Chapter 3

Safety, Personal Protection Equipment, and First Aid

NATEF Tasks

**Required Supplemental Tasks**

**Shop and Personal Safety**

* Identify the location of the posted evacuation routes. Page 71
* Identify general shop safety rules and procedures. Pages 72-74
* Identify marked safety areas. Page 74
* Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment. Pages 78-80
* Identify the location and use of eye wash stations. Page 80
* Locate and demonstrate knowledge of material safety data sheets (MSDS). Pages 80-87
* Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities. Pages 90-95
* Identify and wear appropriate clothing for lab/shop activities. Pages 90-95
* Secure hair and jewelry for lab/shop activities. Page 95
* Utilize proper ventilation procedures for working within the lab/shop area. Page 96

Knowledge Objectives

1. Describe how to follow safe practices in the workplace. (pp 72-74)
2. Describe how the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA) impact the workplace. (pp 72-73)
3. Describe the difference between a shop policy and a shop procedure. (pp 72-73)
4. Explain how shop policies, procedures, and safety inspections make the workplace safer. (pp 72-73)
5. Describe how to identify hazardous environments and the safety precautions that should be undertaken in hazardous environments. (pp 72-73)
6. Explain how the shop layout contributes to efficiency and safety. (pp 72-73)
7. Identify workplace safety signs and their meanings. (p 74)
8. Describe the standard safety equipment that should be in the workplace. (p 74)
9. Describe how to maintain a safe level of air quality in the workplace. (pp 75-76)
10. Describe the safety precautions to be taken when working with electrical tools and equipment. (p 76)
11. Describe how to reduce the risk of fires in the shop. (pp 77-78)

Skills Objectives

1. Identify hazardous environments and apply appropriate risk prevention strategies. (p 73) Skill Drill 3-1
2. Locate information on an SDS and apply appropriate safety measures. (p 87) Skill Drill 3-2
3. Safely clean and dispose of brake dust. (p 88) Skill Drill 3-3 **2-4**

Readings and Preparation

* Review all instructional materials, including Chapter 3: *Safety, Personal Protection Equipment, and First Aid*, and all related presentation support materials.

Support Materials

* Lecture PowerPoint presentation
* Skill Drill PowerPoint presentations
* Test bank
* Image bank

Pre-Lecture

### You Are the Technician

“You Are the Technician” is a progressive case study that encourages critical-thinking skills.

### Instructor Directions

Direct students to read the “You Are the Technician” scenario found at the beginning of Chapter 3.

• You may wish to assign students to a partner or a group. Direct them to review the discussion questions at the end of the scenario and prepare a response to each question. Facilitate a class dialogue centered on the discussion questions.

• You may also use this as an individual activity and ask students to turn in their comments on a separate piece of paper.

Lecture

I. Introduction

1. Occupational safety and health is very important to ensure that everyone can work without being injured.
2. Governments will normally have legislation in place with significant penalties for those who do not follow safe practices in the workplace.
3. Potential hazards are in most workplaces, especially repair shops.
4. Some hazards are obvious, such as vehicles falling from hoists or jacks or tires exploding during inflation.
5. Other hazards are less obvious, such as the long-term effects of fumes from solvents.
6. It is important to recognize unsafe practices or equipment and put in place measures to prevent injuries from happening.
7. Occupational safety and health is everyone’s responsibility.
8. You have a responsibility to ensure that you work safely and take care not to put others at risk by acting in an unsafe manner.
9. Your employer also has a responsibility to provide a safe working environment.
10. Make sure you are aware of the correct safety procedures at your workplace.
11. Listen very carefully to safety information provided by your employer.
12. Ask for clarification, help or instructions if you are unsure how to perform a task safely.
13. Always think about how you are performing shop tasks.
14. Be on the lookout for unsafe equipment and work practices.
15. Wear the correct personal protective equipment (PPE).
    1. Safety footwear, gloves, clothing, protective eyewear, and hearing protection (Figure 3-1)

II. Safety Overview

1. Commercial vehicle servicing is one of the most common vocations worldwide.
2. There is a great potential for things to go wrong.
3. Accidents are not caused by properly maintained tools; accidents are caused by people.
4. Don’t Underestimate the Dangers
5. Because vehicle servicing and repair are so commonplace, it is easy to overlook the many potential risks relating to this field.
6. Think carefully about what you are doing and how you are doing it.
7. Think through the steps, trying to anticipate things that may go wrong and taking steps to prevent them.
8. Be wary of taking shortcuts.
9. Accidents and Injuries Can Happen at Any Time
10. There is the possibility of an accident occurring whenever work is undertaken.
    1. Fires and explosions are a constant hazard wherever there are flammable fuels.
    2. Electricity can kill quickly, as well as cause painful shocks and burns.
    3. Heavy equipment and machinery can easily cause broken bones or crush fingers and toes.
    4. Hazardous solvents and other chemicals can burn or blind as well as contribute to many kinds of illness.
    5. Trips and falls can be caused by things such as oil spills and tools left lying around.
    6. Poor lifting and handling techniques can cause chronic strain injuries, particularly to your back. (See Figure 3-2)
11. Accidents and Injuries are Avoidable
12. Almost all accidents are avoidable or preventable by taking a few precautions.
13. Develop a “safety first” attitude.
14. By following regulations and safety procedures, you can make your workplace safe.
15. Learn and follow all of the correct safety procedures for your workplace.
16. Always wear the right PPE.
17. Stay alert and aware of what is happening around you.
18. Think about what you are doing, how you are doing it, and its effect on others.
19. Know what to do in case of an emergency.
20. Document and report all accidents and injuries whenever they happen, and take the proper steps to make sure they never happen again.
21. Evacuation Routes
22. Evacuation routes are a safe way of escaping danger and gathering in a safe place where everyone can be accounted for in the event of an emergency.
    1. Have more than one evacuation route in case any single route is blocked during the emergency.
23. Your shop may have an evacuation procedure that clearly identifies the evacuation route (Figure 3-3).
24. Often the evacuation routes will be marked with colored lines painted on the floors.
25. Exits should be highlighted with signs that may be illuminated.
26. Always make sure you are familiar with the evacuation routes for the shop.
27. Before conducting any task, identify which route you will take if an emergency occurs.
28. Work Environment
29. Can be described as anywhere you work
30. Condition of the work environment plays an important role in making the workplace safer
31. A safe work environment contains:
    1. A well-organized shop layout
    2. Use of shop policies and procedures
    3. Safe equipment
    4. Safety equipment
    5. Safety training
    6. Employees who work safely
    7. A workplace orientation
    8. Good supervision
    9. A workplace culture that supports safe work practices
32. OSHA and EPA
33. OSHA – Occupational Safety and Health Administration
    1. A U.S. government agency created to provide national leadership in occupational safety and health.
    2. Finds the most effective ways to help prevent worker fatalities and workplace injuries and illnesses
    3. Has the authority to conduct workplace inspections and, if required, fine employers and workplaces if they violate OSHA regulations and procedures.
34. EPA – Environmental Protection Agency
    1. Federal government agency that deals with issues related to environmental safety
    2. Conducts research and monitoring, sets standards, and can hold employees and companies legally accountable in order to keep the environment protected
    3. Shop activities will need to comply with EPA laws and regulations, ensuring that:
       1. Waste products are disposed of in an environmentally responsible way
       2. Chemicals and fluids are correctly stored
       3. Work practices do not contribute to damaging the environment.
    4. While the examples in this chapter refer to OSHA and EPA, most countries have equivalent organizations.
35. Shop Policies and Procedures
36. Shop policies and procedures are a set of documents that outline how tasks and activities in the shop are to be conducted and managed.
    1. Policy – a guiding principle that sets the shop direction
    2. Procedure – a list of the steps required to get the same result every time a task or activity is performed
37. Each shop will have its own set of policies and procedures and a system in place.
    1. Regular reviews ensure that new policies and procedures are developed and old ones are modified.
    2. In general, the policies and procedures are written to guide shop practice; help ensure compliance with laws, statutes, and regulations; and reduce the risk of injury.
    3. Always follow your shop policies and procedures.
38. It is everyone’s responsibility to know and follow the rules.
    1. Locate the general shop rules and procedures for your workplace.
    2. Look through the contents or index pages to familiarize yourself with the contents.
    3. Discuss the policy and the shop rules and procedures with your supervisor.
    4. Ask questions to ensure that you understand how the rules and procedures should be applied and your role in making sure they are followed.
39. Identifying Hazardous Environments
40. Hazardous environment – a place where hazards exist
41. Hazard – anything that could hurt you or someone else
42. It is almost impossible to remove all hazards, but it is important to identify hazards and work to reduce their potential for causing harm by putting specific measures in place.
    1. For example, operating a bench grinder poses a number of hazards.
    2. A risk analysis of a bench grinder would identify specific hazards and risks.
43. To identify hazardous environments, follow the steps in Skill Drill 3-1.

III. Standard Safety Measures

1. Signs
2. To make people more aware of specific shop hazards, legislative bodies have developed a series of safety signs.
3. These signs are designed to give adequate warning of an unsafe situation. Each sign has four components:
   1. Signal words: *Danger, Warning, Caution* (Figure 3-4)
   2. Background Color: The choice of background color also draws attention to potential hazards and is used to provide contrast so the letters or images stand out.
   3. Text: sign will sometimes include explanatory text
   4. Pictorial message: In symbol signs, a pictorial message appears alone or is combined with explanatory text. This type of sign allows the safety message to be conveyed to people who are illiterate or who do not speak the local language.
4. Safety Equipment
5. Handrails
   1. Used to separate walkways and pedestrian traffic from work areas
   2. Provide a physical barrier that directs pedestrian traffic and also provide protection from vehicle movements
6. Machinery guards – prevent people from accidentally walking into the operating equipment or indicate that a safe distance should be kept from the equipment
7. Painted lines – border dangerous equipment
8. Soundproof rooms – usually used when a lot of noise is made by operating equipment
9. Adequate ventilation – To prevent an excess of toxic gas buildup, a well-ventilated work area is needed as well as a method of directly venting the vehicle’s exhaust to the outside.
10. Gas extraction hoses – suction hose that fits over the vehicle’s exhaust pipe; the hose is attached to an extraction pump that vents the gas to the outside
11. Doors and gates – used for the same reason as machinery guards and painted lines
12. Temporary barriers – In the day-to-day operation of a shop, there is often a reason to temporarily separate one work bay from others
13. Air Quality
    1. Managing air quality in shops helps protect you from potential harm and also protects the environment.
    2. There are many shop activities and stored liquids that can reduce the quality of air in shops.
       1. Dangerous fumes from running engines, welding (gas and electric), painting, liquid storage areas, air conditioning servicing, and dust particles from brake servicing
    3. Running Engines
       1. Produce dangerous exhaust gases including carbon monoxide and carbon dioxide
       2. Carbon monoxide in small concentrations can kill or cause serious injuries.
       3. Carbon dioxide is a greenhouse gas.
          1. Vehicles are a major source of carbon dioxide in the atmosphere.
       4. Exhaust gases also contain hydrocarbons and oxides of nitrogen.
          1. These gases can form smog and also cause breathing problems for some people.
       5. Carbon monoxide in particular is extremely dangerous.
          1. It is odorless and colorless and can build up to toxic levels very quickly in confined spaces.
          2. It doesn’t take very much carbon monoxide to pose a danger.
          3. The maximum OSHA permissible exposure limit (PEL) is 50 parts per million (ppm) of air for an 8-hour period.
          4. The National Institute for Occupational Safety and Health has established a recommended exposure limit of 35 ppm for an 8-hour period.
       6. The best solution when running engines in an enclosed space is to directly couple the vehicle’s exhaust pipe to an exhaust extraction system hose
       7. The extraction hose should be vented to where the fumes will not be drawn back indoors, to a place well away from other people and other premises (Figure 3-5).
       8. Do not assume that an engine fitted with a catalytic converter can be run safely indoors.
          1. A catalytic convertor can never substitute for adequate ventilation or exhaust extraction equipment.
14. Electrical Safety
    1. Poor electrical safety practices can cause shocks and burns, as well as fires and explosions.
       1. Make sure you know where the electrical panels for your shop are located.
       2. All circuit breakers and fuses should be clearly labeled (Figure 3-6).
       3. In the case of an emergency, you may need to know how to shut off the electricity supply to a work area or to your entire shop.
    2. Keep the circuit breaker and/or electrical panel covers closed to keep them in good condition, prevent unauthorized access, and prevent accidental contact with the electricity supply.
       1. Do not block or obstruct access to this electrical panel; keep equipment and tools well away so emergency access is not hindered.
       2. In some localities, 3 feet (0.91 m) of unobstructed space must be maintained around the panel at all times.
    3. There should be a sufficient number of electrical receptacles in your work area for all your needs.
       1. Do not connect multiple appliances to a single receptacle with a simple double adapter.
       2. If necessary, use a multi-outlet safety strip that has a built-in overload cutout feature.
       3. Electric receptacles should be at least 3 feet (0.91 m) above floor level to reduce the risk of igniting spilled fuel vapors or other flammable liquids.
15. Portable Electrical Equipment
    1. Extension cords
       1. Make sure they are made of flexible wiring, not the stiffer type of house wiring
       2. Ensure the cord is fitted with a ground wire.
       3. Cord should be neoprene-covered (material resists oil damage); see Figure 3-7.
       4. Always check for cuts, abrasions, or other damage.
       5. Be aware of tripping hazards.
       6. Avoid rolling equipment over cords.
       7. Never use in wet conditions or around flammable liquids.
    2. Portable electric tools that operate at 240 volts are often sources of serious shock and burn accidents.
       1. Always inspect the cord for damage and check the security of the attached plug before connecting the item to the power supply.
       2. Use 110-volt or lower voltage tools if they are available.
    3. All electric tools must be equipped with a ground prong or double-insulated.
       1. If they are not, do not use them.
       2. Never use any high-voltage tool in a wet environment.
       3. Air-operated tools cannot give you an electric shock.
          1. They operate on air pressure instead of electricity; so they are safer to use in a wet environment.
    4. Portable Shop Lights
       1. Useful tools to add light to a particular area or spot on the vehicle you are working on
          1. Always follow safety directions when using shop lights.
          2. Shop lights should have protective covers fitted to them to prevent accidentally breaking the lamp.
          3. If a lamp breaks, it can be an electrical hazard
          4. Often low-voltage lamps or lamps with safety switches fitted are used to prevent accidental electrocution.
          5. Some shop lights are now cordless, particularly those with LEDs fitted as the light source.
          6. Cordless lights are a safe option because they isolate you from the high voltage.
       2. Electric droplights are a common source of shocks, especially if they are the wrong type for the purpose or if they are poorly constructed or maintained.
          1. All droplights should be designed in so that electrical parts can never come into contact with the outer casing of the device.
          2. Such lights are called double-insulated.
          3. The bulb should be completely enclosed in a transparent insulating case or protected within a robust insulating cage.
       3. The bulbs used in electric droplights are very vulnerable to impact and must not be used without insulating cage protection.
          1. Incandescent bulbs present an extreme fire hazard if broken in the presence of flammable vapors or liquids and should not be used in repair shops.
          2. LED and fluorescent bulbs, while still hazardous, are much safer.
16. Shop Layout
    1. Should be efficient and safe with clearly defined working areas and walkways
    2. Customers should not be allowed to wander through work areas unescorted.
    3. Good shop layout can be achieved by thinking about how the work is to be done, how equipment is used, and what traffic movements occur within the shop.
    4. A well-planned shop should have clearly defined areas for various activities:
       1. Parts cleaning
       2. Parts storage
       3. Tool storage
       4. Flammable liquid storage
       5. Jacking or lifting
       6. Tire fitting
       7. Painting.
    5. All flammable items should be kept in an approved fireproof storage container or cabinet, with firefighting equipment close at hand.
17. Preventing Fires
    1. Danger of fuel fire is always present in repair shop
       1. Most vehicles carry a fuel tank.
          1. Can cause a large, very destructive, and potentially explosive fire
       2. Take precautions to ensure correct type and size of extinguishers on hand for a potential fuel fire.
       3. Clean up spills immediately.
       4. Avoid ignition sources, like sparks, in the presence of flammable liquids or gases.
    2. Fuel Vapor
       1. Liquid fuel vaporizes to different degrees.
       2. Is invisible and heavier than air.
          1. Can spread unseen across a wide area, and a source of ignition can be quite some distance from the original spill
          2. Can vaporize from the cloths or rags used to wipe up liquid spills; these materials should be allowed to dry in the open air and not held in front of a heater element.
    3. Spillage Risks
       1. Spills frequently occur when technicians remove and replace fuel filters.
       2. They also occur during removal of a fuel tank sender unit, which can be located on the side of the fuel tank, without first emptying the tank safely.
       3. Spills also can occur when fuel lines are damaged and are being replaced, when fuel systems are being checked, or when fuel is being drained into unsuitable containers.
       4. Avoid spills by following the manufacturer’s specified procedure when removing fuel system components.
       5. Keep a spill response kit nearby to deal with any spills quickly.
       6. Spill kits should contain absorbent material and barrier dams to contain moderate-sized spills.
    4. Draining Fuel
       1. If there is a possibility of fuel spillage while working on a vehicle, then you should first remove the fuel safely.
          1. Do this only in a well-ventilated, level space, preferably outside in the open air.
          2. ii. Make sure all potential sources of ignition have been removed from the area.
          3. Disconnect the battery on the vehicle.
          4. Do not drain fuel from a vehicle over an inspection pit.
          5. Make sure the container you are draining into is an approved fuel storage container (fuel retriever) and that it is large enough to contain all of the fuel in the system being drained.
    5. Using a Fuel Retriever
       1. Always use a fuel retriever, preferably removing the fuel through the filler neck.
       2. A fuel retriever will minimize the chance of sudden large spills occurring.
       3. You may need to use narrow-diameter hoses or adapters to drain fuel lines or to bypass anti-spillage devices.
       4. Check the service manual for details.
18. Extinguishing Fires
19. Three elements must be present at the same time for a fire to occur: fuel, oxygen, and heat.
20. The secret of firefighting involves the removal of at least one of these elements, usually the oxygen or the heat
21. Fire Classifications: Five classes in the United States
    * 1. Class A Fires –ordinary combustibles such as wood, paper, or cloth
      2. Class B Fires – flammable liquids or gaseous fuels
      3. Class C Fires – electrical equipment
      4. Class D Fires – combustible metals such as sodium, titanium, and magnesium
      5. Class K Fires – cooking oil or fat
22. Fire Extinguisher Types (Figure 3-9)
23. Class A – Green triangle
24. Class B – Red square
25. Class C – Blue circle
26. Class D – Yellow pentagon
27. Class K – Black hexagon
28. Fire Extinguisher Operation
    1. Sound the alarm before attempting to fight a fire.
    2. If you cannot fight the fire safely, leave the area while you wait for backup.
    3. Identify what sort of material is burning, the extent of the fire, and the likelihood of it spreading.
    4. Follow the acronym for fire extinguisher use: PASS (Pull, Aim, Squeeze, Sweep). See Figure 3-10.
       1. *Pull* out the pin that locks the handle at the top of the fire extinguisher to prevent accidental use.
       2. Carry the fire extinguisher in one hand, and use your other hand to *aim* the nozzle at the base of the fire.
       3. Stand about 8–12' (2.4–3.7 m) away from the fire and *squeeze* the handle to discharge the fire extinguisher
       4. *Sweep* the nozzle from side to side at the base of the fire
    5. Continue to watch the fire; it may reignite.
    6. If the fire is indoors, stand between the fire and the nearest safe exit.
    7. If the fire is outside, stand facing the fire with the wind on your back, so that the smoke and heat are being blown away from you.
    8. If possible, get an assistant to guide you and inform you of the fire’s progress.
    9. Ensure you have a means of escape.
    10. Report the fire and your actions to your supervisor.
    11. When the fire has been investigated, and the fire department and supervisor have given you the all clear, clean up the debris and submit the used fire extinguisher for inspection.
29. Fire Blankets
    1. Designed to smother a small fire
    2. Very useful in putting out a fire on a person
    3. Used in situations where a fire extinguisher could cause damage
    4. Obtain a fire blanket and study the how-to-use instructions on the packaging.
    5. If instructions are not provided, research how to use a fire blanket or ask your supervisor.
    6. You may require instruction from an authorized person in using the fire blanket.
    7. If you do use a fire blanket, make sure you return the blanket for use or, if necessary, replace it with a new one.
30. Eyewash Stations and Emergency Showers
31. Eye wash stations used to flush the eye with clean water or sterile liquid in the event foreign liquid or particles enter the eye
    1. There are different types of eye washers.
    2. The main ones are disposable eye wash packs and eye wash stations.
    3. Some emergency or deluge showers also have an eye wash station built in.
32. When individuals get chemicals in their eyes, they typically need assistance in reaching the eye wash station.
    1. Take their arm and lead them to it.
    2. Encourage them to use their fingers to pull their eyelids open.
    3. If a chemical splashed in their eyes, encourage them to rinse their eyes for 15 minutes.
    4. While they are rinsing their eyes, call for medical assistance.

IV. Hazardous Materials Safety

1. Hazardous material: Any material that poses an unreasonable risk of damage or injury to persons, property, or the environment if it is not properly controlled during handling, storage, manufacture, processing, packaging, use and disposal, or transportation
2. Can be solids, liquids, or gases.
3. Most shops use hazardous materials daily, such as cleaning solvents, gasket cement, brake fluid, and coolant.
4. Hazardous materials must be properly handled, labeled, and stored in the shop.
5. Safety Data Sheets (Figure 3-12)
   1. Contain detailed information about hazardous materials to help you understand how they should be safely used, any health effects relating to them, how to treat a person who has been exposed to them, and how to deal with them in a fire situation
6. Can be obtained from the manufacturer of the material
7. The shop should have an SDS for each hazardous substance or dangerous product.
8. In the U.S. it is required that workplaces have an SDS for every chemical that is on site.
   1. Consult SDS to learn how to use all products safely.
      1. Be aware that certain combinations of products can be more dangerous than any of them separately.
   2. SDS are usually kept in a clearly marked binder.
      1. They should be regularly updated as chemicals come into the workplace.
      2. Generally the SDS must contain at least the following information:
      3. Revision date
      4. Material and Manufacturer ID
      5. Hazardous ingredient
      6. Health hazard data
      7. Fire and explosion data
      8. Details about the material mixing or reacting with other materials
      9. Special precautions
   3. To identify the information found on an SDS, follow the steps in Skill Drill 3-2.
9. Cleaning Toxic Dust Safely
   1. Toxic dustis any dust that may contain fine particles that could be harmful to humans or the environment.
      1. If you are unsure as to the toxicity of dust, always treat it as toxic; take the precautions identified in the SDS or shop procedures.
      2. Brake and clutch dust are potential toxic dusts that repair shops must manage.
         1. Made up of very fine particles
         2. Can easily spread and contaminate an area
         3. One of the more common sources of toxic dust is inside drum brakes and manual transmission bell housings.
   2. Avoid all dust if possible, whether it is classified as toxic or not.
      1. If you do have to work with dust, never use compressed air to blow it from components or parts.
      2. Always use PPE such as face masks, eye protection, and gloves.
      3. Do not dry sweep dust; instead, use a low-pressure wet cleaning method.
      4. Soap and water solution used in a dedicated portable wash station
      5. A low-pressure aerosol brake cleaning solution
      6. A pump spray bottle filled with water
      7. HEPA vacuum cleaner to collect dust and clean equipment
         1. HEPA filters can trap very small particles and prevent them from being redistributed into the surrounding air.
   3. After completing a servicing or repair task on a vehicle, there is often dirt left behind.
      1. The chemicals present in this dirt usually contain toxic chemicals that can build up and cause health problems.
      2. Clean up dirt immediately after the task is complete.
      3. When sweeping, use a soft broom that pushes, rather than flicks, the dirt forward.
      4. Create smaller dirt piles and dispose of them frequently.
      5. Another successful way of cleaning shop dirt is to use a water hose.
         1. The wastewater must be caught in a settling pit and not run into a storm water drain.
   4. Various tools have been developed to clean toxic dust from vehicle components.
      1. Brake wash station uses an aqueous solution to wet down and wash the dust into a collection basin.
         1. Basin needs periodic maintenance to properly dispose of the accumulated sludge
         2. This tool is probably the simplest way to effectively deal with hazardous dust because it is easy to set up, use, and store.
   5. Another such tool uses a vacuum cleaner that has a large cone attachment at the nozzle end.
      1. The base of the cone is open so the brake assembly can fit into the cone.
      2. A compressed air nozzle, which is also attached to the inside of the cone, is used to loosen dirt particles.
      3. The particles are drawn into the cleaner via a very fine filter.
      4. Domestic vacuum cleaners are not suitable for this application because their filters are not fine enough to capture very small dust particles.
   6. To safely clean brake dust, follow the steps in Skill Drill 3-3.
10. Used Engine Oil and Fluids
11. Liquids that have been drained from the vehicle, usually during servicing operations
    1. Will often contain dangerous chemicals and impurities and need to be safely recycled or disposed of in an environmentally friendly way (Figure 3-13)
    2. Laws and regulations control the way in which they are to be handled and disposed.
    3. Shop policies and procedures describe how you should handle and dispose of used engine oil and fluids.
    4. Be careful not to mix incompatible fluids such as used engine oil and used coolant.
    5. Generally speaking, petroleum products can be mixed together.
    6. Follow your local, state, and federal regulations when disposing of waste fluids.
12. Coming into frequent or prolonged contact with used engine oil can cause dermatitis and other skin disorders, including some forms of cancer.
    1. Avoid direct contact as much as possible by always using gloves and other protective clothing, which should be cleaned or replaced regularly.
    2. Using a barrier-type hand lotion will also help protect your hands as well as make cleaning them much easier.
    3. Follow safe work practices, which minimize the possibility of accidental spills.
    4. Keep a high standard of personal hygiene and cleanliness.
    5. It is important to get into the habit of washing off harmful materials as soon as possible after contact.
    6. Regularly inspect your skin for signs of damage or deterioration.
    7. If you have any concerns, see your doctor.

V. Shop Safety Inspections

1. Shop safety inspections are valuable ways of identifying unsafe equipment, materials, or activities so they can be corrected to prevent accidents or injuries.
2. Inspection can be formalized by using inspection sheets to check specific items
3. Inspection can be general walk-around where you consciously look for problems that can be corrected
4. Common things to look for:
   1. Items blocking emergency exits or walkways
   2. Poor safety signage
   3. Unsafe storage of flammable goods
   4. Tripping hazards
   5. Faulty or unsafe equipment or tools
   6. Missing fire extinguishers
   7. Clutter
   8. Spills
   9. Unsafe shop practices
   10. People not wearing the correct PPE.
5. Formal and informal safety inspections should be held regularly

VI. Personal Protective Equipment

1. PPE is equipment used to block the entry of hazardous materials into the body or to protect the body from injury and includes (Figure 3-14):
2. Shoes
3. Safety glasses
4. Hearing protection
5. Masks
6. Respirators
7. Choose the correct PPE for any given activity; PPE must fit correctly.
8. Protective Clothing
9. Includes items like shirts, pants, shoes, and gloves
10. First line of defense against injuries and accidents
11. Must be worn when performing any work
12. Keep protective clothing clean and in good condition.
13. Replace any clothing that is not in good condition, since it is no longer able to fully protect you.
14. Work Clothing
    1. Always wear appropriate work clothing.
    2. The clothes you work in should be comfortable enough to allow you to move, without being loose enough to catch on machinery.
    3. Material must be flame retardant and strong enough that it cannot be easily torn.
    4. A flap must cover buttons or snaps.
    5. If you wear a long sleeve shirt, the cuffs must be close fitting, without being tight.
    6. Pants should not have cuffs, so that hot debris cannot become trapped in the fabric.
    7. Care of Clothing
       1. Always wash your work clothes separately from your other clothes.
       2. Start a new working day with clean work clothes and change out of contaminated clothing as soon as possible.
       3. Keep a spare set of work clothes in the workshop in case a toxic or corrosive fluid is spilled on the clothes you are wearing.
15. Footwear
16. Proper footwear provides protection against items falling on your feet, chemicals, cuts, abrasions, and slips.
17. The soles of your shoes must be acid and slip resistant, and the uppers must be made from a puncture-proof material such as leather.
18. Some shops and technicians prefer safety shoes with a steel cap to protect the toes (Figure 3-15).
19. Always wear shoes that comply with your local shop standards.
20. Headgear
    1. Includes items like hairnets, caps, and hard hats
    2. Helps protect you from getting your hair caught in rotating machinery and protect your head from knocks or bumps
    3. It is good practice to wear a cap to hold longer hair in place and to keep it clean when working under a vehicle.
    4. Some caps are designed with additional padding on the top to provide extra protection against bumps.
21. Hand Protection
22. Hands are a very complex and sensitive part of the body, and are susceptible to injury and damage.
23. Nearly every activity performed on vehicles requires the use of your hands.
24. Whenever possible, wear gloves to protect your hands.
25. There are many types of gloves available and their applications vary greatly.
26. It is important to wear the correct type of glove for the various activities you perform.
27. Chemical Gloves
    1. Heavy-duty and impenetrable chemical gloves should always be worn when using solvents and cleaners.
    2. They should also be worn when working on batteries.
    3. Chemical gloves should extend to the middle of your forearm to reduce the risk of chemicals splashing onto your skin (Figure 3-16).
    4. Always inspect chemical gloves for holes or cracks before using them, and replace them when they become worn.
    5. Some chemical gloves are also slightly heat resistant.
       * 1. Suitable for use when removing radiator caps and mixing coolant
28. Leather Gloves
29. Will protect your hands from burns when welding or handling hot components (Figure 3-17)
30. Use them when removing steel from a storage rack and when handling sharp objects.
31. Be aware of the potential for heat buildup.
    * 1. Occurs when the leather glove can no longer absorb or reflect heat, and heat is transferred to the inside of the leather glove
      2. At this point, the leather gloves’ ability to protect you from the heat is reduced and you will need to stop work, remove the leather gloves, and allow them to cool down before continuing to work.
      3. Avoid picking up very hot metal with leather gloves because it causes the leather to harden, making it less flexible during use.
         1. If very hot metal must be moved, it would be better to use an appropriate pair of pliers.
32. Light-Duty Gloves
    1. Should be used to protect your hands from exposure to greases and oils (Figure 3-18)
    2. Typically disposable
    3. Can be made from a few different materials, such as nitrile, latex, and even plastic
    4. If you have an allergic reaction when wearing these gloves, try using a glove made from a different material.
33. General Purpose Cloth Gloves
    1. Designed to be worn in cold temperatures, particularly during winter (Figure 3-19)
    2. Over time, cloth gloves will accumulate dirt and grime so you will need to wash them regularly.
    3. Regularly inspect cloth gloves for damage and wear.
    4. Replace them when required.
    5. Not an effective barrier against chemicals or oils
34. Barrier Cream
35. Looks and feels like a moisturizing cream, but has a specific formula to provide extra protection from chemicals and oils
36. Prevents chemicals from being absorbed into your skin and should be applied to your hands before you begin work (Figure 3-20)
37. Even the slightest exposure to certain chemicals can lead to dermatitis
38. Never use a standard moisturizer as a replacement for proper barrier cream.
39. Can prevent fine particles from adhering to your skin.
40. Cleaning Your Hands
    1. Use only specialized hand cleaners, which protect your skin (Figure 3-21).
    2. Never use solvents such as gasoline or kerosene to clean your hands, because they can be absorbed into the bloodstream and remove the skin’s natural protective oils.
41. Ear Protection
42. Should be worn when sound levels exceed 85 decibels, when you are working around operating machinery for any period of time, or when the equipment you are using produces loud noise
    1. If you have to raise your voice to be heard by a person who is 2' away from you, then the sound level is about 85 decibels or more.
    2. Ear protection comes in two forms:
       1. One type covers the entire outer ear.
       2. The other is fitted into the ear canal (Figure 3-22).
       3. Generally speaking, the in-the-ear style has higher noise-reduction ratings.
       4. If the noise is not excessively loud, either type of protection will work.
       5. If you are in an extremely loud environment, verify that the option you choose is rated high enough.
43. Breathing Devices
44. Disposable Dust Mask
    1. Made from paper with a wire- reinforced edge that is held to your face with an elastic strip
    2. Covers your mouth and nose and is disposed of at the completion of the task (Figure 3-23)
    3. Should only be used as a dust mask and should not be used if chemicals, such as paint solvents, are present in the atmosphere
45. Respirator
    1. Has removable cartridges that can be changed according to the type of contaminant being filtered
    2. Ensure the cartridge is the correct type for the contaminant in the atmosphere.
    3. Replace cartridges according to the manufacturer’s recommendation to ensure their effectiveness.
    4. To be completely effective, the respirator mask must make a good seal onto your face (Figure 3-24).
46. Eye Protection
47. There are many things in the workshop environment that can damage or injure eyes.
    1. For example, high-velocity particles coming from a grinder or high-intensity light coming from a welder
    2. Always select the appropriate eye protection for the work you are undertaking.
    3. Sometimes this may mean that more than one type of protection is required.
48. Safety Glasses
49. Most common type of eye protection is a pair of safety glasses, which must be marked with “Z87” on the lens and frame
50. Have built-in side shields to help protect your eyes from the side
51. Approved safety glasses should be worn whenever you are in a workshop.
52. Designed to help protect your eyes from direct impact or debris damage (Figure 3-25)
53. Remove only when you are using other eye protection equipment.
54. Prescription and tinted safety glasses are also available.
55. Tinted safety glasses are designed to be worn outside in bright sunlight conditions.
56. Never wear them indoors or in low light conditions because they reduce your ability to see.
57. Welding Helmet
    1. Wear a welding helmetwhen using or assisting a person using an electric welder.
    2. The light from a welding arc is very bright and contains high levels of ultraviolet radiation.
       1. The lens on a welding helmet has heavily tinted glass to reduce the intensity of the light from the welding tip (Figure 3-26).
       2. Lenses come in a variety of ratings depending on the type of welding you are doing.
       3. Always make sure you are using a properly rated lens.
       4. The remainder of the helmet is made from a durable material that blocks any other light from reaching your face.
    3. Welding helmets that tint automatically when an arc is struck are also available.
       1. Their big advantage is that you do not have to lift and lower the lens by hand
58. Gas Welding Goggles
    1. Can be worn instead of a welding mask when using or assisting a person using an oxyacetylene welder (Figure 3-27)
    2. Eyepieces are available in heavily tinted versions, but not as tinted as those used in an electric welding helmet
    3. There is no ultraviolet radiation from an oxyacetylene flame, so the welding helmet is not required. However, the flame is bright enough to damage your eyes, so always use goggles of the correct rating.
59. Full Face Shield
    1. Use when using solvents and cleaners, epoxies, and resins or when working on a Battery (Figure 3-28).
    2. Clear mask of the face shield allows you to see all that you are doing
    3. Will protect your entire face from chemical burns should there be any splashes or battery explosions
    4. It is recommended that you use a full face shield combined with safety goggles when using a bench or angle grinder.
60. Safety Goggles
    1. Provide much the same eye protection as safety glasses but with added protection against harmful chemicals that may splash up behind the lenses of glasses (Figure 3-29)
    2. Provide additional protection from foreign particles
    3. Must be worn when servicing air-conditioning systems or any other system that contains pressurized gas
    4. Can sometimes fog up when in use; if this occurs, use one of the special anti-fog cleaning fluids or cloths to clean them.
61. Hair Containment
62. It is easy to get hair caught in rotating machinery, such as drill presses or running engines, and it can happen very quickly.
63. If your hair gets caught in the machinery, you can be pulled into the machinery and injured or killed.
64. Hair should always be tied back and contained within a hairnet or cap.
65. Your workshop will have policies and procedures relating to appropriate hairstyles for shop activities.
66. Research the policy and procedures to determine appropriate hairstyles for activities.
67. Always wear your hair according to the policy and procedures.
68. Use hairnets, caps, or elastic bands as required for each activity.
69. Watches and Jewelry
70. Present a number of hazards in the workshop environment
71. Can get caught in rotating machinery
72. Can conduct electricity if constructed from metal
73. Always remove before starting work

VII. Injury Protection Practices

1. Safe Attitude
2. Develop a safe attitude toward your work.
3. Always think “safety first,” and then act safely.
4. Think ahead about what you are doing.
5. Ask yourself the following questions:
   1. What could go wrong?
   2. What measures can I take to ensure that nothing goes wrong?
   3. What PPE should I use?
   4. Have I been trained to use this piece of equipment?
   5. Is the equipment I’m using safe?
6. Proper Ventilation
7. Required for working in the shop area
8. Ensure that any task or procedure that may produce dangerous or toxic fumes is recognized so that measures can be put in place to provide adequate ventilation.
9. Ventilation can be provided by natural means, such as by opening doors and windows to provide air flow for low-exposure situations.
10. In high-exposure situations, such as vehicles running in the shop, a mechanical means of ventilation is required (e.g., exhaust extraction system).
11. Parts cleaning areas or areas where solvents and chemicals are used should also have good general ventilation,
    1. If required, additional exhaust hoods or fans should be installed to remove dangerous fumes.
12. In some cases, such as when spraying paint, it may be necessary to use a personal respirator in addition to proper ventilation.
13. Lifting
14. Reduce the risk of injury by breaking down the load into smaller quantities, asking for assistance if required, or possibly using a mechanical device to assist the lift.
15. When lifting:
    1. Bend your knees to lower your body.
    2. Do not bend over with straight legs because this can damage your back (Figure 3-30).
    3. Place your feet about shoulder width apart.
    4. Lift the item by straightening your legs while keeping your back as straight as possible.
16. Housekeeping and Orderliness
17. Trash and liquid spills should be quickly cleaned up.
18. Tools need to be cleaned and put away after use.
19. Spare parts need to be stored correctly
20. Generally, everything needs to have a safe place to be kept.
21. Carry out good housekeeping practices while working, not just after a job is completed.
22. Periodically perform a deep clean of the shop so that any neglected areas are taken care of.
23. Slip, Trip, and Fall Hazards
24. Can be caused by trash, tools and equipment, or liquid spills being left lying around
25. Always be on the lookout for hazards that can cause slips, trips, or falls.
26. Floors and steps should be kept clean and have anti-slip coatings applied to them.
    1. High-visibility strips with anti-slip coatings can be applied to the edge of step treads to reduce the hazard.
27. Clean up liquid spills immediately and mark the area with wet floor signs until the floor is dry.
28. Make sure the workshop has good lighting so hazards are easy to spot.
29. Keep walkways clear from obstruction.
30. Think about what you are doing and make sure the work area is free of slip, trip, and fall hazards as you work.

VIII. First Aid Principles

1. This section of the text is designed to provide you with an awareness of basic first aid principles and the importance of first aid training courses.
2. This information is only a guide.
3. It is not a substitute for training or professional medical assistance.
4. Always seek professional advice when tending to an injured person.
5. First aid is the immediate care given to an injured or suddenly ill person.
6. First aid courses are available through many organizations, such as the Emergency Care and Safety Institute (ECSI).
   1. It is strongly advised that you seek out a certified first aid course and become certified in first aid.
7. First Aid Concepts
8. Prompt care and treatment prior to the arrival of emergency medical assistance can sometimes mean the difference between life and death.
9. Goals of first aid are to:
   1. Make the immediate environment as safe as possible
   2. Preserve the life of the patient
   3. Prevent the injury from worsening
   4. Prevent additional injuries from occurring protect the unconscious
   5. Promote recovery
   6. Comfort the injured
   7. Prevent any delay in treatment
   8. Provide the best possible care for the injured person
10. When attending to an injured victim, always send for assistance.
11. Make sure the person who stays with the injured victim is more experienced in first aid than the messenger.
12. If you are the only person available, request medical assistance as soon as reasonably possible.
13. When you approach the scene of an accident or emergency:
    1. Danger: Make sure there are no other dangers, and assist only if safe to do so.
    2. Response: Check to see if the victim is responsive and breathing. If responsive, ask if he/she needs help. If the victim does not respond, he/she is unresponsive.
    3. Have a bystander call 9-1-1.
    4. If alone, call 9-1-1 yourself (if in another country, dial the relevant number)
    5. If unresponsive and not breathing, place your hands in the center of the victim’s chest and provide 30 chest compressions hard and fast (Figure 3-31)
    6. Tilt the victim’s head back and lift the chin to open the airway. Give one rescue breath lasting 1 second, take a normal breath for yourself, and then give the victim another breath lasting 1 second. Each rescue breath should make the victim’s chest rise.
    7. Repeat the compression and breath cycles until an AED is available or EMS personnel arrive.
    8. Once an AED arrives, expose the victim’s chest and turn on the AED. Attach the AED pads. Ensure that no one touches the victim. Follow the audio and visual prompts from the AED. If no shock is advised, resume CPR immediately (five sets of 30 compressions and two breaths). If a shock is advised, do not touch the victim and give one shock. Or, shock as advised by AED. Resume immediately 30 compressions and two breaths.
14. Bleeding
15. A wound that is severely bleeding is serious.
    1. If the bleeding is allowed to continue, the victim may collapse or die.
    2. Bleeding is divided into two categories: external and internal.
    3. External bleeding is the loss of blood from an external wound where blood can be seen escaping.
    4. Internal bleeding is the loss of blood into a body cavity from a wound with no obvious sign of blood.
16. Before providing first aid, make sure you are not exposed to blood.
    1. Wear latex gloves or an artificial barrier.
    2. Lay the victim down, then apply a gauze pad and direct pressure to the wound (Figure 3-32).
    3. Apply a pressure bandage over the gauze.
    4. If blood soaks through the bandage, apply additional dressings and pressure bandage (Figure 3-33).
    5. Call 9-1-1 if bleeding cannot be controlled.
    6. Give nothing by mouth and seek medical aid immediately.
17. If an object punctures the victim’s skin and becomes embedded in the victim’s body, do not attempt to remove the object.
    1. Stabilize the object with a bulky dressing.
    2. Seek medical care immediately.
18. If the injured person has internal bleeding, it may not be immediately obvious.
    * 1. Symptoms of internal bleeding are bruising, a painful or tender area, coughing frothy blood, vomiting blood, stool that is black or contains bright red blood, and passing blood with urine.
      2. To assist an injured victim with internal bleeding, lay the victim down, loosen tight clothing, give nothing by mouth, and seek medical aid immediately.
19. Eye Injuries
20. Foreign objects can become embedded in the eye or chemicals can splash into the eye.
    1. If an object penetrates and becomes embedded in the eye, do not attempt to remove it.
    2. Lay the victim down.
    3. Stabilize the object with a bulky dressing or clean cloths.
    4. Ask the victim to close the other eye.
    5. Call 9-1-1 (or relevant emergency assistance phone number) (Figure 3-34).
21. If an object is loose on the surface of the eye:
    1. Pull the upper lid over the lower lid.
    2. Hold the eyelid open and gently rinse with water.
    3. Examine the lower lid by pulling it down gently.
    4. If you can see the object, remove it with a moistened sterile gauze, a clean cloth, or a moistened cotton swab.
    5. Examine the underside of the upper lid by grasping the lashes of the upper lid and rolling the lid upward over a cotton swab.
    6. If you can see the object, remove it with a moistened sterile gauze or a clean cloth (Figure 3-35).
22. If a chemical splashes into the eyes, you may be able to flush it out using an eye wash station (Figure 3-36).
    1. Hold the eye wide open and flush with warm water for at least 20 minutes, continuously and gently.
    2. Irrigate from the nose side of the eye toward the outside to avoid flushing material into the other eye.
    3. Loosely bandage the eyes with wet dressings.
    4. Call 9-1-1 (or the relevant emergency assistance phone number).
23. Fractures
24. A fracture is a broken or cracked bone.
    1. Always seek medical care for all fractures.
    2. There are three types of bone fractures:
       1. Simple fracture – involves no wound or internal or external bleeding
       2. Open fracture – involves bleeding or the protrusion of bone through the skin
       3. Complicated fracture – involves penetration of a bone into a vital organ.
25. Symptoms of a fracture:
    1. Hearing a snapping noise when the injury occurred
    2. Pain or tenderness at or near the injury
    3. Inability to move the limb
    4. Loss of strength in the limb
    5. Shortening of the limb or an abnormally shaped limb
    6. Swelling and/or bruising around the area
    7. A grinding noise if the limb is moved
26. Allow the victim to support the injured area in the most comfortable position.
    1. Stabilize the injured part with your hands or a splint to prevent movement.
    2. If the injury is an open fracture, do not push on any protruding bone.
    3. Cover the wound and exposed bone with a dressing.
    4. Apply ice or a cold pack if possible to help reduce swelling or pain.
    5. Call 9-1-1 (or the relevant emergency assistance phone number) for any open fractures or large bone fractures.
    6. Do not move the victim unless there is an immediate danger.
    7. Be aware of the onset of shock, which may present as the victim vomiting or fainting.
       1. Shock is when the body’s tissues do not receive enough oxygenated blood.
27. Sprains, Strains, and Dislocations
28. Sprain – occurs when a joint is forced beyond its natural movement limit
    1. This causes stretching or tearing in the ligaments that hold the bones together.
    2. The symptoms of a sprain include pain and loss of limb function, with swelling and bruising present.
    3. When a sprain occurs:
       1. Apply covered ice packs every 20 minutes.
       2. Elevate the injured limb.
       3. Apply an elastic compression bandage to the area and beyond the affected area.
       4. Always treat a sprain as a fracture until medical opinion says otherwise.
29. Strain – an injury caused by the overstretching of muscles and tendons.
    1. Symptoms of a strain are sharp pain in the area immediately after the injury occurs, increased pain when using the limb, or tenderness over the entire muscle.
    2. The muscle may also have an indentation at the strain location.
    3. When a strain occurs:
       1. Have the victim rest.
       2. Elevate the injured limb.
       3. Apply covered ice packs every 20 minutes.
       4. Apply an elastic compression bandage.
30. Dislocation – the displacement of a joint from its normal position
    1. Caused by an external force stretching the ligaments beyond their elastic limit
    2. Symptoms of a dislocation are pain or tenderness around the area, inability to move the joint, deformity of the joint, and swelling and discoloration over the joint.
    3. If a dislocation occurs, try to immobilize the limb and seek medical attention.
    4. Do not try to put the joint back in place.
31. Burns and Scalds
32. Burns are injuries to body tissues, including skin, that are caused by exposure to heat, chemicals, and radiation.
    1. Burns are classified as either superficial, partial thickness, or full thickness.
    2. Superficial burns, or first-degree burns, show reddening of the skin and damage to the outer layer of skin only (Figure 3-37).
    3. Partial-thickness burns, or second-degree burns, involve blistering and damage to the outer layer of skin (Figure 3-38).
    4. Full-thickness burns, or third-degree burns, involve white or blackened areas and include damage to all skin layers and underlying structures and tissues (Figure 3-39).
33. Burns can be caused by excessive heat, friction, radiation, chemicals, or electricity.
    1. Scalds are injuries to the skin caused by exposure to hot liquids and gases.
    2. The effects of burns and scalds can include permanent skin and tissue damage, blisters caused by damage to surface blood vessels, severe pain, and shock.
34. Remove the victim from any danger.
    1. If clothing is burning, have the victim roll on the ground using the “stop, drop, and roll” method.
    2. Smother the flames with a fire blanket or douse the victim with water.
    3. For minor burns, cool the burn with cool water until the body part is pain free.
    4. After the burn has cooled, apply antibiotic ointment.
    5. Do not apply lotions or aloe vera.
    6. Cover the burn loosely with a dry, nonstick, sterile or clean dressing.
    7. Do not break any blisters.
    8. Give an over-the-counter pain medication such as ibuprofen.
    9. Seek medical care.
       1. Any large or third-degree burn must be treated by a qualified medical practitioner.
    10. Serious burns include skin that is blackened, whitened, or charred; a burn that is larger than 2 cm (0.79") in diameter; or a burn that is in the airway or on the face, hands, or genitals.
        1. When presented with such burns, call 9-1-1 immediately.

IX. Summary

1. Your employer is responsible for maintaining a safe work environment; you are responsible for working safely.
2. Always wear the correct personal protective equipment, such as gloves or hearing protection. Personal protective equipment (PPE) protects the body from injury but must fit correctly and be task appropriate.
3. Accidents and injuries can be avoided by safe work practices.
4. Every shop should mark evacuation routes; always know the evacuation route for your shop.
5. OSHA is a federal agency that oversees safe workplace environments and practices.
6. The EPA monitors and enforces issues related to environmental safety.
7. Shop policies and procedures are designed to ensure compliance with laws and regulations, create a safe working environment, and guide shop practice.
8. Identify hazards and hazardous materials in your work environment.
9. Safety signs include a signal word, background color, text, and a pictorial message.
10. Shop safety equipment includes handrails, machinery guards, painted lines, soundproof rooms, adequate ventilation, gas extraction hoses, doors and gates, and temporary barriers.
11. Air quality is an important safety concern. Carbon monoxide and carbon dioxide from running engines can create a hazardous work environment.
12. Electrical safety in a shop is important to prevent shocks, burns, fires, and explosions.
13. Portable electrical equipment should be the proper voltage and should always be inspected for damage.
14. Shop layouts should be well planned to maximize safety.
15. Fuels and fuel vapors are potential fire hazards.
16. Use fuel retrievers when draining fuel and have a spill response kit nearby.
17. Types of fires are classified as A, B, C, D, or K, and fire extinguishers match them accordingly.
18. Do not fight a fire unless you can do so safely.
19. Eyewash stations and emergency showers allow flushing of chemicals or other irritants.
20. Safety data sheets contain important information on each hazardous material in the shop.
21. Vacuuming and using water are the safest methods of cleaning dust or dirt that may be toxic.
22. Used engine oil and fluids must be handled and disposed of properly.
23. Shop safety inspections ensure that safety policies and procedures are being followed.
24. Hazardous chemicals and oils can be absorbed into your skin.
25. Breathing devices include disposable dust masks and respirators.
26. Forms of eye protection are safety glasses, welding helmet, gas welding goggles, full face shield, and safety goggles.
27. Before starting work, remove all jewelry and watches, and make sure your hair is contained.
28. Thinking “safety first” will lead to acting safely.
29. All shops require proper ventilation.
30. Lifting correctly or seeking assistance will prevent back injuries.
31. First aid involves providing immediate care to an ill or injured person.
32. Do not perform first aid if it is unsafe to do so.

Post-Lecture

This section contains various student-centered end-of-chapter activities designed as enhancements to the instructor’s presentation. As time permits, these activities may be presented in class. They are also designed to be used as homework activities.

## Review and ASE-Type Questions

This activity is designed to assist the student in gaining a further understanding of and familiarity with review and ASE-type questions.

### Instructor Directions

**1.** Direct students to read and individually answer the questions located in the Wrap-up section at the end of Chapter 3. Allow approximately 10 minutes for this part of the activity.

**2.** Facilitate a class review and dialogue of the answers, allowing students to correct responses as may be needed. Use the quiz question answers noted below to assist in building this review.

**3.** You may wish to ask students to complete the activity on their own and turn in their answers on a separate piece of paper.

### Answers to Review Questions

1. Who is responsible for providing a safe work environment?

a. The customer

b. The coworkers

c. The technician

d. The employer

1. Your shop should have a(n) \_\_\_\_\_\_\_\_\_that clearly identifies the evacuation routes.

a. safety procedure

b. safety first manual

c. emergency manual

d. evacuation procedure

1. All automotive shop activities need to comply with EPA laws and regulations by:

a. ensuring that waste products are disposed of in an environmentally responsible way.

b. storing chemicals and fluids correctly.

c. ensuring that work practices do not contribute to damaging the environment.

d. All of the choices are correct.

1. A \_\_\_\_\_\_\_\_\_\_\_is a list of the steps required to get the same result each time a task or activity is performed.

a. theory

b. measure

c. policy

d. procedure

1. Which of the following is a typical component found in safety signage?

a. Background color

b. Text

c. A signal word

d. All of the choices are correct.

1. There are three signal words: \_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_.

a. stop; warning; danger

b. warning; general; danger

c. danger; warning; caution

d. caution; stop; danger

1. The maximum OSHA permissible exposure limit (PEL) for carbon monoxide is \_\_\_\_\_\_\_\_\_\_ parts per million (ppm) of air for an 8-hour period.

a. 20

b. 30

c. 40

d. 50

1. Typically, there should be \_\_\_\_\_\_\_\_\_\_of unobstructed space around an electrical panel.

a. 1'

b. 2'

c. 3'

d. None of the choices is correct.

1. Which of the following bulb types presents an extreme fire hazard if broken in the presence of flammable vapors or liquids?

a. Incandescent

b. LED

c. Fluorescent

d. None of the choices is correct.

1. Class C fires involve:

a. electrical equipment.

b. paper and wood.

c. flammable liquids.

d. None of the choices is correct.

### Answers to ASE-Type Questions

* 1. Technician A says that exposure to solvents may have long-term effects. Technician B says that accidents are almost always avoidable. Who is correct?

a. Technician A

b. Technician B

c. Both Technician A and Technician B

d. Neither Technician A nor Technician B

* 1. Technician A says that both OSHA and the EPA can inspect facilities for violations. Technician B says that a shop safety rule does not have to be reviewed once put in place. Who is correct?

a. Technician A

b. Technician B

c. Both Technician A and Technician B

d. Neither Technician A nor Technician B

* 1. Technician A says that both caution and danger indicate a potentially hazardous situation. Technician B says that an exhaust extraction hose is not needed if the vehicle is only going to run for a few minutes. Who is correct?

a. Technician A

b. Technician B

c. Both Technician A and Technician B

d. Neither Technician A nor Technician B

* 1. Technician A says that firefighting equipment includes safety glasses. Technician B says that a class A fire extinguisher can be used to fight an electrical fire only. Who is correct?

a. Technician A

b. Technician B

c. Both Technician A and Technician B

d. Neither Technician A nor Technician B

* 1. Technician A says that a good way to clean dust off brakes is with compressed air. Technician B says that asbestos may be in current auto parts. Who is correct?

a. Technician A

b. Technician B

c. Both Technician A and Technician B

d. Neither Technician A nor Technician B

* 1. Technician A says that personal protective equipment (PPE) does not include clothing. Technician B says that the PPE used should be based on the task you are performing. Who is correct?

a. Technician A

b. Technician B

c. Both Technician A and Technician B

d. Neither Technician A nor Technician B

* 1. Technician A says that appropriate work clothes include loose-fitting clothing. Technician B says that you should always wear cuffed pants when working in a shop. Who is correct?

a. Technician A

b. Technician B

c. Both Technician A and Technician B

d. Neither Technician A nor Technician B

* 1. Technician A says that a hat can help keep your hair clean when working on a vehicle. Technician B says that chemical gloves may be used when working with solvent. Who is correct?

a. Technician A

b. Technician B

c. Both Technician A and Technician B

d. Neither Technician A nor Technician B

* 1. Technician A says that barrier creams are used to make cleaning your hands easier. Technician B says that hearing protection only needs to be worn by people operating loud equipment. Who is correct?

a. Technician A

b. Technician B

c. Both Technician A and Technician B

d. Neither Technician A nor Technician B

* 1. Technician A says that tinted safety glasses can be worn when working outside. Technician B says that welding can cause a sunburn. Who is correct?

a. Technician A

b. Technician B

c. Both Technician A and Technician B

d. Neither Technician A nor Technician B

## Assignments

A. Review all materials from this lesson and be prepared for a lesson quiz to be administered (date to be determined by instructor).

B. Direct students to read the next chapter as listed on your syllabus to prepare for the next class session.