper, and become soft.

- Make sure to wear eye protection when using or grinding a chisel or punch.

Files

Files remove burrs, nicks, and sharp edges and perform other smoothing operations. They are useful when only a small amount of material must be removed. The basic parts of a file are shown in Figure 3-18.

A file is classified by its length, shape, and cutting surface. Generally, a coarse file with large cutting edges should be used on soft materials, such as plastic, brass, and aluminum. A fine file with small cutting edges is needed to produce a smoother surface and to cut harder materials, like cast iron or steel.

There are several file safety rules that should be remembered. These are:

- Never use a file without a handle securely attached. If the file's pointed tang is not covered by a handle, it can puncture your hand or wrist.

- To prevent undue file wear, apply pressure only on the forward stroke. Lift the file on the backstroke.

- When filing, place one hand on the handle and the other on the file tip. Hold the file firmly but do not press too hard.

- Do not file too rapidly. One file stroke every second is fast enough. Count to yourself: one thousand one, one thousand two, one thousand three, one thousand four, etc. This will time your strokes properly at about 50-60 strokes per minute.

![Figure 3-17. Always keep the top of a chisel or punch ground to a chamfer. A sharp, mushroomed end is dangerous. (Deere & Co.)](image)

![Figure 3-18. A file is used for smoothing metal. Note the different parts of a file and the different types of files available. (Starrett)](image)
• If a file becomes clogged, clean it with a file card or a stiff wire brush.
• Never hammer on or pry with a file. A file is very brittle and will break easily. Bits of the file can fly into your face or eyes.

**Saws**

A **hacksaw** is used to cut metal objects. Blades of various lengths can be mounted in the saw’s adjustable frame. The blade teeth should point away from the handle, and the blade should be fastened tightly in the frame.

Select the appropriate blade for the job. As a rule of thumb, at least two saw teeth should contact the material being cut at any given time. If not, the teeth can catch and break.

When cutting, place one hand on the hacksaw handle and the other on the end of the frame. Press down lightly on the forward stroke and release pressure on the backstroke. See **Figure 3-19**. As with a file, use 50-60 strokes per minute. If cuts are made faster than this, the blade will quickly overheat, soften, and become dull.

**Holding Tools**

There are several different types of tools used for holding objects in the automotive shop. These tools are covered in the next sections.

**Vise**

A **vise** is used to hold parts during cutting, drilling, hammering, and pressing operations. See **Figure 3-20**. It is mounted on a workbench. Avoid clamping a smooth, machined part in the uncovered jaws of a vise. If a machined surface is scarred, the part may be ruined.

![Figure 3-19. Hacksaws are used to cut metal. Hold the saw as shown and only push down on the forward stroke.](image)

**Figure 3-19.** Hacksaws are used to cut metal. Hold the saw as shown and only push down on the forward stroke.

**Figure 3-20.** A vise mounts on the workbench. It holds parts securely. (Snap-on Tool Corp.)

**Vise caps** or wood blocks should be used to prevent damage when mounting precision or delicate parts in a vise. Vise caps are soft metal jaw covers. They will not only protect the part, but will provide a more secure grip on the part.

A few vise rules include:

• Never hammer on a vise handle to tighten or loosen the vise. Use the weight of your body.
• Keep the moving parts of the vise clean and oiled.
• Wear safety glasses when using a vise. Tremendous clamping force can be exerted and parts may break and fly out.
• Be careful not to damage parts in the jaws of a vise.
• Use vise caps when a precision part is held in a vise. This will prevent part damage.

**C-clamp**

A **C-clamp** holds parts on a work surface when drilling, filing, cutting, welding, or doing other operations. Being portable, it can be taken to the job. Refer to **Figure 3-21**. C-clamps come in many different sizes.

**Stands and Holding Fixtures**

**Stands** and holding fixtures can be used to secure heavy or clumsy parts during repairs, **Figure 3-22**. Cylinder head stands, transmission fixtures, rear axle holding stands, and others will make your work safer and easier. Always use them when available.
Cutting Oil

Chuck
Wood block

Figure 3-21. A C-clamp is a portable means of securing parts. It can also be used for light pressing operations.

Cleaning Tools

There is an old saying, "if you do the job right, you will spend most of your time cleaning parts." Dirt is a major enemy of a vehicle. One grain of sand can cause a major breakdown by clogging a passage or scarring a part. Cleaning tools, such as scrapers and brushes, help the technician remove carbon, rust, dirt, grease, old gaskets, and dried oil from parts.

Scrapers remove grease, gaskets, sludge, dried oil, and carbon on parts. They are used on flat surfaces. Never scrape toward your body. Keep your other hand out of the way. Brushes are used to remove light rust and dirt on parts. They are slow and should be used only when necessary.

Probe and Pickup Tools

Pickup and probing tools are needed when bolts, nuts, or other small parts are dropped and cannot be reached by hand. A magnetic pickup tool is a magnet hinged to the end of a rod. It can usually be shortened or lengthened and swiveled to reach into any area. If a ferrous (iron) metal part is dropped, it will be attracted and stick to the magnet. Figure 3-23A.

A finger pickup tool grasps nonmagnetic parts (aluminum, plastic, or rubber), which will not stick to a magnet, Figure 3-23B. A mirror probe allows you to
look around corners or behind parts, Figure 3-23C. For example, a mirror probe will allow you to see an oil leak behind the engine.

**Pry Bars**

Pry bars are strong steel bars. They are helpful during numerous assembly, disassembly, and adjustment operations. For example, they are commonly used when adjusting the tension of engine belts. They are also used to align heavy parts. When prying, always be careful to **not** damage any part of the vehicle.

**Workplace Skills**

A properly designed tool acts as an extension of your body or mind. Tools are essential to the repair of any motor vehicle. For this reason, you should learn about new tools as they are developed. A good tool is a wise investment that will help you be a more productive, successful technician. To learn more about tools, you might want to log onto tool manufacturer websites, such as www.snapon.com.

**Summary**

- It is almost impossible to do even the simplest auto repair without using some type of tool.
- Professional auto technicians invest thousands of dollars in tools. A well-selected set of tools will speed up repairs, improve work quality, and increase profits.
- Purchase quality tools. Quality tools are lighter, stronger, easier to use, and more dependable than off-brand, bargain tools.
- Keep tools organized. There should be a place for every tool and every tool should be in its place.
- Use the right tool for the job. A good technician will know when, where, and why a particular tool will work better than another.
- A toolbox stores and protects a technician's tools when not in use.
- A 6-point wrench is the strongest wrench configuration.
- A socket is a cylinder-shaped, box-end tool for removing or installing bolts and nuts.
- Socket handles fit into the square opening in the top of the socket.
- A ratchet is the most commonly used and versatile socket handle. It can either loosen or tighten bolts.
- Extensions are used between a socket and its handle.
- Pliers are used to grip, cut, crimp, hold, and bend various parts.
- A hacksaw is the saw most frequently used by the technician.
- A vise is used to hold parts during cutting, drilling, hammering, and pressing operations.
- Cleaning tools, such as scrapers and brushes, help a technician remove carbon, rust, dirt, grease, old gaskets, and dried oil from parts.
- Pry bars are strong steel bars that are helpful during numerous assembly, disassembly, and adjustment operations.

**Important Terms**

| Toolbox | Sledge hammer |
| Tool holders | Rawhide hammer |
| Wrenches | Rubber mallet |
| Wrench size | Dead blow hammer |
| Socket | Chisels |
| Drive size | Punches |
| Socket handles | Files |
| Extensions | Hacksaw |
| Universal joint | Vise |
| Adjustable wrench | Vise caps |
| Pipe wrench | C-clamp |
| Allen wrench | Stands |
| Screwdrivers | Holding fixtures |
| Scratch awl | Cleaning tools |
| Impact driver | Probing tools |
| Pliers | Pry bars |
| Ball peen hammer |

**Review Questions—Chapter 3**

Please do not write in this text. Place your answers on a separate sheet of paper.

1. List and explain four general tool rules.
2. A bolt head is rusted and partially rounded off. Which wrench would work best for removing the bolt?
   (A) Open-end wrench.
   (B) 6-point box-end wrench.
   (C) 12-point box-end wrench.
   (D) None of the above.
3. What are the four socket drive sizes? Explain when each should be used.
4. _____ or______ screwdrivers are useful in very tight places, such as inside a glove box.
5. Describe four rules to follow when using hammers.

6. What is the difference between a center punch, a starting punch, and an aligning punch?

7. A coarse file should be used on _____ materials. A fine file should be used on _____ materials.

8. When should you use vise caps?

9. List and explain four vise rules.

10. Which of the following tools should be used to remove old gasket material from a flat surface?
   (A) Hand scraper.
   (B) Chisel.
   (C) Probe.
   (D) Pry bar.

ASE-Type Questions

1. A bolt head is badly rusted and is difficult to loosen. Technician A says to use a pair of pliers to loosen the rusted bolt. Technician B recommends a six-point wrench or socket. Who is correct?
   (A) A only.
   (B) B only.
   (C) Both A and B.
   (D) Neither A nor B.

2. Which of the following is not a common socket drive size?
   (A) 1/4"
   (B) 3/8"
   (C) 5/8"
   (D) 1/2"

3. The most commonly used and versatile socket handle is the:
   (A) ratchet.
   (B) flex bar.
   (C) breaker bar.
   (D) speed handle.

4. An _____ is a swivel that lets the socket wrench reach around obstructions.
   (A) extension
   (B) hand spinner
   (C) flexible driver
   (D) universal joint

5. When working with sockets, Technician A states that a socket's "point" is the size of the square opening for the handle. Technician B states the point of a socket is the box configuration for the bolt head. Who is right?
   (A) A only.
   (B) B only.
   (C) Both A and B.
   (D) Neither A nor B.

6. Which type of screwdriver is especially good to use in tight spaces?
   (A) Torx.
   (B) Offset.
   (C) Phillips.
   (D) Clutch head.

7. Pliers are used on various parts to do each of these except:
   (A) cut.
   (B) grip.
   (C) bend.
   (D) screw.

8. Which type of pliers open extra wide to hold very large objects?
   (A) Rib joint.
   (B) Channel lock.
   (C) Water pump.
   (D) All the above.

9. The heaviest kind of hammer is:
   (A) lead.
   (B) brass.
   (C) sledge.
   (D) dead blow.

10. Which punch configuration is used to mark parts for reassembly or to start a drilled hole?
    (A) Center.
    (B) Aligning.
    (C) Tapered.
    (D) Diamond.

Activities—Chapter 3

1. Collect automotive catalogs and create a list of hand tools needed to equip an automotive shop. Provide an estimate of what it will cost to purchase the tools.

2. Discuss tool safety with your instructor. Prepare a list of safety regulations for your shop area.
After studying this chapter, you will be able to:

- List the most commonly used power tools and equipment.
- Describe the uses for power tools and equipment.
- Explain the advantages of one type of tool over another.
- Explain safety rules that pertain to power tools and equipment.
- Correctly answer ASE certification test questions that require a knowledge of power tools and equipment.

To be a productive technician in today's automotive service facility, you must know when and how to use power tools and equipment. **Power tools** are tools driven by compressed air, electricity, or pressurized liquid. They make many repair operations easier and quicker. Large shop tools, such as floor jacks, parts cleaning tanks, and steam cleaners, are called **shop equipment**.

This chapter discusses properly selecting and using common power tools and shop equipment. They can be very dangerous if misused. Always follow the operating instructions for the particular tool or piece of equipment before use. If in doubt, ask your instructor for a demonstration. Specialized power tools and equipment are covered in later chapters. Refer to the index to find more information on them as needed.

**Compressed-Air System**

The components of a **compressed-air system** include an air compressor, air lines, air hoses, and air tools. In addition, a pressure regulator, filter, and lubricator may be attached to the system. Air tools are driven by the compressed-air system. Air-powered tools can be found in nearly every service facility.

**Air Compressor**

An **air compressor** is the source of compressed air for an automotive service facility. Look at **Figure 4-1**. An air compressor normally has an electric motor that spins an air pump. The air pump forces air into a large, metal storage tank. The air compressor turns on and off automatically to maintain a preset pressure in the system. Metal air lines feed out from the tank to several locations in the shop. Technicians can then connect their flexible air hoses to the metal lines.

**Warning!**

Shop air pressure usually ranges from 100-150 psi (689-1034 kPa). This is enough pressure to kill or severely injure a person. Respect shop air pressure!

**Air Hoses**

Flexible, high-pressure air hoses are connected to the metal lines from the air compressor. These hoses allow the technician to take a source of air pressure to the vehicle being repaired. **Quick-disconnect couplings** are used to connect air hoses and air tools to the compressed air system without using a wrench. To join or separate a quick-disconnect coupling, pull back on the coupling's outer sleeve with finger pressure. With the sleeve pulled back, you can push the coupling together or pull it apart.

**Other Components**

A **pressure regulator** is used to set a specific pressure in the compressed-air system. This pressure is often called **shop pressure**. In most cases, shop pressure is between 100 and 150 pounds per square inch (psi). A filter may be connected to the system. The **filter** removes water from the compressed air. This increases the life of air tools. In addition, a lubricator may also be connected
Air compressor unit

Figure 4-1. The basic parts of a typical compressed air system. The air compressor unit develops air pressure. The filter removes moisture. The regulator allows the technician to control system pressure. Metal lines and flexible hoses carry pressurized air to the tool. (Florida Dept. of Voc. Ed.)

to the system. The lubricator introduces oil into the air-stream. This also increases the life of air tools.

Air Tools

Air tools use the energy of compressed air for operation. They are also called pneumatic tools. Air tools are labor-saving devices and well worth their cost. Always lubricate an air tool before and after use. While pressing the air tool’s trigger, squirt a few drops of air tool oil into the tool’s air inlet fitting. Not only will the oil protect the internal parts of the tool during use, but it will also prevent the internal parts from rusting during storage.

Air Wrenches

Air wrenches, or impact wrenches, provide a very fast means of installing or removing threaded fasteners. Look at Figure 4-2A. An impact wrench uses compressed air to rotate a driving head. The driving head holds a special impact socket.

Impact wrenches come in 3/8”, 1/2”, and 3/4” drive sizes. A 3/8” drive impact is ideal for small fasteners, such as 1/4”—9/16” bolts. A 1/2” drive is for general purpose use with medium to large fasteners, such as 1/2”—1” bolts. The 3/4” drive impact is for extremely large fasteners. It is not commonly used in automotive service. A button or switch on the impact wrench controls the direction of rotation. In one position, the impact wrench tightens the fastener. With the switch in the other position, the wrench loosens the fastener.

Figure 4-2. A—1/2” drive impact wrench. B—3/8” drive air ratchet. (Snap-on Tool Corp.)

Caution!

Until you become familiar with the operation of an air wrench, be careful not to overtighten bolts and nuts or leave them too loose. It is easy to strip or break fasteners with an air tool.
Air Ratchet

An air ratchet is a special impact wrench designed for working in limited space. Look at Figure 4-2B. For instance, an air ratchet is commonly used when removing water pumps. It will fit between the radiator and engine easily. It works in much the same way as a hand-tool ratchet. An air ratchet normally has a 3/8" drive. However, it does not have very much turning power. Final tightening and initial loosening must be done with hand tools.

Impact Sockets and Extensions

Special impact sockets and impact extensions must be used with air wrenches. These are case hardened, thicker, and much stronger than conventional sockets and extensions. A conventional socket can be ruined or broken by the hammering blows of an impact wrench. Impact sockets and extensions are easily identified because they are flat black, not chrome.

Caution!

Know when and when not to use power tools. In most situations, power tools will speed up your work. However, there are many times when they should not be used. For example, never use an impact wrench in place of a torque wrench. An impact wrench will not torque critical fasteners to their correct specification. Problems and comebacks will result.

Air Hammer

An air hammer, or air chisel, is useful during various driving and cutting operations. Look at Figure 4-3. An air hammer is capable of producing about 1000-4000 impacts per minute. Several different cutting or hammering attachments are available. Be sure to select the correct one for the job.

Warning!

Never turn an air hammer on unless the tool head is pressed tightly against the workpiece. Otherwise, the tool head can fly out of the hammer with great force, as if shot from a gun!

Blowgun

An air-powered blowgun is commonly used to dry and clean parts washed in solvent. It is also used to blow dust and loose dirt from parts before or during disassembly. See Figure 4-4A.

When using a blowgun, wear eye protection. Direct the blast of air away from yourself and others. Do not blow brake and clutch parts clean. The dust from these parts may contain asbestos. Asbestos is a cancer-causing substance. Another type of blowgun is a solvent gun, Figure 4-4B. It can be used to wash parts that will not fit into a cleaning tank.
Air Drill

An air drill is excellent for many repairs because of its power output and speed adjustment capabilities. Its power and rotating speed can be set to match the job at hand. Look at Figure 4-5. With the right attachments, air drills can drill holes, grind, polish, and clean parts.

A rotary brush is used in an air or electric drill for rapid cleaning of parts, Figure 4-6. It can quickly remove old gasket material, carbon deposits, and rust with a minimum amount of effort.

An abrasive pad is another type of cleaning tool that can be used in an air or electric drill. It is used for removing old gasket material. It has the advantage of not scratching aluminum like a rotary brush can.

A rotary file, or stone, can be used in an air drill, electric drill, or air (die) grinder, Figure 4-7. It is handy for removing metal burrs and nicks. Make sure the stone is not turned too fast by the air tool. Normally, the maximum speed is printed on the file or stone container.

**Warning!**
Use a high-speed rotary brush in an air drill. A brush designed for an electric drill may fly apart. To be safe, always adjust an air drill to the slowest acceptable speed when using a rotary brush. Also, always wear eye protection.

**Figure 4-5.** An air drill. The speed of the air drill can be adjusted. The air drill is capable of very high turning force.

**Figure 4-6.** A rotary brush is commonly used in a drill for cleaning off carbon deposits or old gaskets. Always wear eye protection.

**Figure 4-7.** This die grinder is equipped with a high-speed stone. This tool is used for removing burrs and for other smoothing operations. Here, the technician is making minor repairs to a damaged cylinder head combustion chamber.

Electric Tools

There are many electric tools that can be useful to a technician. Some of these tools, such as a drill press or grinder, may be fixed to the floor or a bench. Other tools, such as a drill, are portable and can be taken to the job site.

Bench Grinder

A bench grinder can be used for grinding, cleaning, or polishing operations, Figure 4-8. A bench grinder usually has two wheels—a grinding wheel and a wire wheel. The hard, abrasive grinding wheel is used for sharpening and deburring. The soft wire wheel is used for cleaning and polishing. A few bench grinder rules to follow are:

- Always wear eye protection and keep your hands away from the wheel.
- Make sure the grinder shields are in place.
- Keep the tool rest adjusted close to the wheel. If the rest is not close to the wheel, the part being ground can catch in the grinder.
- Do not use a wire wheel to clean soft metal parts, such as aluminum pistons or brass bushings. The abrasive action of the wheel can remove metal or scuff the part and ruin it. Instead, use a solvent and a dull hand scraper on soft metal parts that could be damaged.

Drills

Drills are used to create holes in metal and plastic parts. Some drills are portable; others are mounted on a workbench or the floor. Drills use different-size bits to create the size of hole needed.
Figure 4-8. The grinding wheel on a bench grinder is used to sharpen tools. The wire wheel can be used to clean and polish small parts. Always keep shields, tool rests, and guards in place.

**Bits**

Drills use *drill bits*, or *twist drills*, to drill holes in metal and plastic parts. **Figure 4-9.** A drill bit is mounted in the drill *chuck*. A special key, called a *chuck key*, is sometimes needed to tighten the drill bit in the chuck, **Figure 4-10.** Drill bits are commonly made of either carbon steel or high-speed steel. High-speed steel is better because of its resistance to heat. It will not lose its hardness when slightly overheated.

**Portable Electric Drill**

*Portable electric drills* are hand-held drills. They come in different sizes. The size of a drill is an indication of the capacity of its chuck. Commonly used sizes are 1/4", 3/8", and 1/2", **Figure 4-11.** Portable electric drills work fine on most small drilling operations.

![Drill Bit Diagram](image)

**Figure 4-9.** The basic parts of a drill bit. (Florida Dept. of Voc. Ed.)

**Drill Press**

A *drill press* is a large, floor- or bench-mounted drill needed for drilling large holes, deep holes, or a great number of holes in several parts. **Figure 4-12.** The drill press handle allows the bit to be pressed into the work with increased force. Also, very large bits can be used. A few drill press rules to follow include:

- Remove the key from the chuck before turning on the drill press.
- Secure the part to be drilled with C-clamps or other holding fixtures.
- Use a center punch to indent the part and start the hole.
- To prevent injury, release drilling pressure right before the bit breaks through the bottom of the part. A drill bit tends to catch when breaking through. This can cause the drill or part to rotate dangerously.
- Oil the bit as needed.
Hydraulic Tools

Hydraulic tools are powered by pressurized liquid. The hydraulic tools typically used in the automotive shop include jacks, cranes, and presses. These tools are discussed in the next sections.

Floor Jack

A floor jack is used to raise either the front, sides, or rear of a vehicle. Look at Figure 4-13. To avoid vehicle damage, place the jack saddle under a solid part of the car such as the frame, suspension arm, or axle housing. If the saddle is not properly located, it is very easy to smash the oil pan, muffler, floor pan, or another part of the vehicle. To raise the vehicle, turn the jack handle or knob clockwise and pump the handle. To lower the vehicle, turn the handle or knob counterclockwise slowly to release the pressure-relief valve.

When raising the front of a vehicle, place the transmission in neutral and release the parking brake. This lets the vehicle roll, preventing it from pulling off the jack. After raising, secure the vehicle on jack stands. Place an automatic transmission in park and a manual transmission in gear. Apply the emergency brake and block the wheels. It is then safe to work under the vehicle.

Caution!
Most floor jack handles tend to stick when the pressure-relief valve is released. This makes it easy for you to lower the vehicle too quickly. When releasing the valve, turn it very slowly. This will prevent the car or truck from slamming to the ground violently!

Transmission Jack

Transmission jacks are designed to hold transmissions and transaxles during removal or installation. One type is similar to a floor jack. However, the saddle is enlarged to fit the bottom of a transmission. Another type of transmission jack is designed to be used when the vehicle is raised on a lift. Figure 4-14. It has a long post that can reach high into the air to support the transmission.

Figure 4-12. The parts of a drill press. A drill press is for drilling deep or large holes when a part will fit on the table. (Florida Dept. of Voc. Ed.)

Figure 4-13. A floor jack is for raising the car only. (Lincoln Automotive)

Figure 4-14. A transmission jack is designed for holding transmissions during removal, transporting, and installation. This foot-operated, hydraulic stand can be extended to a height of 72". (OTC Div. of SPX Corp.)
Engine Crane

A portable engine crane is used to remove and install heavy engine assemblies, Figure 4-15. It has a hydraulic hand jack for raising engines and a pressure-release valve for lowering engines. The engine crane is also handy for lifting intake manifolds, cylinder heads, engine blocks, transmissions, transaxles, and other heavy parts.

Hydraulic Press

A hydraulic press is used to install or remove gears, pulleys, bearings, seals, and other parts requiring a high pushing force. One is shown in Figure 4-16. A hydraulic ram extends as the pump handle is worked. The ram presses the parts against a table.

![Figure 4-15](image)

Figure 4-15. A hydraulic engine crane can be used to lift heavy objects, such as engines, transmissions, transaxles, and rear axle assemblies. This technician has used a crane to mount an engine on a stand.

![Figure 4-16](image)

Figure 4-16. A hydraulic press is needed for numerous pressing operations. It is commonly used to remove and install bearings, bushings, seals, and other pressed-on parts.

Warning!

A hydraulic press can literally exert tons of force. Wear eye protection and use recommended procedures. Parts can break and fly out with deadly force!

Shop Equipment

In addition to pneumatic, hydraulic, and electric tools, there are various pieces of shop equipment that a technician may find useful. These include tire changers, stands, cleaners, welders, lights, and creepers. These are all discussed in the following sections.

Arbor Press

An arbor press works like a hydraulic press. However, it is all mechanical. Hydraulic pressure is not used; therefore, the operating pressure is much lower. An arbor press is suited for smaller jobs.

Tire Changer

A tire changer is used to remove and replace tires on wheels. It is a common piece of shop equipment. Some tire changers are pneumatic; others are hand operated. Do not attempt to operate a tire changer without proper supervision. Follow the directions provided with the changer.

Jack Stands

Jack stands support a vehicle during repairs. After raising the vehicle with a jack, place stands under the vehicle, Figure 4-17. Be sure the stands are placed in secure positions. For example, place jack stands under the frame, axle housing, or suspension arm.

![Figure 4-17](image)

Figure 4-17. Jack stands are needed to safely support the weight of a vehicle.
Warning!
It is not safe to work under a vehicle held up by only a jack. Secure the vehicle on jack stands before placing any part of your body under the vehicle. Even a small car can weigh well over a ton. The next chapter details the safe use of lifts, jacks, and jack stands.

Engine Stand

An engine stand is used to hold an engine assembly once it is removed from the vehicle for rebuilding or repair. The engine cylinder block bolts to the stand just as it would to the transmission or transaxle. The engine can usually be rotated and held in different positions on the stand, making it easy to work on different parts.

Cold Solvent Tank

A cold solvent tank contains a pump, reservoir, and solvent, and it is used to remove grease and oil from parts, Figure 4-18. After removing all old gaskets and scraping off excess grease, you can scrub the parts clean in the solvent. A blow gun is then normally used to dry the solvent.

Steam Cleaner and High-Pressure Washer

A steam cleaner or high-pressure washer is used to remove heavy deposits of dirt, grease, and oil from the outside of large assemblies, such as engines, transmissions, and transaxles. Look at Figure 4-19. To help keep the environment clean, wire brush the item to be cleaned and collect oil-soaked dirt before steaming or washing. Then, dispose of the oil-soaked material properly.

Oxyacetylene Torch

An oxyacetylene torch can be used to heat, cut, weld, or braze metal parts, Figure 4-20. The oxyacetylene setup consists of an oxygen tank, an acetylene tank, pressure regulators, hoses, and a hand-held torch. Tremendous heat is produced by the burning acetylene gas and oxygen. The oxyacetylene cutting torch is often used to remove old, rusted exhaust systems.

Warning!
A steam cleaner operates at high pressures and temperatures. Follow the manufacturer's safety rules and specific operating instructions.

To use an oxyacetylene cutting torch:
1. Put on all necessary protective gear, including a welding helmet or goggles, welding gloves, and a leather jacket.
2. Inspect the oxyacetylene equipment for damage and make sure all cylinder, regulator, and torch valves are closed.
3. Light the cutting torch according to the manufacturer's recommendations.
4. With the torch held at a 90° angle to the workpiece, concentrate the flame on the spot where the cut will begin.
5. When the spot becomes cherry red, depress the oxygen cutting lever to begin the cut.
6. Move the torch along the workpiece to make the cut.
7. After making the cut, release the cutting lever and shut off the torch.
Torch Main on/off valve
Flame control valves
Pressure regulator valve
Hoses
Tanks

Acetylene
Oxygen

240 volt electrical outlet

Warning!
Whenever working with a torch or welder, there is always a chance of fire. Always observe standard safety practices.

Soldering Gun
A soldering gun or soldering iron is used to join wires during electrical repairs, Figure 4-21. An electric current heats the tip of the gun. The hot gun tip is used to heat the wires. Solder is then applied to the hot wires and it melts. Solder is a lead-tin alloy. When the solder cools, it hardens into a strong, solid connection.

Battery Charger
A battery charger is used to re-energize a "dead," or discharged, battery. It forces current back into the battery to recharge the plates and battery acid. The red charger lead connects to the positive (+) battery terminal. The black charger lead connects to the negative (-) battery terminal.

Warning!
The gases around the top of a battery can explode. Always connect the battery charger leads to the battery before turning on the charger. This prevents sparks, which could ignite the battery gases.

Note!
There are several types of cutting torches available, and the lighting procedure may vary from one type to another. Follow the torch manufacturer’s recommendations for lighting, adjusting, and shutting down the torch.

Welder
A welder uses high electric current to create a hot electric spark, or arc, to melt and fuse metal parts together, Figure 4-20. Be sure to complete proper training before attempting to weld. Using a welder improperly can result in personal injury or damage to parts.

Warning!
Whenever working with a torch or welder, there is always a chance of fire. Always observe standard safety practices.

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A soldering gun or soldering iron is used to join wires during electrical repairs, Figure 4-21. An electric current heats the tip of the gun. The hot gun tip is used to heat the wires. Solder is then applied to the hot wires and it melts. Solder is a lead-tin alloy. When the solder cools, it hardens into a strong, solid connection.

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**Droplight**

A droplight provides a portable source of light. The light can be taken to the repair area under the vehicle or in the engine compartment. Several types of droplights are shown in Figure 4-22.

**Pullers**

Pullers are used to remove seals, gears, pulleys, steering wheels, axles, and other pressed-on parts. A few puller types are pictured in Figure 4-23. Special pulling operations are covered in later chapters.

**Warning!**
Pullers can exert tons of force. They must be used properly to prevent personal injury or part damage. Always wear eye protection!

**Jumper Cables**

Jumper cables are used to start a vehicle that has a dead battery. The cables are connected between the dead battery and another battery. The second battery is often in a running vehicle. Once the cables are connected, the car with the dead battery can be started. See Figure 4-24.

**Warning!**
Improper use of jumper cables can cause the batteries to explode. Refer to Chapter 30, *Battery Testing and Service*, for information on the correct use of jumper cables.
**Creepers**

A **creeper** is useful when working under a car supported on jack stands, Figure 4-25A. It lets the technician easily roll under vehicles without getting dirty. A **stool creeper** allows the technician to sit while working on parts that are near the ground. See Figure 4-25B. For example, a stool creeper is often used during brake system repairs. The brake parts and tools can be placed on the creeper. The service technician can sit and still be at eye level with the brake assembly.

**Roll-Around Cart**

A large **roll-around cart** or table is handy for taking a number of tools to the job. One is pictured in Figure 4-26. A technician can quickly place all needed tools in the cart and take them to the vehicle. The cart places the tools within hand's reach. This saves time and effort before, during, and after the job.

**Covers**

**Fender covers** are placed over fenders, upper grille, or other body sections to prevent vehicle damage. They protect the paint or finish from nicks, scratches, and grease. See Figure 4-27. Never lay tools on a painted surface. Costly scratches may result.

**Seat covers** are placed over seats to protect them from dirt, oil, and grease that might be on your work clothes. These covers should be used while driving the vehicle or while working in the passenger compartment.

**Workplace Skills**

**Social skills** are the techniques you use to conduct yourself in such a way that your customers and fellow employees like and respect you. Many times, you will need the help of another technician to complete a difficult task. If your co-workers dislike you, you may have trouble finding help when you need it.

**Summary**

- Power tools use electricity, compressed air, or hydraulic pressure (liquid confined under pressure). Large shop tools, such as floor jacks, parts cleaning tanks, and steam cleaners, are classified as shop equipment.
- An air compressor is the source of compressed (pressurized) air for the auto shop.
- High-pressure air hoses are connected to the metal lines from the air compressor.
- Air tools, also called pneumatic tools, use air pressure for operation. They are labor-saving tools and are well worth their cost.
• Air wrenches, or impact wrenches, provide a very fast means of installing or removing threaded fasteners.
• Special impact sockets and impact extensions must be used with air wrenches.
• A blowgun is commonly used to dry and clean parts washed in solvent.
• An air drill is excellent for many repairs because of its power output and speed adjustment capabilities.
• A bench grinder can be used for grinding, cleaning, or polishing operations. The hard grinding wheel is used for sharpening or deburring. The soft wire wheel is for cleaning and polishing.
• Drill bits, or twist drills, are used to drill holes in metal and plastic parts.
• A drill bit is mounted in and rotated by a drill. A special key is sometimes needed to tighten the drill bit in the drill chuck.
• A floor jack is used to raise either the front, sides, or rear of a vehicle.
• A tire changer is a common piece of shop equipment used to remove and replace tires on wheels.
• Jack stands support a vehicle during repair. After raising a vehicle with a jack, place stands under the vehicle.
• A portable engine crane is used to remove and install engines.
• An engine stand is used to hold an engine while it is overhauled (rebuilt) or repaired.
• A cold solvent tank can be used to remove grease and oil from parts.
• An oxyacetylene torch outfit can be used to heat, cut, weld, or braze metal parts.
• A soldering gun or iron is used to solder wires.
• A battery charger is used to recharge a discharged car battery.
• A droplight provides a portable source of light.
• Pullers are needed to remove seals, gears, pulleys, steering wheels, axles, and other pressed-on parts.
• Jumper cables are used to start engines that have a dead (discharged) battery.
• Fender covers are placed over the fenders, the upper grille, or other body sections to protect them.

Important Terms

Power tools
- Portable electric drills
- Shop equipment
- Air compressor
- Air hoses
- Quick-disconnect connectors
- Pressure regulator
- Filter
- Lubricator
- Air tools
- Air wrenches
- Impact wrenches
- Air ratchet
- Impact sockets
- Impact extensions
- Air hammer
- Air chisel
- Blowgun
- Solvent gun
- Air drill
- Rotary brush
- Abrasive pad
- Rotary file
- Stone
- Electric tools
- Bench grinder
- Drill bits

Shop equipment
- Drill press
- Hydraulic tools
- Floor jack
- Transmission jacks
- Engine crane
- Hydraulic press
- Arbor press
- Tire changer
- Jack stands
- Engine stand
- Cold solvent tank
- Steam cleaner
- High-pressure washer
- Oxyacetylene torch
- Welder
- Soldering gun
- Soldering iron
- Battery charger
- Droplight
- Pullers
- Jumper cables
- Creeper
- Stool creeper
- Roll-around cart

Air tools
- Jack stands
- Engine stand
- Cold solvent tank
- Steam cleaner
- High-pressure washer
- Oxyacetylene torch
- Welder
- Soldering gun
- Soldering iron
- Battery charger
- Droplight
- Pullers
- Jumper cables
- Creeper
- Stool creeper
- Roll-around cart

Quick-disconnect transmission
- Connectors
- Connections

Air tools
- Air tool
- Air tools
- Air wrenches
- Impact wrenches
- Air ratchet
- Impact sockets
- Impact extensions
- Air hammer
- Air chisel
- Blowgun
- Solvent gun
- Air drill
- Rotary brush
- Abrasive pad
- Rotary file
- Stone
- Electric tools
- Bench grinder
- Drill bits

Review Questions—Chapter 4

Please do not write in this text. Place your answers on a separate sheet of paper.

1. Power tools use______,_______, or_______as sources of energy.

2. Which of the following is not a commonly used air tool?
   (A) Impact wrench.
   (B) Air ratchet.
   (C) Air chisel.
   (D) Air saw.

3. A(n)______is used to blow dirt off parts and to dry parts after cleaning.

4. A rotary file is frequently used to remove______.
   (A) old gasket materials
   (B) carbon deposits
   (C) metal burrs and nicks
   (D) None of the above.

5. List four important rules for a bench grinder.

7. Floor jacks are used to support a vehicle while working under it.
(A) Floor jacks
(B) Jack stands
(C) Transmission jacks
(D) Bumper jacks

8. Explain the use of a solvent tank.

9. What are wheel pullers for?

10. A 1/2" drive impact wrench is used for fasteners with head sizes between 1/2" to 1". Which of the following sockets can be used by this particular tool?
(A) 5/8" chrome plated socket.
(B) 9/16" flat black socket.
(C) 7/16" flat black socket.
(D) None of the above.

ASE-Type Questions

1. Power tools are tools that use:
(A) electricity.
(B) hydraulics.
(C) compressed air.
(D) All of the above.

2. Technician A says that shop air pressure is usually around 100 to 150 psi. Technician B says shop air pressure is much higher, around 300 psi. Who is correct?
(A) A only.
(B) B only.
(C) Both A and B.
(D) Neither A nor B.

3. Which of the following is not a common impact wrench drive size?
(A) 1/4".
(B) 3/8".
(C) 1/2".
(D) 3/4".

4. Technician A says to use a 1/4" drive on sockets from 1/4" to 9/16". Technician B says to use a 3/8" drive on these socket sizes. Who is correct?
(A) A only.
(B) B only.
(C) Both A and B.
(D) Neither A nor B.

5. Special impact sockets and extensions are easily identified because they are:
(A) chrome.
(B) aluminum.
(C) flat black.
(D) hard rubber.

6. Each of the following can be used to clean parts except:
(A) air drill.
(B) blowgun.
(C) air ratchet.
(D) bench grinder.

7. Which of the following is not a rule to follow when using a bench grinder?
(A) Wear eye protection.
(B) Make sure shields are in place.
(C) Use the wire wheel to clean soft metal parts.
(D) Keep the tool rest adjusted close to the stone and brush.

8. When using a drill press, Technician A believes drilling pressure should not be released until the bit breaks completely through the bottom of the part. Technician B believes pressure release should occur just before the bit breaks through. Who is right?
(A) A only.
(B) B only.
(C) Both A and B.
(D) Neither A nor B.

9. After using a floor jack to raise the front of a car:
(A) place the car in park.
(B) block the car's wheels.
(C) secure the car on jack stands.
(D) All of the above.

10. The _____ press performs the same function as a hydraulic press, but at lower pressures.
(A) arbor
(B) steam
(C) rotary
(D) ratchet

Activities for Chapter 4

1. Using an automotive tool catalog, develop a list of power tools needed to equip your school's automotive repair shop. Find prices and add up the cost.

2. Research safety literature on power equipment used in an automotive repair facility.
   (A) Develop a bibliography of resources for safe use of power equipment.
   (B) Develop a list of safety rules for their use.