Chapter 11

Auto & Shop Information

In This Chapter

- Looking under the hood of vehicles
- Knowing the tools of the trade
- Checking out the many uses of fasteners
- Driving up your test score

Ever wonder why automobile mechanics and carpenters charge you about a billion dollars an hour when you need to hire their services? Because if the jobs were easy, everyone would do them.

Fortunately, in order to do well on the Auto & Shop Information subtest of the ASVAB, you won't have to get your hands greasy or chance hitting your thumb with a hammer. The questions on this subtest are pretty basic. Automotive questions usually ask about basic automotive systems and malfunctions. The shop questions generally ask you to identify a tool or fastener, or the purpose of such.

The Auto & Shop Information subtest consists of 25 questions. Happily, the ASVAB gurus give you 26.4 seconds to answer each question (11 minutes total). About one-half of the questions measure your basic knowledge of automotive principles and one-half queries you about shop tools and basic shop principles. On this subtest you either know the answer, or you don't, but sometimes basic *common sense* can come into play. For example, if a car stalls when the needle of the gas gauge is resting on "E," the most probable cause of the malfunction is obvious. Well, obvious to most people, that is. Rod's daughters may argue with this statement.

REMEMBER

The military only uses the Auto & Shop Information subtest to determine your qualifications for certain jobs. It's not used in the calculation of your AFQT score. Turn to the Appendix at the back of this book to find the jobs that require a good score on this subtest. If you don't need to do well on this subtest to qualify for the kind of job you want, you may be better off studying for a different part of the ASVAB.

Checking Under the Hood

Contrary to what you may think, an automobile is much more than the mechanical monster you park in your driveway each night that both you and the bank own. It's actually a complex machine that has undergone over a century of evolution. Henry Ford would probably have a stroke if he could see what his simple horseless carriage evolved into today.

The modern car is divided into several primary and secondary systems. These systems are covered in the next few sections.

Engine

How does an engine work? You turn the key, and if it doesn't start, you call your mechanic or your dad, right? Well, not quite. The *internal combustion engine* burns a mixture of gas and air. Burning gas and air (the fuel mixture) makes the fuel mixture expand quickly (explode). The pressure from this explosion is transferred to the wheels to make the car move.

The movement is brought about by a cycle, which your car's engine repeats a zillion and one times. Figure 11-1 illustrates how this process works:

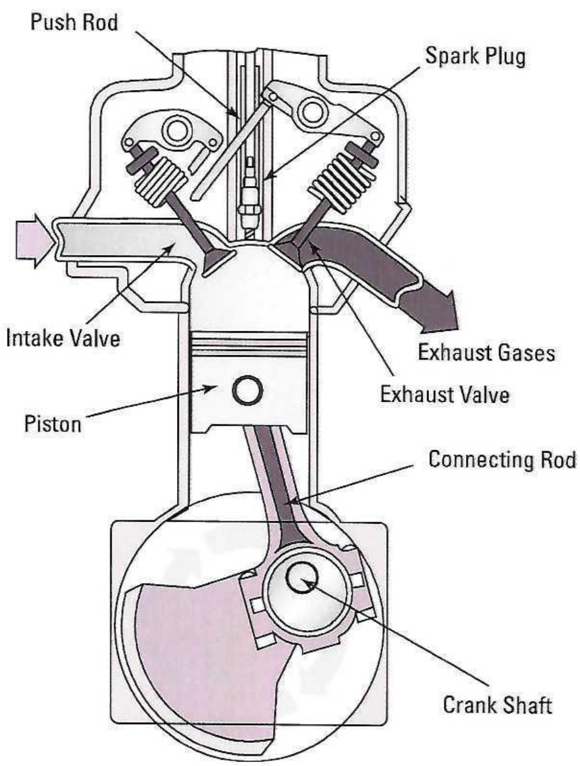

Figure 11-1: The cycle process of an engine.

1. **During the *intake stroke,* an explosive mixture of fuel and air enters a *cylinder* through the *intake valve.***

   The intake valve knows when to open because it is attached to a *pushrod,* which is connected to the *crankshaft* of the engine. The crankshaft is discussed in further detail below.

   Engines in cars have more than one cylinder. Generally cars have an even number of cylinders — four, six, or eight. These cylinders are arranged in a row or rows, which are called *inline* (one row) or *V* (two rows) depending on how the cylinders are arranged.

2. **A *piston,* located within the cylinder, compresses the fuel and air mixture during the *compression stroke.***

   This increase in pressure makes the mixture extremely explosive.

3. **At the point of maximum compression, a spark plug emits (you guessed it) a spark, igniting the fuel and air mixture.**

   The pressure from the burning gas and air moves the piston. This is referred to as the *power stroke.*

Octane ratings

Octane ratings measure gasoline's ability to resist *engine knock,* a rattling or pinging sound that results from premature ignition of the compressed fuel-air mixture in one or more cylinders. Most gas stations offer three octane grades: regular (usually 87 octane), midgrade (usually 89 octane) and premium (usually 92 or 93). By federal law, the ratings must be posted on bright yellow stickers on each gasoline pump.

The octane rating correlates to how much the gasoline can be compressed before it ignites spontaneously. When gasoline ignites this way, instead of by the spark of a spark plug, the engine begins knocking. That's not a good thing because early ignition can cause engine damage over time.

But, don't be fooled — that doesn't mean using higher octane gas is better. In most cases, using a higher octane gasoline than your owner's manual recommends offers absolutely no benefit. It won't make your car perform better, go faster, get better mileage, or run cleaner. The only time you might need to switch to a higher octane level is if your car engine knocks when you use the recommended fuel. This occurrence happens to a small percentage of cars. Buying higher octane gasoline is a waste of money, too. Premium gas costs 15 to 20 cents per gallon more than regular. That can add up to $100 or more a year in extra costs.

How can you tell if you're using the right octane level? Listen to your car's engine. If it doesn't knock when you use the recommended octane, you're using the right grade of gasoline.

4. **The *piston*, which is connected (by a *connecting rod*) to a crankshaft, turns the crankshaft.**

   The *crankshaft* is connected to the flywheel at the rear of the engine. Only one crankshaft is present, even with multiple cylinders. But the crankshaft has more than one crank (in fact, it has exactly as many cranks as the engine has cylinders).

5. **The *flywheel,* once properly motivated, continues revolving (using momentum) between pushes from the crankshaft.**

   The flywheel keeps the engine going.

6. **The crankshaft forces the piston back to the top of its stroke, while at the same time moves a pushrod, opening the exhaust valve so that the exploded gases can escape the cylinder.**

REMEMBER

Most people refer to their engines as a four-cycle engine. This isn't really true. It is a four-stroke, one cycle engine, including the intake stroke, compression stroke, power stroke, and exhaust stroke that are one engine cycle. When the fourth stroke is completed, the cycle begins again. Automobile engines do this very fast. When the *tachometer* (an instrument measuring revolutions per minute [rpm]) on your dashboard shows 4,800 rpm, for example, that means the engine is performing 4,800 of these cycles every minute.

In order for the cycle to happen at all, fuel must be properly mixed with air and transported within the cylinder at the proper time. Various components perform this function:

- *Carburetors* are used on most older cars (pre-1990) to mechanically mix the fuel and air. As air moves faster through the carburetor, it creates a vacuum which draws more and more fuel into the mixture.
- *Fuel injectors* have replaced carburetors on newer cars to perform the air/fuel mixture function. Actually, fuel injectors have been around since the late 1950s, but weren't widely introduced until the late 80s and early 90s. The fuel injector acts as the fuel-dispensing nozzle. It injects liquid fuel directly into the engine's air stream. In almost all cases this requires an external pump.

A doodad called the *EFI computer* (Electronic Fuel Injection computer) determines the amount of fuel entering the engine. Just as your brain takes in information from your five senses and processes it, so does the EFI computer. It receives information from the sensors in the fuel, air and exhaust system and from that information, it determines how much fuel the engine needs to operate at optimum levels.

- A *throttle* is mechanically connected to the carburetor (on older cars) and electronically connected to the EFI computer (on newer cars). Advancing (opening) the throttle causes more fuel to be transferred to the carburetor or the fuel injectors.
- The *accelerator* (the gas pedal) is connected to the throttle by mechanical linkages. The harder you push on the gas pedal, the farther the throttle is advanced (opened). Thus, more fuel is transported to the carburetor or fuel injectors.

Cooling system

Because of the high temperature at which the fuel burns, the engine has a cooling system (otherwise the engine would melt). Here's how the process works:

1. ***Water jackets* surround the parts that reach the highest temperatures.**
2. **The *water pump* circulates water through the jackets.**
3. **While the water circulates, it heats up and then passes through the *radiator,* where outside air cools the water.**
4. **The water in the system is usually mixed with *coolant* (antifreeze).**

   This mixture raises the boiling point of the water (which keeps the water from boiling away), as well as its freezing point (which keeps the system from freezing up during cold weather.

In addition, the engine parts must be lubricated to prevent them from breaking down, which occurs if the metal parts are allowed to rub against each other. An oil pump circulates oil through the engine; oil flows through the crankshaft and connecting rods, lubricating as it goes.

Electrical and ignition systems

Your car requires more than just gasoline to operate. It also needs a supply of electricity. In the old days, automotive electrical systems operated on six volts. Shortly after World War II, as electrical accessories became more prevalent in automobiles, 12 volts became the standard.

An electric motor powered by the *battery* starts the engine when you turn the key. This motor is called a *starter* (for obvious reasons). A gizmo called an *alternator* sends an electric current back to the battery to keep the battery charged and also powers the other electronic gadgets on your car when the engine is running.

The ignition system supplies a high-voltage current to the spark plugs to ignite the fuel mixture in the cylinders. (See the section entitled, "Engine," earlier in this chapter.) The system takes the 12-volt current from the battery, steps it up to about 20,000 volts, and then sends the current to the spark plugs.

In older cars, this increase of voltage is accomplished by means of a device called a *coil,* which uses electromagnetic induction to step up the voltage. The current then passes through an electrical/mechanical switching device called a *distributor.* A rotating shaft and a switch within the distributor, called *breaker points*, routes the current through wires to the spark plugs. A *condenser* absorbs excess current and protects the breaker points from damage by the high-voltage surge. The distributor and other devices control the timing of the spark-plug discharges.

In the 1970s, the electronic ignition systems were introduced. In modern ignition systems, the distributor, coil, points, and condenser have been replaced by solid-state electronics controlled by a computer. A computer controls the ignition system and adjusts it to provide maximum efficiency in a variety of driving conditions.

Drive system

Having a working engine is all fine and dandy, but the power of the engine still has to be transferred to the wheels to make them move. This is the job of the *drive system.* Cars have drive systems that run on axles. The *axle* is the shaft on which the wheels revolve. The *universal joint* allows the axle to move up and down without breaking the drive shaft. Gears on the axle allow the vehicle to make turns. Axle shafts turn the wheels. The wheels on vehicles turn in three different ways:

- **Rear-wheel drive:** The rear wheels push the car. The drive shaft extends from the transmission to the rear axle.
- **Front-wheel drive:** The front wheels pull the car. The drive shaft extends from the transmission to the front axle.
- **All-wheel drive (four-wheel-drive):** All wheels push and pull the car at the same time. The drive shaft extends from the transmission to both axles.

Cars also have transmissions. The *transmission* changes the speed of the engine in relation to the speed of the rear wheels (in rear-wheel-drive), the front wheels (in front-wheel-drive), or all the wheels (in four-wheel or all-wheel-drive). Vehicles have two types of transmissions: automatic and manual (stick shift).

The transmission consists of gears in several combinations so that the amount of torque used can vary according to needs. When the terrain is difficult (as in snow), the wheels need more *torque* (the force that produces rotation) in order to move. The transmission increases torque as needed. In an automatic transmission, this variation is done automatically by the *torque converter.* In a manual transmission, the driver shifts the gears by hand. The *clutch* is used to facilitate this process; it also allows the engine to run when the car isn't moving.

Brake system

When a vehicle is in motion, brakes are applied to stop that car from moving. (A long way from the time when Fred and Barney stopped their car by dragging their heels.) Today's brake system process is a detailed one:

1. **Each wheel has a brake that applies friction to the wheel to stop its rotation.**
2. **A *drum brake* consists of a master cylinder that has *brake lines* (filled with *brake fluid*) running from it.**
3. **The *brake pedal* applies pressure to the *master cylinder,* which sends pressure (and brake fluid) through the lines.**
4. **The lines are connected to a *hydraulic cylinder* on each wheel.**

   This cylinder contains pistons that move outward and force two *brake shoes* against a *metal drum* that rotates the wheel. Usually, two independent systems are used; one governs the front wheels and the other controls the rear wheels.

The magic of ABS

In the modern world of cars today, most vehicles are equipped with an *Anti-Lock Brake System* (ABS). The ABS is a four-wheel system that prevents the wheels from locking up. The system does this by automatically adjusting the brake pressure during an emergency stop. This enables the driver to maintain steering control and to stop in the shortest possible distance under most conditions.

The theory behind ABS is simple. A skidding wheel has less traction than a non-skidding wheel. If your car isn't equipped with ABS, and you have to stop quickly, your wheels may lock up (stop turning), causing you to skid. As a result, you don't stop as quickly, and you won't be able to steer while your wheels are skidding.

5. **A *disc-brake system* consists of *master cylinder* that forces a *caliper,* with brake shoes on each side, to squeeze against a rotating disc in each wheel, thus stopping your car.**

Emissions-control systems (in layman's terms, filters)

Think of the engine as a giant cigarette and the emissions-control system as a filter. The exhaust from automobiles emits pollutants, including carbon monoxide. These pollutants are a result of the combustion process (or they're partially combusted fuel or unburned fuel). To prevent these pollutants from poisoning the atmosphere, manufacturers place emissions-control systems on cars. These systems include

- **Positive-crankcase ventilation:** An old method (still in use) that forces unburned or partially burned fuel back into the cylinder so the fuel can be burned
- **Air-injection systems:** Systems that force air into the engine's exhaust system to burn unburned or partially burned fuel before the fuel comes out the exhaust pipe
- **Catalytic converter:** Oxidizes hydrocarbons and carbon monoxide into water vapor and carbon dioxide (the same thing people exhale). This system doesn't control other types of pollutants such as nitrogen oxides.
- **Exhaust-gas-recirculation system:** Helps control nitrogen-oxide emissions by forcing some of the gases back into the cylinders

Picking Up the Tools of the Trade

You've probably heard the phrase, "the right tool for the right job." This comment is what Dad used to yell at you when you'd use a Phillips screwdriver to punch holes in oil cans (thereby getting oil on your shirt). The ASVAB folks also believe in using the right tool for the right job, and many of the questions on the Auto & Shop subtest ask you to identify the best tool for certain tasks.

Tools are easiest to understand when you classify them by their function, so the following sections are divided by function. See Figure 11-2 for an illustration of the various types of tools covered.

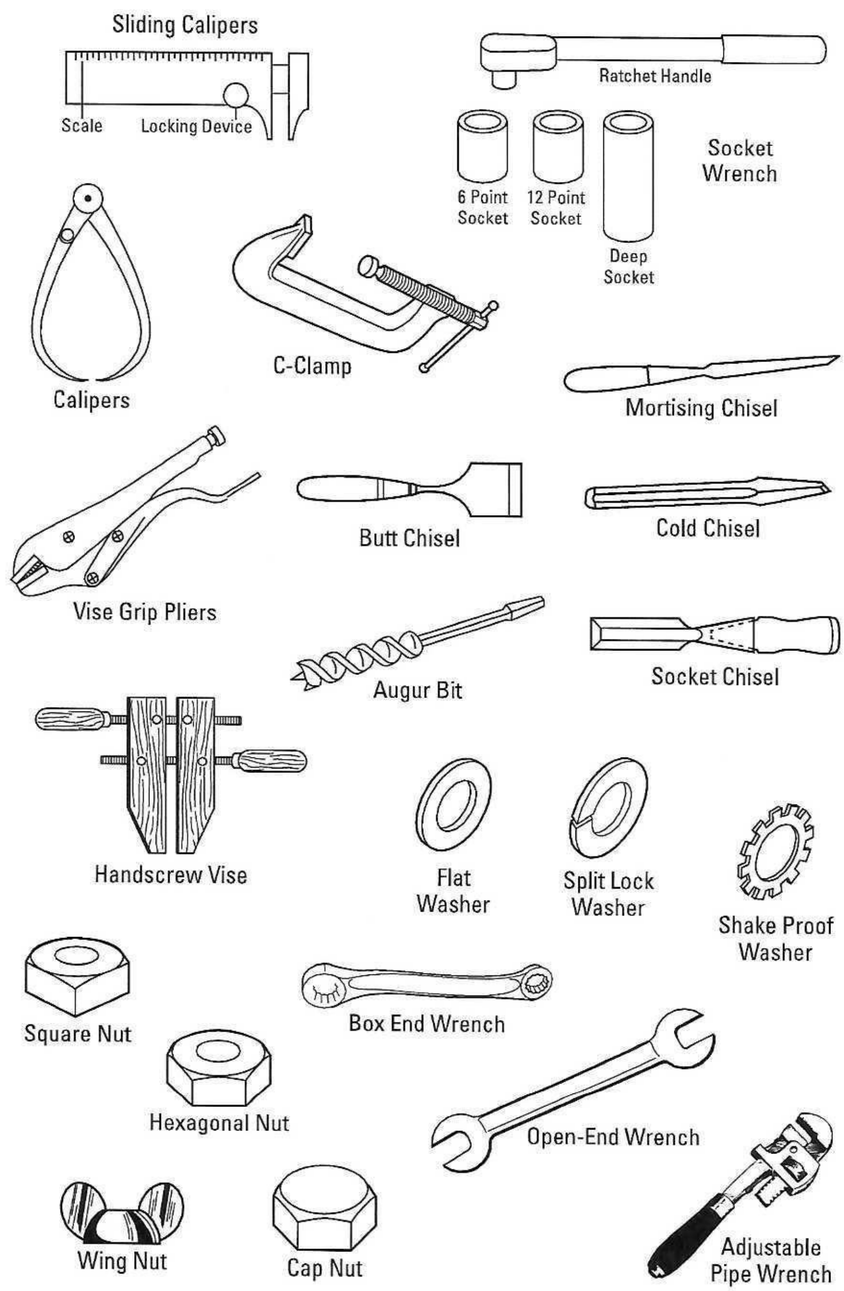

Figure 11-2: Pictures of the various tools you need to know for the ASVAB.

Striking tools

Striking tools apply driving force to an object. (Watch your fingers!) These tools include hammers, sledges, and mallets. Here's a brief explanation of the three:

- **Hammer:** Generally made of metal or plastic and consists of a handle, a head, a face (the part of the hammer that touches the nail or other fastener), a claw (to pull nails), and a wedge that attaches the head to the handle. The face of a hammer may be made of steel, brass, or lead.

- **Mallet:** Generally made of metal or plastic but may be made of wood, rubber, or rawhide. Used to strike another tool or to strike a surface without damaging it. A mallet doesn't have a claw like its friend, the hammer.
- **Sledge:** Generally made of metal; people use it to drive bolts and chisels and to break rock. A sledge doesn't have a claw either.

Fastening tools

Fastening tools apply fasteners, such as screws, to objects. (For more info on fasteners, check out "Sticking Materials Together with Fasteners," later in this chapter.) Numerous tools make up the fastening category:

- A *stapler* is a fastening tool; heavy-duty staplers can staple roofing felt to a roof, for instance.
- *Wrenches* turn screws and bolts. The bolt or screw fits between the jaws of the wrench, and the wrench turns the bolt. Some wrenches have adjustable jaws.
    - *Open-end wrenches* have open jaws.
    - *Box wrenches* are closed. Some wrenches have open-end jaws on one end and a box wrench on the other.
    - *Socket wrenches* have box-type sockets of varying sizes that can be attached to a handle, which in turn can be attached to an extension.

      Socket, box, and open-ended wrenches come in set, standard sizes — either in inches or in millimeters. They're not interchangeable. (Selecting the wrong socket wrench is how mechanics learn to use cuss words.)
    - *Torque wrenches* apply additional leverage to a fastener.
    - *Pipe wrenches* have serrated jaws and grip round objects.
- A *screwdriver,* in the shop world, turns screws. (In the civilian world, it's a yummy drink!) Some special screwdrivers have different blades to fit different types of special screws.
    - A *standard screwdriver* has a flat blade at one end of the shank (the other end of the shank goes into a handle).
    - *Phillips screwdrivers* have a blade that is shaped like a cross; this blade fits into a cross-shaped Phillips screw.
    - An *Allen wrench* fits hexagonal screw heads. Nobody knows why this tool is called an Allen wrench, instead of an Allen screwdriver; after all it's used on hexagonal screws. That's just one of the mysteries of the shop-world.

      This tool gets its name from the Allen Manufacturing Company of Hartford, Connecticut. The Allen wrench was designed in 1943.
    - *Offset screwdrivers* have the shank set at an angle to the blade to allow the tool to be used in cramped spaces. Offset screwdrivers can have a standard blade, Phillips blade, or any number of other blades.
- *Pliers* can be used to fasten and unfasten fasteners, hold objects, and cut material. When you squeeze the handles, the jaws of the pliers come together.
    - *Long-nosed pliers,* also called *needle-nose pliers,* have tapered jaws that can hold small objects or fit into small spaces.
    - *Curve-nose pliers* have curved jaws.
    - *Slip-joint pliers* can be adjusted so the handles lock in a certain position.

- *Wrench pliers* or *vise-grip pliers* have serrated jaws that clamp onto and hold objects of all shapes.
- *Cutting pliers* are used to cut wire.

Cutting tools

Cutting tools use sharp blades to cut through metal, wood, or other materials. Cutting tools have teeth. The number of teeth per inch, called *points per inch,* gives an indication of the type of work the saw can do. A saw with fewer teeth is used for rough work, like cutting wood to size. A saw with more teeth cuts more finely and is used for more delicate work, like sawing joints and lightweight pieces of wood. Check out Table 11-1 for a breakdown of the different cutting tools that may be covered on the ASVAB.

Table 11-1 Cutting Tools Covered on the ASVAB

Cutting Tool	*Function*
Bolt cutters to cut bolts	Heavy-duty shears that produce enough force when the handles are closed to slice through metal bolts or rods
Circle snips	Used to cut curves
Crosscut saw	A type of handsaw that cuts against the grain of the wood. The shape of the teeth and the angle in which they're set are the main differences in this type of saw.
Coping saw	A type of handsaw that's used to cut curved lines or shapes.
Hacksaw	A type of handsaw that's used to cut metal. A hacksaw has an adjustable frame that holds thin blades of varying length in place; a handle is set in one end.
Pipe cutters and tube cutters	Used to score and cut metal pipes and tubes
Ripsaw	A type of handsaw that cuts with the grain of the wood. The shape of the teeth and the angle in which they're set are the main differences in this type of saws.
Snips and shears of various types	Snips and shears have two cutting blades that scissor together when the handles close. The blades can be curved or straight.

Drilling, punching, and gouging tools

No, this section isn't about hand-to-hand combat training from basic training. Masters in the art of shop often make holes in the material they're working with in order to build that perfect birdhouse (or whatever else they're working on). These holes can be done with a variety of tools, which are covered in the following sections.

Drills and bits

Twist drills use *drill bits,* which are round pieces of steel shaped in a spiral, to create holes. Drill bits are attached to a drill (usually a power drill, but sometimes a hand drill operated by manually turning a crank). The point of the drill bit is sharpened, and the shank is smooth and fits into the drill.

A *countersink* is a drill bit that enlarges the surface of a hole so that a screw head can be accommodated. A countersink is used to allow the top of the fastener to be set exactly even with the material to which it's attached. Without a countersink, the fastener slightly protrudes from the material to which it's been attached.

Auger bits bore larger holes. They're shaped differently from drill bits. They're also much larger. Auger bits are most commonly used with a brace for drilling holes in wood. Their length varies from 7 to 10 inches.

Punches

Punches have a sharp end that's placed against the material to be punctured; the other end is struck with a hammer. A *center punch* is used to mark where a drilled hole is to be placed; this keeps the drill bit in position and prevents the drill from jumping to another part of the material.

Using a Phillips screwdriver as a punch is bad form in the shop world because hitting the handle of a screwdriver with a hammer can damage it (and then you'll get talked about in serious shop circles).

Chisels

Chisels are used to chip or cut metal or wood. Chisels are made of steel and have a sharp cutting edge. *Metal-cutting chisels* have different shapes depending on how they'll be used; *cold chisels* are flat; *round chisels* make circular cuts. Chisels that cut metal are usually struck with a mallet to make the cut. Some *wood chisels,* called *socket chisels,* are also struck with a mallet. Other wood chisels require only the pressure of your hands.

Wood chisels also come in different shapes, depending on what they're used for. A *butt chisel* has a short blade and is used for in-close work. A *mortising chisel* has a narrow blade made for chiseling out the narrow mortises in joints. A *framing chisel* has a heavy, strong blade meant for rough work.

Because you use chisels with other tools and the pressure of your hands, there's a little bit of a risk involved with this tool. One slip and these instruments can easily cut large chunks out of your skin, so be careful.

Finishing tools

Filing and finishing shop tools are used to sharpen the blades of other tools and to smooth the edges of cut metal objects. Files come in a range of fineness, and the blades can be cut in different patterns. Files also come in different shapes to finish different kinds of objects. Here are the different kinds of files:

- *Single-cut files* are used for finishing work and sharpening blades.
- *Double-cut files* are used for rough work.
- *Flat files* and *half-round files* are for general purposes.
- *Square* and *round files* fit square and round openings.

Planes are also a type of finishing tool used to prepare wood for final finishing and to fit doors and trim. Planes consist of a handle to push with, a knob to guide with, a frame, a sole, and a mouth (where the blade is). *Bench planes* are used to smooth surfaces. Longer planes give a more uniform surface.

Clamping tools

A *clamping tool* is a device used to hold or fasten objects securely so they won't move while you're working on them. There are several types of clamping tools available for many different purposes:

- *Pliers* (discussed in the "Fastening tools" section earlier in the chapter) can be used to hold objects while you're working on them.
- *Vises* hold material while it's being sawed, drilled, or glued. There are different types of vises:
    - *A bench vise* has large, rough jaws that keep the material from slipping.
    - *Pipe vises* hold round trim or pipes.
    - A *handscrew vise* has two hard, wood jaws connected by two long screws. The screws are tightened to bring the jaws of the handscrew vise together.

Clamps are used when a vise won't work. *C-clamps* consist of a stationary frame and a screw that moves back and forth to open and shut the clamp.

Measuring tools

As any shop enthusiast will tell you, the golden rule of shop is to "measure twice and cut once." It's frustrating to cut a piece of material only to find it's just a little bit too short to fit in the place you intended. Using measuring tools helps you avoid this embarrassing situation.

Tape rules, rigid steel rules, steel (or fiberglass) tape rules, and *folding rules* are all used to measure material. *Calipers* are also used for very exact and small measurements. Calipers can be used with a rule to measure diameter; the legs of a caliper curve in to measure outside curves and curve out to measure inside curves. *Slide calipers* have the rule built in.

Depth gauges measure the depth of holes. *Thickness gauges* measure the thickness of small openings. *Thread gauges* measure the number of threads per inch in threaded fasteners. *Wire gauges* measure the thickness of wire.

Leveling and squaring tools

A *square* is used to check the trueness (accuracy) of an angle. Because most squares have a rule, they can also be used for measuring (see "Measuring tools" earlier in this chapter). Squares have two arms, called the blade and the tongue, that meet at a right angle. A square can be set against any angle that is supposed to be a 90-degree angle. If a gap exists between the square and the material, the material isn't true — that is, it's not at the specified angle. A *sliding T-bevel* has an adjustable blade so that different angles can be checked.

A *plumb bob* is a heavy weight that's suspended from a line. It indicates vertical trueness. *Levels* show whether a surface is true. A level has one or more small tubes filled with a liquid (like alcohol) and an air bubble. If the level is placed on a surface, and the bubble remains exactly in the center of the tube, the surface is level. (This method can't be used to see if your recruiter is on the level. We tried it. Recruiters simply won't hold still long enough.)

Sticking Materials Together with Fasteners

Although wood and metal (and other materials) can be held together with glue, straps, and other brilliant fastening methods, people usually fasten these types of materials with nails, screws, bolts, and rivets. These fasteners offer more strength and stability than the white glue that you used to fasten painted macaroni noodles onto construction paper in the first grade.

Nails

Nails are used to hold pieces of wood together. The nail head is flat, and the shank is usually round. Nail length is designated by the *penny system,* which is abbreviated with a *d.* A ten-penny nail is a 10d nail. Length and thickness generally correspond. Nails that are larger than 20-penny are called *spikes* and are measured in inches.

Other type of nails include

- **Brad and finish nails:** They have heads that are made to fit flush with or slightly below the surface of the wood.
- **Common nails:** These nails are the most commonly used nails. (How about that for a truly difficult vocab word?)
- **Double-headed nails:** These have two heads, one lower than the other. The nail is driven to the lower head but can be pulled out of the material because of the remaining higher head. These nails are used for temporary construction that will be taken apart.

Screws and bolts

Unlike nails, you can easily take screws and bolts out of the wood without causing additional damage to the wood (unless of course the threads are stripped). These fasteners also hold more tightly than nails. Screws have flat heads, round heads, or oval heads; and in addition to this classification, they also have standard heads (for slotted screwdrivers) or Phillips heads. Screw sizes are based on length and the diameter of the unthreaded part of the screw.

Here's the lowdown on these types of fasteners:

- *Wood screws* can also be used to fasten wood. (Hmmm, ingenious!)
- *Lag screws* have square- or hexagon-shaped heads.
- *Bolts* don't thread into wood. They have flat ends (as opposed to the pointed ends of screws). They're held in place by a *nut* and *washer* (check out the following "Nuts and washers" section). The body of the bolt may have few threads or many.
- *Machine screws* are used to fasten metal parts. Machine screws are sometimes used with nuts. They come in various lengths and widths and have a wide variety of heads.

Nuts and washers

Nuts can be square or hexagonal. *Cap nuts* are rounded and smooth; *stop nuts* prevent the screw or bolt from coming loose. *Wing nuts* have flanges on each side so they can be tightened by hand.

Washers, on the other hand, prevent damage to the surface of material by preventing the bolt head from digging into the material. They also help keep the bolt or screw in place. *Flat washers,* a simple ring of flat metal, are the most common type of washer. *Shakeproof washers* have teeth to prevent them from skipping, while *split-lock washers* have two ends that dig into the nut and the material to keep the screw from slipping out.

Rivets

Rivets are commonly used to fasten metal parts together, especially when a weld is insufficient. *Standard rivets* are driven using a *bucking bar.* They come in a wide variety of lengths, diameters, and head shapes. The rivet material should match the material being fastened. *Pop rivets* can be driven when only one side of a join is accessible.

Building a Better Score

If you haven't picked up auto and shop knowledge by this point in your life and want to do well on this subtest, one thing you can do is get an automotive manual and take your car apart (hoping that you can get it back together again). Then get a woodworking book and build some furniture for your mom. (Even if you mess it up, Mom always likes gifts from the heart.) Or you can check out your local community college, which may be a more practical solution. Many community colleges offer basic Auto & Shop classes. You may also want to take a gander at the following books, all published by Wiley Publishing, Inc.:

- *Auto Repair For Dummies* by Deanna Sclar
- *Woodworking For Dummies* by Jeff Strong
- *Home Improvement All-in-One For Dummies* by Roy Barnhart, James Carey, Morris Carey, Gene Hamilton, Katie Hamilton, Donald R. Prestly, and Jeff Strong

REMEMBER

On this subtest, you usually either know the answer or you say, "Huh?" However, some questions you run into can be answered by using the common sense approach. For example, say you run into a question on the ASVAB that reads something like the following:

When attaching two pieces of wood together, the most secure bond would be formed by using:

(A) wood screws

(B) nails

(C) wood glue

(D) both A and C

If you think about it, screws have threads, which are likely to "grab" wood more securely than a nail would. Glue would likely strengthen that bond even more. It's obvious that the *common sense answer* would be Choice (D).

Try a variation of the same question:

The best fastening method to use when attaching pieces of wood together, when time is of the essence would be:

(A) wood screws

(B) nails

(C) wood glue

(D) both A and C

In this case, the best answer would be Choice (B), as pounding a nail in with a hammer is generally faster than screwing a screw in with a screwdriver. (Even in these days of electric screwdrivers).

When all else fails, guessing is okay. If you guess, you have a 25 percent chance of guessing the right answer. If you leave the answer blank, you have a zero percent chance. If you're taking the computerized version of the ASVAB, you don't have a choice, of course, because you must provide an answer before you're presented with the next question.

For help with general guessing hints, check out Chapter 3.