

TCIA Arborist Apprenticeship Training Program Sample

The core of the Arborist Apprentice Training Program is Instructor's Guides and Arborist Apprentice Manuals that guide trainers and apprentices through the three years of the apprenticeship program. The guides and the manuals are intended to be used in tandem.

The full Arborist Apprenticeship Training Program will contain the following:

1. Employer Guide and kit
2. Three Instructor Guides to help trainer's implement Year 1, Year 2, and Year 3 of the program.
3. Three Arborist Apprentice Manuals to provide content to apprentices for Year 1, Year 2, and Year 3 of the program.

This sample of the Year 1 program provides you with:

1. The Instructor's Guide Introduction. ***Read this first*** to get a good understanding of how the program works.
2. Instructors Guide Module 1 – *General Safety*
3. Arborist Apprenticeship Manual Module 1 – *General Safety*

Questions? Contact TCIA: Apprenticeship@tcia.org

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Welcome to the TCIA Apprenticeship Program. If you are reading this manual, you have probably been tasked to work with one or more apprentices in your organization. Although the program is designed to allow for a significant amount of self-guided learning, the role of the “instructor” is extremely important to effective learning and assessment of knowledge and skills. Moreover, the instructor plays a critical role in the safety of the apprentice(s) as they learn to perform tree care related skills.

Instructors should be properly trained in all skills covered in this manual, as well as in all applicable safety procedures, emergency response, and first aid.

Instructors should also be trained in the basics of adult education, provision of training, and procedures for safe training of skills.

Purpose of the Program

The purpose of the TCIA Arborist Apprenticeship Program is to connect motivated workers with experts in the tree care industry and provide a comprehensive training program to advance their skills and certify their qualifications on a national level, building a trusted workforce of professional arborists.

This program will provide participant apprentices with the opportunity to earn a salary while also learning a skilled trade in the tree care industry. The program includes a combination of job-related classroom instruction and hands-on training at the job site.

The primary objective of the TCIA Arborist Apprenticeship Program is to train apprentices to be tree climbers and/or aerial lift operators with the knowledge and skills to care for trees. The program is designed to take approximately 3 years, but the time may be reduced based on relevant education or work experience and, if applicable, overtime work.

Program Objectives

The objectives of the Education and Training Component of the TCIA Apprentice Program shall be:

1. To provide a means of training and assessing participating arborist apprentices in the knowledge and skills important to arborists;
2. To provide a curriculum template, learning guidance, and educational materials for job-related arboricultural instruction and learning;
3. To provide guidance for hands-on instruction and competency checklists for critical skills used in the tree care profession; and
4. To aid participating employers in developing apprentices to become safe, proficient arborist journeyworkers.

Program Design

The TCIA Arborist Apprenticeship Education and Training Component is designed and developed according to best practices in instructional design. It has been designed by individuals with subject-matter expertise as well as instructional design training and experience. It utilizes principles and best practices in adult education and training. Careful and deliberate design helps to ensure the essential link between the course training and assessment and the desired learning outcomes of the program.

The learning objectives of the program are based on competency and knowledge parameters and, to allow reciprocity, parallel and/or coincide with those of existing arborist apprenticeship programs in other jurisdictions.

The program is designed using established principles of adult education:

- Allowing a degree of autonomy and self-direction within the course construct;
- Utilizing the accumulated foundation of experiences and knowledge of the learners;
- Emphasizing content and techniques that are goal-oriented, relevant, and practical; and
- Showing respect for time, needs, knowledge, and experience of the adult learners.

Based on Knowles, 1970

Safety

The TCIA Apprentice Manual provides a great deal of information, terminology, learning objectives, and opportunities for practice and reinforcement of concepts. Yet most aspects of an arborist's work are very much skills-based. A manual can offer fundamental knowledge, but no manual can provide absolute guidance for learning and practicing physical skills. Arborist skills can be potentially dangerous if not learned and practiced under close supervision by a properly trained instructor.

At no time should an apprentice be permitted to attempt or practice arborists skills, especially those involving equipment or aerial work, without the close supervision of a trained instructor. Aerial skills should be learned and practiced "low and slow" to minimize the chance of an injury.

How to Use This Manual

Modules

The Apprentice Manual is divided into modules that correspond to the key areas of knowledge and skills that an apprentice must learn. The first year has a very strong focus on safety and basic groundworker skills. This is coupled with basic knowledge related to tree biology, tree and shrub identification, and pruning. Each year of the apprenticeship builds upon what has already been learned. The depth and breadth of knowledge increase, and the skills become more advanced. All of the modules are designed to align closely with on-the-job training.

The Apprenticeship Modules by year are as follow.

YEAR 1

- General Safety
- Arborist Equipment Fundamentals
- Introduction to Aerial Work - Aerial Lift Basics
- Introduction to Tree and Shrub Identification
- Introduction to Tree Biology
- Pruning Fundamentals
- Introduction to Aerial Work - Tree Climbing Basics

YEAR 2

- Pruning Trees and Shrubs
- Tree and Shrub Identification 2
- Tree Biology - Understanding the Tree as a System
- Aerial Work - Climbing and Aerial Lift 2
- Introduction to Tree Support Systems and Lightning Protection
- Rigging and Removal Fundamentals
- Introduction to Tree Planting and Establishment

YEAR 3

- Aerial Work 3
- Rigging Techniques and Tree Felling
- Plant Health Care
- Tree Risk Assessment
- Transition to Journeyworker

Learning Objectives

The learning objectives establish, in more specificity, the desired learning outcomes for each module. Development of learning objectives was based on 1) already-established learning objectives for parallel programs, 2) prior job-task analysis statements from other similar programs, and 3) subject-matter expert and employer panel review. The text, practice exercise and questions, performance demonstrations, and written exam questions all relate to the learning objectives for each module.

Text

The main body of each module is divided into sections that present the main points in a logical sequence. Text is written at a level that should be easily understood by anyone with a high school diploma. Informative lists and bullets are used to help the reader grasp and follow the key points and progression of concepts. Graphics are used extensively to illustrate the concepts. Long sections of body text (prose) have been minimized, to the extent practical, and text is broken into segments followed by reinforcement content through activities, exercises, and/or assessments.

The introductory paragraph(s) give an overview of what is covered in the module, as well as a statement/short paragraph of why it is important. The introductory section may also provide conceptual background information.

Sidebars (side boxes) are used for presentation of information that enhances or illustrates the text but is not necessarily fundamental to achieving the learning objectives. Sidebars are also used when more detail is desired on a specific concept but including it in the main body would distract from the logical progression of ideas.

This Instructor's Manual provides instructor guidance for each module/section. Guidance emphasizes safety, positive feedback, expected learning objectives, and suggestions for guiding learning and performance.

Practice Exercises

Recognizing the importance of reinforcement in learning and of formative assessments to guide learners, workbook-type exercises are incorporated at the end of each topic section. Workbook sections include matching, fill in the blank statements, and true/false statements. Occasionally, fun exercises such as crossword puzzles and word searches are incorporated.



Multiple-choice practice questions will be included as formative assessments to help prepare apprentices for the written section assessments to be administered at the end of each module.

Answers to practice exercises are provided at the end of each module. The exercises do not have to be graded, but you should check that they have been completed and ensure that the apprentice is checking responses with the correct answers provided.

Practice Questions

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Important Terms

Rather than include a master glossary at the end of the manual, key terms and their definitions are included at the end of each module. The goal is to facilitate and encourage checking the definitions as the terms are encountered.

Performance Assessments

You will assess apprentice skills that are established using performance assessments. The Apprentice Manual provides guidance of what specifically is expected of them for each skills performance assessment. This guidance will correspond to the assessment rubrics that are included in this Instructor's Guides.



This instructor's Guide also provides guidance for you in preparing for and conducting each performance demonstration. **It is essential that you read and understand each module and section before conducting any performance assessments.**

Rubrics

A **rubric** is a tool used to score skills assessments based on established criteria for each task. Each rubric is customized for the learning objective being assessed. Many provide gradations of proficiency, which are scored based on the criteria provided.

A primary purpose of the rubrics is to establish clear expectations and an objective means by which to assess performance according to those expectations. A second, very important, purpose for the rubrics is to help apprentices improve by providing constructive feedback and ideas for improvement. Do not skip this section, even if the apprentice has demonstrated proficiency of the skill(s). Thoughtful use of rubrics can help apprentices become more objective judges of their own performance. Even when you have no suggestions to improve performance, positive feedback is an essential part of encouraging continued learning and growth.

Note that the percentage required for proficiency varies among performance demonstrations. Often demonstrations directly related to safety require 100 percent proficiency.

All performance assessments can be repeated as many times as necessary to receive a passing score.

Two copies of each performance assessment are included here. If the apprentice fails the first of any assessment, be sure to photocopy the second copy to ensure there will be a clean copy in the event the apprentice fails two times.

Written Module Assessments

In addition to the brief formative assessments that are included throughout each section, a written summative assessment consisting of multiple-choice questions is included for each module.

Two copies of the exam are included here. If the apprentice fails the first exam, be sure to photocopy the second copy of the test to ensure there will be a clean copy in the event the apprentice fails two times. **All written assessments can be repeated as many times as necessary to receive a passing score.**

It is possible that you will encounter an apprentice with a special need such as a learning disability. Any reasonable accommodation should be made to make this program assessable, as long as it does not result in a fundamental alteration of the program, assessment, or exam. For example, reading exam text aloud for an apprentice is an acceptable accommodation.

Checklists

A checklist for each module is included in this Manual. The checklist is for you to mark as each element of each module is successfully completed. Successful completion of a module requires that every exercise, practice question, and performance demonstration for every section is completed. You must work with the apprentice to help them achieve this goal.

Basic Training Skills

Adult Learners

Apprentices are adult learners and you should understand the characteristics of adult learners to be as effective as you can. Most adults learn because they are motivated to; they have a reason for wanting to learn. Apprentices are eager to work their way through the program and advance to the journeyworker level.

They need to see that the subject matter relates to what they will be doing on the job. You should take every opportunity to give practical examples and share stories of how the information is applicable. Emphasize why the knowledge and skills are important to them.

Make sure that apprentices are actively engaged and use on-the-job training to connect to the classroom knowledge and skills being learned. Most people learn best by “doing,” so try to align work duties to what is being learned, when possible.

Treat apprentices with respect. An instructor with an authoritarian attitude and dominant style may risk driving the apprentice away before completion of the program. Similarly, if apprentices are regularly assigned “grunt work” and feel that they are not given opportunities to learn new skills, they may become resentful and leave the program.



Praise apprentices frequently for their achievements. Positive reinforcement will encourage them to keep learning new concepts and skills.

Remember that reinforcement and repetition are very important to learning. Don't assume that everything that has been learned once will stay with the apprentice. You must review previous learning and build upon it, connecting it to new concepts and skills.

Learning Outcomes

Keep in mind always what the desired learning outcomes are. Tie the individual learning objectives to the bigger picture of proficiency as an arborist.

Clearly communicate expectations, both with the coursework and the on-the-job training. Most people genuinely want and try to do well. Provide positive and constructive feedback whenever you can.

Learning Environment

Although much of this course is designed for self-guided instruction, there will likely be training opportunities with more interaction between you and the apprentice(s). Provide an atmosphere that is conducive to learning. Even the way a learning area is set up can have a profound effect on the course atmosphere and how effective the learning will be. If you instruct or train a group, avoid the traditional classroom arrangement or lecture hall (sometimes called theater-style). A better arrangement is round tables or a U-shaped arrangement in which everyone can see each other and interact. A lecture arrangement or instructor style should be avoided. Most apprentices in this program gravitated toward arboriculture because they did not see their future in a formal academic setting.

Immersion in the subject matter content is a proven way to speed and enhance learning. If your company has a dedicated learning area, fill it with learning materials such as posters, tree ID and diagnosis specimens, and samples that have been collected on the job.

Facilitate Learning

Your role is to facilitate learning. The focus should be on the learner, not the instructor. Do not project yourself as the fountain of all knowledge and avoid



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Helping an employee to grow and develop new skills shows an organization's commitment to continuous improvement, but also to that individual.

Active Listening

- Pay attention. Try to give your undivided attention.
- Make eye contact and show that you are listening.
- Be aware of non-verbal communication; yours and theirs.
- Defer judgment.
- Repeat or summarize what you have heard, acknowledging the other person's viewpoint.
- Respond appropriately without diminishing the person's self-esteem.

becoming defensive if you are questioned. Exercise your active listening skills. Be empathetic to the feelings and concerns of the apprentice and exercise patience.

Guide the apprentice. Offer encouragement, when needed. Feedback, especially positive and constructive feedback is essential. Measure and point out improvements and achievements and provide reinforcement for progress.

There is a lot to be said for the value of entertainment to maintain interest and enthusiasm. Sharing stories, humorous demonstrations, and tales of mistakes can sometimes help a concept to stick with the apprentice.

Learning Styles

Apprentices will have different learning preferences (i.e., format in which their learning potential is maximized). The activities in this training were designed to successfully instruct participants using a variety of learning styles. Three common learning styles are visual, auditory/verbal, and kinesthetic.

Visual learners tend to learn by seeing information. Some activities and materials useful for visual learners include diagrams, images, graphics, charts, demonstrations, and illustrations.

Auditory/verbal learners learn through talking, listening, and discussing. Some activities in this training are designed to appeal to auditory/verbal learners include question-and-answer sessions, lectures, and small- and large-group discussions.

Kinesthetic learners learn through practical exercises. Activities helpful for these learners include problem-solving scenarios, note-taking, and field exercises.

As the instructor, you have some flexibility to customize the approach. Discover what techniques work well with your apprentice(s) and strive to maximize that approach.

Participation

Participatory methods work quite well with people who have difficulty reading and writing. They also allow the instructor to observe who may be having difficulty with the concepts and to engage with them to ensure comprehension. Participatory methods (1) draw on the participants' own knowledge and experience about safety and health issues; (2) emphasize learning through doing without relying on reading; and (3) create a comfortable learning experience for everyone.

Do not rely on printed material alone. Do not rely on written instructions or checklists as the only way of explaining an activity or concept. Explain any special terms, jargon, or abbreviations that come up during the training. Use tips to help people remember things. A few such tips are built into the instruction materials, but it is likely you know many more. Think back to what helped you learn when you first started.

Leveraging On-the-job Training

As the apprentice instructor, you must support and encourage the growth and development of your apprentice(s). It is also your responsibility to see that your apprentice(s) receive complete and consistent on-the-job training for all tasks that they will be performing. You must ensure that they can perform each task safely and skillfully. Your success in accomplishing this is dependent on your knowledge and abilities in training and your commitment to facilitating learning.

Keep in mind that teaching is a way of demonstrating care. When you share your knowledge with your apprentices, it sends a message that you value them and you are investing in them. For the apprentices, it is an opportunity for growth and development that may help them advance in their careers. As they learn more about the trees that they work on, they begin to care more about their work. They begin to see their work less as a job and more as a professional occupation. Often you will stoke a desire to learn and understand more, perhaps to become Certified Arborists.



When you share your knowledge with your crew members, it sends a message that you value them and you are investing in them.

Technique for providing feedback

After watching a person do something, stop them and tell them you'd like to review how they did.

Ask how they thought they did. "What did you do well?" Follow up with, "What do you think you need to improve on or could have done better?"

Ask them what they would do to improve when they try it again.

Now give feedback from your perspective, again starting with what was done well. Review the items that can be improved upon and agree on an approach for improvement.

Almost everything is a learning opportunity on a tree job. Cutting through a log presents the opportunity to point out the phloem, cambium, and xylem, and to explain about growth rings. Tree identification can become a daily, fun challenge. Diagnosing plant pests and diseases is an exercise in problem solving.

By sharing just one or two small nuggets of arboricultural knowledge a day you can make the job more interesting and rewarding for your apprentice, and likely for you as well. You will find that, as they become more devoted to their arboriculture career, they will begin to ask more questions. This is part of the continuous improvement process.

Most training of crews is on-the-job training. Using this approach, a crew member can get a great deal of personal attention. You might conduct the training yourself or a person you designate might do it.

Because safety is a critical factor in tree work, structure is essential for training. Structured on-the-job training for an apprentice is based on the list of tasks the crew member must learn, skills the apprentice must develop, and knowledge that is needed.

Tell-Show-Do Technique

One proven training technique that typically works well in tree care training is the Tell-Show-Do approach. Explain the steps in detail, emphasizing safety precautions and offering tips. Next, demonstrate the task. Third, allow the apprentice to practice the task with instructions and coaching from you. Observe every aspect of the apprentice's performance to ensure that it is done correctly, and nothing is left out. Then ask the apprentice to do it again, this time without coaching (unless required for safety intervention). Review the training with the apprentice and ensure that there are no questions. Reinforce the importance and benefit of proper performance of the task.

Remember that learning is not always linear. That is, individuals may pick up different aspects at different times and rates. Learning usually requires many repetitions for long-term memory. Conventional wisdom points out that we forget more than half of what we hear within twenty-four hours. If we combine seeing and doing with hearing, the retention rate goes up significantly. Remember that if a task is not performed regularly, most people will forget the details about how to do. Training is not a one-time occurrence, it must be continually reinforced.

General Safety

Learning Objectives

ANSI Z133

1. Explain the importance of the ANSI Z133 Safety Standards.
2. Describe the purpose of the ANSI Z133 Safety Standards.
3. Discuss the scope of the ANSI Z133 Safety Standards.
4. Describe the consequences of failure to comply with safety regulations, standards, or company safety rules.

Personal Protective Equipment (PPE)

1. List the PPE used by arborists in the field.
2. Demonstrate proper use of PPE for chipping brush.
3. Demonstrate proper use of PPE for operating a chain saw.
4. Describe the consequences of failure to wear appropriate PPE.

Communication

1. Discuss the importance of effective communication on the work site.
2. Explain the command-and-response system of worksite communication.
3. With a coworker, demonstrate the command-and-response system.

Work site set-up

1. Summarize the steps involved in setting up a safe work site.
2. List the safety precautions used to protect workers and the public when working along a street.
3. Set up a work site using all of the appropriate items.

Electrical Hazards Basics

1. Describe the hazards related to direct and indirect contact with electrical conductors.
2. Define common terms related to electrical work.
3. Explain minimum approach distances.
4. Discuss regulations and standards related to working near conductors.
5. Discuss precautions taken when working around electrical conductors.
6. Identify common conductor types on a job site.

Tree and Site Inspection

1. List the potential hazards on a job site.
2. List the potential hazards in a tree.
3. Describe methods of checking trees for hazards before ascending.
4. Demonstrate a site hazard inspection on a job site.
5. Demonstrate a tree hazard inspection on a job site, including the root zone.
6. Describe the procedure for reporting a hazard, if found.

Job Briefing

1. Describe why job briefings are an important part of every job.
2. Discuss all of the elements of a job briefing.
3. Lead a job briefing out on an actual job site.

Groundworker Responsibilities

1. Describe the steps taken to prepare for work on a tree trimming/removal site.
2. Discuss how a groundworker cooperates with climbers aloft.
3. Summarize groundworker responsibilities.
4. Explain the role of a groundworker in a rigging operation.
5. Explain the drop zone in a tree trimming/removal operation.
6. Discuss the role of the groundworker in protecting the public.
7. Demonstrate sending a line up to a climber/aerial lift operator.
8. Demonstrate sending a tool up to a climber/aerial lift operator.
9. Demonstrate proper lifting technique.
10. Demonstrate the proper way to put away and store a rope.
11. Discuss the importance of thorough site clean-up.
12. Ensure that all tools and gear are on the truck before leaving a job site.

Emergency Response Basics

1. Discuss the common ways that accidents can occur on a job site.
2. Discuss the common ways that accidents can occur in a tree.
3. Explain why emergency response training is important to avoiding panic and taking the right action.
4. Describe the equipment that should be carried for emergency response and aerial rescue.
5. Describe the steps to take in an emergency situation.
6. With a team of coworkers, demonstrate effective emergency response to an accident on the ground.

Introduction

Safety is the most important consideration in tree work. Period. Tree care and preservation are important, quality of work is important, and productivity is important, but none more so than safety.

In this profession, mistakes in the field translate into injuries and near misses. Injuries can be serious, even tragic. Why are near misses important? Often the only difference between an injury and a near miss is a fraction of an inch or an instant of time.

Tree workers must make a commitment to work safely. Remind yourself about this commitment on a daily basis with “Stop, Look, and Listen.”

Stop, look, and listen

Stop Stop before every job. Have the required equipment and job site hazard inspections been completed?

Look Look at every job set-up from a perspective of improving safety.

Listen Listen to your co-workers, supervisor, and trainers. They may offer different perspectives and experiences that can help improve safety.

ANSI Z133

Learning objectives

1. Explain the importance of the ANSI Z133 Safety Standards.
2. Describe the purpose of the ANSI Z133 Safety Standards.
3. Discuss the scope of the ANSI Z133 Safety Standards.
4. Describe the consequences of failure to comply with safety regulations, standards, or company safety rules.

ANSI Z133, often referred to as “the Z” is the safety standard for tree care in the United States. It is published by the International Society of Arboriculture under the procedures of the American National Standards Institute (ANSI). It is developed by a large, diverse committee representing all aspects of the tree care profession including large and small companies, equipment manufacturers and suppliers, labor, trainers, professional associations, utilities, and other interested parties.



Purpose

The stated purpose of ANSI Z133 is to provide safety standards for **arborists** and other workers engaged in **arboricultural** operations. It is intended as a guide for federal, state, and local authorities in drafting their regulations.

The most obvious and serious consequence of nonconformance is potential injury or death to personnel. There are other potential consequences for failing to comply with safety standards and regulations. Noncompliance can lead to citations from **OSHA**, which can be extremely costly. In addition, conscientious employers often have significant penalties for employees that fail to comply, especially with repeated offenses.

ANSI Z133 is not law, but it can have legal standing. Portions of the standard have been adopted by the Occupational Safety and Health Administration (OSHA). Other portions are frequently cited by OSHA. In addition, ANSI Z133 is the primary standard against which practices are measured in a court of law. That is, in the event of a lawsuit claiming negligence, the courts will look to see if the work practices met the applicable ANSI standard clauses.

ANSI Z133 is also the basis for almost all tree care company safety regulations and training programs. TCIA produces many training manuals, qualifications, videos, and training posters to reinforce the standard.

Scope

The standard establishes safety requirements for pruning, repairing, maintaining, and removing trees; cutting brush; and using equipment in those operations. This includes general safety requirements, electrical hazards, safe use of vehicles, tools and other equipment, tree climbing, and performance of tree care operations. Most of the content in this module is based, at least in part, on ANSI Z133.

ANSI standards use two important kinds of statements: **shall** and **should** statements. A shall statement denotes a mandatory requirement. A should statement denotes an advisory recommendation.

PRACTICE EXERCISES



1. “The Z” refers to the American National Standards Institute (ANSI) Z133.
TRUE FALSE
2. ANSI Z133 is the safety standard for tree care operations in the United States.
TRUE FALSE
3. ANSI Z133 was developed by the government (OSHA) to establish standards for the industry.
TRUE FALSE
4. The stated purpose of ANSI Z133 is to provide safety standards for _____ and other workers engaged in _____ operations.
5. A _____ statement denotes a mandatory requirement. A _____ statement denotes an advisory recommendation.
6. Portions of the Z133 standard have been adopted by the Occupational Safety and Health Administration (OSHA).
TRUE FALSE
7. In the event of a lawsuit claiming negligence, the courts will look to see if the work practices met the applicable ANSI standard clauses.
TRUE FALSE
8. List four potential consequences for failure to comply with Z133.
 - a.
 - b.
 - c.
 - d.

PRACTICE TEST QUESTIONS



1. Which of the following are NOT covered by Z133
 - a. general safety and electrical hazards
 - b. chain saw and chipper operation
 - c. tree biology and identification
 - d. climbing and tree removal

2. The ANSI Z133 standards are developed by
 - a. industry representatives
 - b. ISA
 - c. TCIA
 - d. OSHA

3. In ANSI standards, a “shall” statement denotes a(n)
 - a. advisory recommendation
 - b. mandatory requirement
 - c. federal regulation
 - d. legal obligation

Personal Protective Equipment (PPE)

Learning objectives

1. List the PPE used by arborists in the field.
2. Demonstrate proper use of PPE for chipping brush.
3. Demonstrate proper use of PPE for operating a chain saw.
4. Describe the consequences of failure to wear appropriate PPE.

Your first line of defense against the hazards of tree care is your attitude and your training. Wearing proper **personal protective equipment (PPE)** is your backup. You should never count on your PPE to allow you to violate safety procedures, nor should you ever work without wearing the appropriate PPE.

Selecting PPE

Always use the PPE needed for each job task. Inspect PPE for proper function before use. For general job site tasks, you need a helmet, eye protection, work gloves (non-gauntlet style), and sturdy work boots.

Additional PPE is required or recommended for specialized tasks:

Job Function:	Standard PPE	Additional Required	Recommended
chain saw operation	helmet, eye protection, work gloves, sturdy boots	leg protection, hearing protection	face protection
chipper operation	helmet, eye protection, work gloves, sturdy boots	hearing protection	face protection
stump cutter operation	helmet, eye protection, work gloves, sturdy boots	hearing protection, face protection—when run from an unguarded position	
pesticide application	based on pesticide label instructions		
traffic exposure	high-visibility, reflective clothing meeting ANSI Z107 standards		
aerial lift work	fall arrest or work restraint system, as appropriate		
tree climbing	appropriate climbing systems		

Eye protection

Many different styles are approved for impact protection in the standards for eye protection, ANSI Z87.1. An appropriate type for tree care is safety glasses with side shielding. Goggles are best for pesticide mixing and application.

Prescription eye glass wearers

A number of options are available, such as:

- wear approved goggles/helmet visor over prescription glasses
- purchase prescription safety glasses
- use contact lenses and standard safety glasses

Face protection

Face protection is required when using equipment that will be throwing off debris. Both face shields and face screens can be used for face protection. Eye protection must always be worn with face screens.

Hearing protection

Working around chain saws and chippers each day can damage your hearing, so hearing protection is required when operating or working around such equipment. Ear muffs, ear muffs attached to helmets, or ear plugs can be used.

Head protection

Helmets must meet the requirements of ANSI Z89.1 and be designated as Class G, E, or C* (ANSI Z89.1) for general duty work or Class E for line-clearance tree trimming operations or working within 10 feet of electrical conductors.

**Note: any helmet with a “C” designation is at least 7 years old and probably should be retired.*



Possible PPE for applicators.

Hand protection

Sturdy work gloves should be worn. Do not use gauntlet-style gloves, the cuffs and/or straps can catch on branches causing injury. Appropriate glove styles for different tasks are:

- waterproof latex/rubber gloves for pesticide application;
- grip gloves, such as Kevlar-studded gloves, for line-handling; or,
- leather or synthetic equivalent work gloves for general duty.

Leg protection

The apparel should be identified by the manufacturer as appropriate for use as leg protection during chain saw operation. Leg **chaps**, chain saw pants, and chain saw overalls are all appropriate styles.



PERFORMANCE DEMONSTRATION



PPE

Demonstrate proper use of PPE for chipping brush.

Requirements:

- helmet
- eye protection
- work gloves
- sturdy boots
- hearing protection

All PPE must be appropriate, approved (meeting standards), functional, and worn correctly.

Demonstrate proper use of PPE for operating a chain saw.

Requirements:

- helmet
- eye protection
- work gloves
- sturdy boots
- hearing protection
- leg protection

All PPE must be appropriate, approved (meeting standards), functional, and worn correctly.

Communication

Learning objectives

1. Discuss the importance of effective communication on the work site.
2. Explain the command-and-response system of worksite communication.
3. With a coworker, demonstrate the command-and-response system.

Effective communication is key to avoiding accidents such as struck-by injuries, resulting from a climber dropping a limb while a ground worker is below. The most important aspect of good worksite communication is the pre-job briefing, which is covered later in this module. The job briefing is where potential hazards and their mitigation is discussed.

Not all communication is spoken. Studies indicate that non-verbal communication can make up as much as 90% of communication. Non-verbal communication includes body language, tone of voice, gestures, and facial expressions. Non-verbal communication controls the flow of communication and provides social cues.

Non-verbal communication can dramatically affect communication and may even affect relationships. Often, the right words are erased by the wrong non-verbal signals. You should be aware of your non-verbal communication. Are you reinforcing what you are saying? Or are you sending conflicting or confusing messages?

Good communication with other employees at your company can be learning opportunities. As you begin to understand more about what other employees do and how the organization operates, you will likely find ways to make your own work easier and to remove obstacles. Keep in mind that you are all members of the same team, with shared goals and related purposes. Taking an interest in the bigger picture may be looked upon favorably by your employer/supervisor and could lead to opportunities for growth and/or advancement within the organization.

Active listening

- Pay attention. Try to give your undivided attention.
- Make eye contact and show that you are listening.
- Be aware of non-verbal communication; yours and theirs.
- Defer judgment.
- Repeat or summarize what you have heard, acknowledging the other person's viewpoint.
- Respond appropriately without diminishing the person's self-esteem.

Overcoming language barriers

- Use gestures, hand signals, and other forms of non-verbal communication.
- Learn a few key words of the crew member's language.
- Help the crew member learn your language.
- Enlist the help of others who speak a little of both languages.
- Use smart phone apps.
- Use simple drawings.
- Respect the other person's language and culture.

Tree care crews today can be made up of workers from several different countries, and may be diverse in age, gender, race, and socio-economic background. Communicating with a multicultural crew has some unique challenges. Perceptions and interpretation of actions and words can vary. For example, some cultures perceive strong language and aggressive behavior as demeaning and disrespectful and it demoralizes them. Learn ways to communicate effectively when there are language barriers.

Another communication challenge that is essential to overcome is that between workers aloft and those on the ground. The person aloft should always know where the people on the ground are and what they are doing, and vice versa. Constant voice or visual communication ensures greater safety and work efficiency.

A proven and effective communication system uses voice **command and response**. This system uses a verbal



Effective communication is key to avoiding accidents such as struck-by injuries, resulting from a climber dropping a limb while a ground worker is below.

PERFORMANCE DEMONSTRATION



Communication

With a coworker, demonstrate the command-and-response system.

Requirements:

Worker aloft (coworker) announces, “Stand clear!”

Worker below (apprentice)

- exits the drop zone
- checks that all other workers exit the drop zone
- responds, “Clear!” or “All clear!”



A proven and effective communication system uses voice command and response. This system uses a verbal command such as, “Stand clear!” for the climber to alert workers below, but the climber does not drop anything until hearing the acknowledgment, “All clear!” or “Clear” from each of the workers below.

command such as, “Stand clear!” for the climber to alert workers below, but the climber does not drop anything until hearing the acknowledgment, “All clear!” or “Clear” from each of the workers below.

Prearranged, two-way hand signals may also be used, and may be necessary when hearing is limited due to equipment noise or distance. Regardless of what system your company uses, be sure you understand and know how to use the system.

Technology has greatly improved worksite communication. Worker helmets can be fitted with two-way communications systems that weigh very little yet have clear audio. Communication can be much more detailed between workers aloft and those on the ground directing operations. That said, it is always wise to remember hand signals as a back-up in case technology fails.

PRACTICE EXERCISES



1. List the basic PPE for general tree care operations.
 - a.
 - b.
 - c.
 - d.
2. Your first line of defense against the hazards of tree care is your attitude and your training.
TRUE FALSE
3. Wearing appropriate PPE allows you to violate safety procedures.
TRUE FALSE
4. An appropriate type of eye protection for tree care is safety glasses with side shielding.
TRUE FALSE
5. An appropriate type of gloves for tree care operations is the gauntlet type.
TRUE FALSE
6. If your hard hat has a face shield, you need not wear safety glasses.
TRUE FALSE
7. List three options for hearing protection.
 - a.
 - b.
 - c.
8. Helmets for line-clearance tree trimming operations or working within 10 feet of electrical conductors must be Class ____.

9. List three options for leg protection.
- a.
 - b.
 - c.
10. Studies indicate that non-verbal communication can make up as much as 90% of communication.
TRUE FALSE
11. A good practice for active listening is to repeat or summarize what you have heard, acknowledging the other person's viewpoint.
TRUE FALSE
12. Tree care crews today can be made up of workers from several different countries, and may be diverse in age, gender, race, and socio-economic background.
TRUE FALSE
13. A proven and effective communication system uses voice _____ system.
14. Worker helmets can be fitted with communications systems, but they allow for one-way communication only.
TRUE FALSE
15. If the climber alerts workers below by saying, "Stand clear!" each of the workers below should exit the drop zone and respond, "_____!"

PRACTICE TEST QUESTIONS



1. Which of the following is NOT an active listening tactic?
 - a. pay attention to the person speaking
 - b. make eye contact with the person speaking
 - c. defer judgment based on what you are hearing
 - d. while the other person is speaking, plan how you will respond

2. Which of the following is NOT a way to overcome language barriers?
 - a. use gestures or hand signals
 - b. speak louder in your own language
 - c. use smart phone apps
 - d. draw simple pictures

3. What PPE is required for operating a chain saw?
 - a. work boots; helmet; eye protection; leg protection; hearing protection
 - b. eye protection; leg protection; non-gauntlet gloves; face protection
 - c. work boots; helmet; eye protection; hearing protection
 - d. non-gauntlet gloves; face protection; hearing protection; helmet

4. What PPE is required for operating a chipper?
 - a. work boots; helmet; eye protection; leg protection; hearing protection
 - b. eye protection; leg protection; non-gauntlet gloves; face protection
 - c. work boots; helmet; eye protection; hearing protection
 - d. non-gauntlet gloves; face protection; hearing protection; helmet

5. Which of the following is NOT an allowable choice of eye protection for someone who wears eyeglasses?
 - a. wear goggles over prescription glasses
 - b. helmet with a built-in face shield
 - c. prescription safety glasses
 - d. contact lenses and standard safety glasses

Work Site Set-up

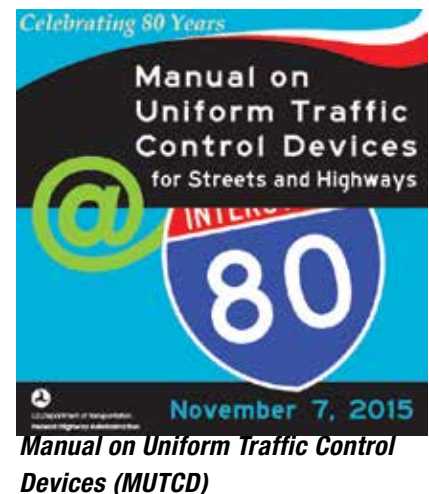
Learning objectives

1. Summarize the steps involved in setting up a safe work site.
2. List the safety precautions used to protect workers and the public when working along a street.
3. Set up a work site using all of the appropriate items.

Traffic control

Your first concern for every job is creating a safe work site by controlling pedestrian and vehicular traffic. If the work site is remote, there might be little or nothing you need to do. At some sites you will only be concerned with pedestrians—people on the ground in the vicinity of where you're working. At other sites you will be concerned with vehicular traffic. Each work site will be different.

If your work site or your vehicles project into traffic lanes, then you have to take precautions using U.S. Department of Transportation (DOT) guidelines. State and local regulations may also apply. Specifications for work site setup in vehicular traffic areas as well as the specific types of warning devices you must use are provided in the U.S. Department of Transportation's Manual on Uniform Traffic Control Devices (MUTCD), Part VI, Standards for Work Zone Traffic Control.



Action steps for work site set up:

- keep equipment and material neat and orderly within the protected area
- use the truck's four-way flashers and beacon light, if equipped, while you're setting up the signs and cones
- always chock trucks, or detached chippers, with at least two wheel chocks
- be especially careful whenever children are in the vicinity
- do not venture outside the established work area and into the roadway
- keep driveways, steps and walkways as clear of debris as possible
- do not allow another vehicle to park in a manner that obscures visibility of the work site

In rural areas, there are generally higher speed limits, less turning traffic, lower volumes of traffic, and fewer pedestrians. Urban areas are usually just the opposite. Your crew must evaluate the location, decide which controls are to be used, and see that a plan is followed.

Your goals are:

- to create a safe and efficient work site
- to hinder traffic as little as possible; and
- to guide vehicles and pedestrians in a clear and positive manner

Warning signs and cones

When your work obstructs any part of the roadway, advance-warning signs are required well down the road from the site, in both traffic directions on a two-way road.

Multiple signs may be needed on high-speed roads or where visibility is obstructed, such as from a bend or hump in the road. The closest sign should be about 200 feet away on low speed roads to as much as 1,000 feet on highways.



Traffic cones are used with working signs

Your company will follow local, state, and federal rules and regulations for working signs and cones. Here are some common warning sign space recommendations:

ROAD TYPE	DISTANCE		
	1st sign	2nd sign	3rd sign
Urban low speed	200 ft.	200 ft.	200 ft.
Urban high speed	350 ft.	350 ft.	350 ft.
Rural	500 ft.	500 ft.	500 ft.
Highway	1,000 ft.	1,600 ft.	2,600 ft.

Cones are used to channel traffic in the oncoming lane(s) away from the work site. They should be used with warning signs. The cones create a highway taper, which is used to move traffic out of or back into its normal path of travel. A good rule of thumb is to space cones the same number of feet apart as the speed limit.

Some work sites will also require workers to control traffic with signs and/or flags. All workers will be required to wear high-visibility apparel when working near traffic. Special training is required for flag workers in traffic control operations.

Once you have the vehicles placed and traffic control handled, there are a few more work site set-up considerations. In some cases, it may be necessary to also use caution tape to manage pedestrian access. Remember that the public is often curious, and people have a tendency to walk right into work zones, unaware of the danger.



It is a good idea to also set up a designated area for tools, equipment, and refueling. Many companies will use a tarp to keep fuel or chain saw bar oil from damaging the work site. Keeping the tools together in one place will help minimize the chances of worker tripping on them or leaving anything behind at the end of the day. Also, it can eliminate wasted time caused by workers hunting for the needed tool.

Finally, it is a good idea to have a **rescue kit** and to always take it off the truck at the start of every job. The rescue kit includes any equipment that might be needed in the event of an **aerial rescue**, as well as the first aid kit. The reason it should be taken off the truck is to ensure that it is always available, even if the truck has left the site, become energized by electrical wire, and/or caught fire.

PERFORMANCE DEMONSTRATION



WORK SITE SET-UP

Set up a work site using all of the appropriate items.

Requirements:

All appropriate signage and cones are properly placed; wheel chocks are properly placed; a tool/refueling area has been established; rescue kit is off the truck; and other precautions (caution tape, flagger, etc.) are used as deemed appropriate.

- cones
- signage
- wheel chocks
- tools/refueling area
- rescue kit
- other (caution tape, flagger, etc.) as appropriate

PRACTICE EXERCISES



1. If you are not working along a road, you have nothing to do for work site set-up.
TRUE FALSE
2. If your work site or your vehicles project into traffic lanes, then you have to take precautions using U.S. Department of Transportation (DOT) guidelines.
TRUE FALSE
3. Specifications for work site setup in vehicular traffic areas are provided in the U.S. Department of Transportation's Manual on Uniform Traffic Control Devices (MUTCD).
TRUE FALSE
4. The closest advance-warning sign should be about _____ feet away on low speed roads.
5. Keeping tools together in one place will help minimize the chances of a worker tripping on them or leaving anything behind at the end of the day.
TRUE FALSE
6. When your work obstructs any part of the roadway, advance-warning signs are required well down the road from the site, in both traffic directions on a two-way road.
TRUE FALSE
7. All workers are required to wear high-visibility apparel when working near traffic only if the speed limit is greater than 25 mph.
TRUE FALSE
8. You should use the truck's four-way flashers and beacon light, if equipped, while you're setting up the signs and cones.
TRUE FALSE
9. Vehicles and detached chippers need only be chocked when parked on a slope of at least two percent incline.
TRUE FALSE
10. List three goals for traffic control.
 - a.
 - b.
 - c.

PRACTICE TEST QUESTIONS



1. Which of the following is NOT true about rural areas compared to urban areas?
 - a. lower speed limits
 - b. lower traffic volume
 - c. less turning traffic
 - d. fewer pedestrians

2. A good rule of thumb is to space cones
 - a. 50 feet apart for each 10 mph of speed limit
 - b. 100 feet apart on rural roads, 200 on urban roads
 - c. 200 feet apart for all speed limits
 - d. the same number of feet apart as the speed limit

3. A good reason for keeping tools and equipment at a designated area on the work site is to
 - a. prevent them from becoming tripping hazards
 - b. avoid wasted time looking for a tool
 - c. reduce the chances of anything getting left behind
 - d. all of the above

Electrical Hazards Basics

Learning Objectives

1. Describe the hazards related to direct and indirect contact with electrical conductors.
2. Define common terms related to electrical work.
3. Explain minimum approach distances.
4. Discuss regulations and standards related to working near conductors.
5. Discuss precautions taken when working around electrical conductors.
6. Identify common conductor types on a job site.

Electricity has done more to raise the standard of living, expand our horizons of knowledge, reduce manual labor, and provide the conveniences that we take for granted than any other single invention. We never fully appreciate our dependence on electricity until a severe storm causes widespread, long-lasting interruptions to our electric service.

Most utility outages in the US and Canada are caused by trees. Trees may fall directly on lines, taking them out completely. Broken branches might fall across lines causing faults. Heat and large draws of electricity, such as during a heat wave, may cause lines to sag and touch trees. Some outages are even caused when wind is strong enough to blow limbs and branches into utility wires.

Because our society is so dependent on electricity, utility providers spend billions of dollars annually to minimize tree and utility conflicts. Thousands of tree workers are employed by contractors to work on line clearance tree trimming. But almost all tree workers find themselves working on properties where utility lines are present, so all arborists must have some training in electrical hazard awareness.

The degree of training in electrical hazards that arborists need is determined by the risk to the employee for hazard(s) involved. Those who work in line clearance generally have a much higher degree of training than those who occasionally work around service wires that supply houses with power.

This course segment provides just a basic introduction to electricity and electrical hazards. Your employer will determine whether you need more specialized training.



Most storm-related outages are due to trees.

What is electricity?

One common definition of electricity is the presence and motion of electric charge. This charge is in the form of sub-atomic particles called electrons. A fundamental property of charged particles is that particles with the same charge tend to repel each other and particles with different charge tend to attract each other.

Current is the movement of electrons. The unit of measurement is called the **ampere** or Amp. One Amp represents the flow of a fixed number electrons past a point in one second. One ampere is equal to 1,000 milliamperes. As little as one-tenth of an ampere, 100 milliamperes, can cause your heart to go into a spasm known as ventricular fibrillation. If not properly treated, ventricular fibrillation can be fatal.

Voltage can be thought of as electrical pressure. It is a force resulting from negatively charged particles repelling each other. The unit of measure is the **volt**. Voltage causes current to flow through a conductor, similar to the way water pressure forces water through a hose. It is often expressed in units of 1,000 volts or kV. The “k” stands for kilo, which means one-thousand, and the “V” stands for volts. A 13,200 volt conductor is called a 13.2 kV line. House voltage is usually 120 or 240 volts.

Resistance is a property of materials that resists or restricts the flow of current. Good conductors like copper and aluminum have a low resistance because it is relatively easy for current to flow. Insulators like plastic and glass have a high resistance because it is relatively hard for current to flow. The unit of measure for resistance is the **ohm**. One Ohm is the resistance that will allow one Amp of current to flow when one Volt is applied.

The current equals the voltage present divided by the resistance. **Amps = Volts/Ohms**. This indicates that the higher the voltage the more current will flow. Or, the lower the resistance the more current will flow. This relationship is called Ohm’s Law.

Power is the rate of energy conversion that occurs when current flows through a load. This electrical energy can be converted to mechanical energy as in a motor or into heat energy as in a stove. The unit of measurement of power is the **watt**. The power is the product of the current squared times the resistance. **Watts = Amps x Amps x Ohms**. One watt is consumed when one volt causes one amp of current to flow through a resistance of one ohm.

Why is electricity dangerous?

Electricity can cause serious injury and death through two very different mechanisms. The first involves interfering with the normal heart rhythm. Your heart beat is controlled by very small electrical signals in your body. If a current of only 100 milliamps were to pass through your chest cavity it could interfere with the heart beat and cause death.

The second mechanism of harm is heating. When current passes through the resistance of our bodies, heat is generated inside the tissue or organs the current is passing through. The heat can very quickly cook and burn this tissue from the inside out. Depending on the path of the current, the tissue damage could cause immediate death or internal organ damage could result in death days or weeks after the accident.

In both cases, it is the current that actually causes the damage. It is the voltage, however, that determines how much current will flow. The higher the voltage the more current will flow. So, it is the amount of voltage that determines the severity of the hazard.

Electrical circuits and conductors

Electrical current (movement of charged particles) flows in all available paths in inverse proportion to the resistance of each path. The voltage for a **conductor** can be considered to be a constant value.

Here are some general points about voltages:

- The highest voltage lines are usually at the top of the pole;
- Telephone, cable television, fiber optics, and fire alarm wires are usually at the lowest position on the pole;
- Larger and/or more numerous insulators indicate higher voltages; and,
- Taller poles, towers, or structures indicate higher voltages.

Phase wires are the wires—other than ground or neutral—that are used to conduct electricity. These wires (phases) carry various voltages. If you contact any two phase wires simultaneously, your voltage is almost twice what it would be if you contacted a phase wire and a neutral (or ground) wire—either case means severe injury or death.

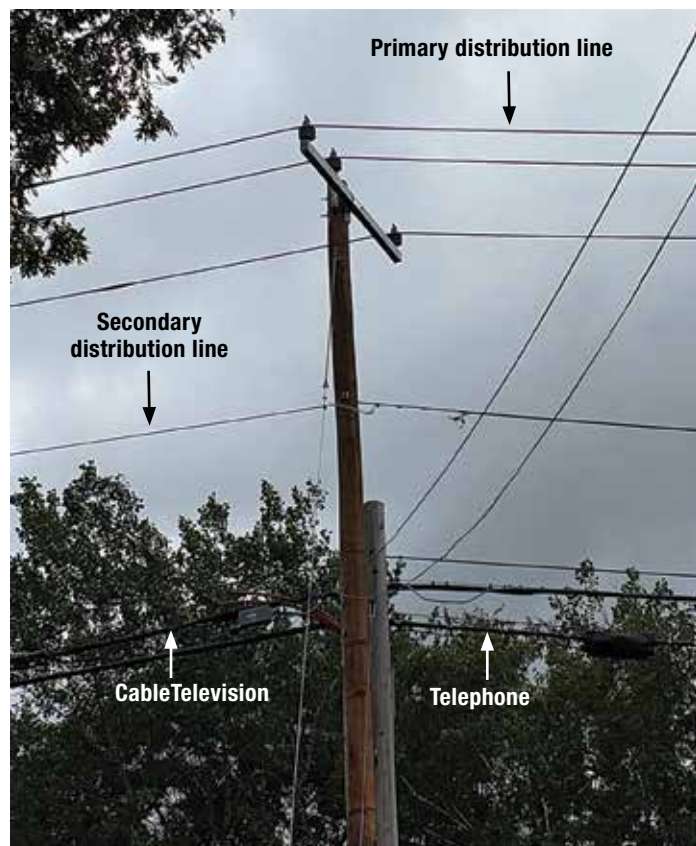
Transmission lines are conductors usually carrying more than 69 kV that run from the generating plant to the transmission substation. These are the power lines on the large power line towers. Most arborists never have occasion to work around transmission lines.

Primary distribution lines carry 2.4 kV to 34.5 kV from distribution substations to local areas where it is stepped down by a transformer to low voltage. The primary distribution lines feed the high voltage side of the transformers. They are typically the highest lines at the top of the utility poles.

Secondary distribution lines carry low voltages, usually of 120 and 240 volts, from pole-mounted transformers to groups of customers, individual consumers, street lights, etc.

Service wires, usually three-wire lines (triplex), connecting secondary distribution lines on the pole to the customer's meter (service). Service wires that connect secondary distribution lines to a house are sometimes called **house drops**.

A **transformer** is a device that increases (steps-up) or decreases (steps-down) voltage depending on requirements of electrical circuit.



All of the above are considered conductors carrying potentially fatal voltages. Note the location of primary and secondary distribution lines.

Secondary or service wires?

The terms service and secondary are often confused or used interchangeably. Secondary runs from pole to pole. Service runs from pole to customer. They carry the same voltage.

Why be concerned about 120-volt house drops?

Don't confuse the type of shock you might have received (and survived) when changing a household light switch with the type of shock you will receive if you contact a "low-voltage" utility wire. Just because both may contain only 120 volts does not mean the type of shock you might receive would be the same. Here are a few good reasons:

- First, given the right set of circumstances, the shock you get from a common light switch could kill you.
- Second, the amount of current available is many times higher than the lethal amount.
- Third, it is easier to break electrical contact standing in your house. If you are in a bucket or climbing a tree, it may be more difficult to break contact.

Tree workers have been killed by contact with 120-volt house drops. In fact, TCIA conducted a study of OSHA recorded fatalities over a 10-year period and almost half of fatalities occurred due to electrical contact with house drops or other "low-voltage" secondary conductors.

Weatherproofing may or may not be present on wires. It is usually made of synthetic plastic-like materials. It may look like insulation, but ***it does not function as insulation from electrical shock***; it is only weatherproofing.

Warning: Guy wires can become energized. Often there is an insulator or isolator in the guy wire to reduce the chances of this happening.

Faults

A **fault** is any path for current to flow that is not intended to be there. If a tree contacts an energized power line (phase line), the tree may become energized, creating a path for current to flow. The path created is called a phase-to-ground fault. If you directly or indirectly become the link completing the circuit between the tree, or other grounding source (such as a ground wire) and the power line, an



Guy wires

electric shock will occur. Injury or death is likely to occur.

Examples:

- standing on a limb while using your hands to remove a branch resting on utility wires
- standing next to an energized tree and leaning against it (your body can give the electricity a path to ground)

If a tree or a tree worker causes two energized conductors to touch, a fault occurs. This creates what is called a short circuit. It is also called a phase-to-phase fault. If a person directly or indirectly becomes part of a phase-to-phase circuit, an electric shock occurs and injury or death will result, as it would with a phase-to-ground fault. Phase-to-phase contact is one of the most serious types of electrical exposures. An insulated bucket cannot keep you safe if this type of contact occurs. An example would be resting one hand on a limb that is touching one phase wire while trying to hold the cut portion of the branch as it touches a second phase wire

Phase-to-neutral faults are similar to phase-to-phase except that they occur when an energized wire (phase wire) and neutral wire are connected.

Remember this: A bird can sit safely on any one wire but, if a large bird spans any two wires (phase-to-phase, phase-to-ground, phase-to-neutral) it is dead! Contact with the two wires completes a circuit.

Contact with electrical conductors

A **direct contact** is made when any part of the body touches or contacts an energized electrical conductor. For example, you are climbing a tree next to electrical conductors and you unintentionally lean back away from the trunk and contact an energized conductor. If your back touches the conductor while one or both of your feet are touching the trunk, a phase-to-ground circuit is completed, and you are likely to be fatally or seriously injured.



Phase-to-ground faults can be created by a tree touching a primary. Touching an energized tree could cause you to become part of the circuit.

An **indirect contact** is made when any part of the body touches any conductive object, including tools, tree branches, trucks, equipment, or other object that is in contact with an energized electrical conductor. Such contact can also be made as the result of communication wires and cables, fences, or guy wires being accidentally energized. For example, you are in the bucket of your aerial lift. The lift becomes energized because the boom contacted an energized line and the insulation failed. Then a ground worker touches the body of the truck and a phase-to-ground circuit is completed. The person who touches the truck is fatally or seriously injured!

Arcing

Actual physical contact between the object and the conductor may not be necessary under certain unusual conditions for electricity to flow. Electricity at high voltages has the potential to arc (jump) a distance, which increases with rising voltage and certain atmospheric conditions. Usually, after a contact is made, a one-foot arc can be drawn for every 10,000 volts when trying to break contact.



Phase-to-phase faults can be caused when any object connects two phase wires.

PRACTICE EXERCISES



MATCHING

_____	current	A	measure of power
_____	voltage	B	restriction of the flow of current
_____	ampere	C	unintended path of current flow
_____	volt	D	conductor lines (other than neutral and ground)
_____	resistance	E	measure of current
_____	ohm	F	electrical pressure
_____	watt	G	measure of resistance
_____	conductor	H	capable of carrying electric current
_____	phase	I	movement of electrons
_____	fault	J	measure of voltage

- Most utility outages in the US and Canada are caused by trees.
TRUE FALSE
- The degree of training in electrical hazards that arborists need is determined by the risk to the employee for hazard(s) involved.
TRUE FALSE
- Those who work in line clearance generally have a much lower degree of training than those who may have occasion to work around the service wires that supply houses with power.
TRUE FALSE
- A fundamental property of charged particles is that particles with the same charge tend to _____ each other and particles with different charge tend to _____ each other.
- When current passes through the resistance of a body, _____ is generated inside the tissue or organs.
- While it is the current that actually causes the damage, is the voltage that determines how much current will flow.
TRUE FALSE
- If a current of only 100 milliamps were to pass through your chest cavity it could interfere with the heart beat and cause death.
TRUE FALSE

8. The highest voltage lines are usually at the bottom of the pole.
TRUE FALSE
9. Telephone, cable television, fiber optics, and fire alarm wires are usually at the lowest position on the pole.
TRUE FALSE
10. Larger and/or more numerous insulators indicate lower voltages.
TRUE FALSE
11. Taller poles, towers, or structures indicate higher voltages.
TRUE FALSE
12. The conductors—other than ground or neutral—that are used to conduct electricity are known as _____.
13. If you contact any two phase wires simultaneously, your voltage is almost twice what it would be if you contacted a phase wire and a neutral (or ground) wire.
TRUE FALSE
14. Tree workers have been killed by contact with 120-volt house drops.
TRUE FALSE
15. Weather proofing may look like insulation, but it does not function as insulation from electrical shock.
TRUE FALSE
16. _____ are conductors usually carrying more than 69 kV that run from the generating plant to the transmission substation.
17. _____ carry 2.4 kV to 34.5 kV from distribution substations to local areas where it is stepped down by a transformer to low voltage.
18. _____ usually three-wire lines (triplex), connect secondary distribution lines on the pole to the customer's meter (service).
19. A _____ is made when any part of the body touches or contacts an energized electrical conductor.
20. An _____ is made when any part of the body touches any conductive object, including tools, tree branches, trucks, equipment, or other object that is in contact with an energized electrical conductor.

PRACTICE TEST QUESTIONS



1. Ohms are the unit of measure for
 - a. electrical pressure
 - b. flow of current
 - c. electrical resistance
 - d. electrical wattage

2. Amperes are the unit of measure for
 - a. electrical pressure
 - b. flow of current
 - c. electrical resistance
 - d. electrical wattage

3. Volts are the unit of measure for
 - a. federal regulation electrical pressure
 - b. federal regulation flow of current
 - c. electrical resistance
 - d. electrical wattage

4. Which of the following lines carry the highest voltage?
 - a. primary distribution
 - b. secondary distribution
 - c. transmission
 - d. service wires

5. Utility wires—other than ground or neutral—that are used to conduct electricity are known as
 - a. faults
 - b. phases
 - c. transformers
 - d. transmission lines

6. A house drop is another name for
 - a. primary distribution
 - b. secondary distribution
 - c. transmission
 - d. service wires

7. If any part of the body touches or contacts an energized electrical conductor, it is known as
 - a. direct contact
 - b. indirect contact
 - c. step potential
 - d. cross-wire contact

8. If you directly or indirectly become the link completing the circuit between the tree, or other grounding source (such as a ground wire) and the power line
 - a. death or injury will result
 - b. you will not get shocked
 - c. you might suffer a small burn
 - d. you will be insulated from the current

9. If any part of the body touches any conductive object, including tools, tree branches, trucks, equipment, or other object that is in contact with an energized electrical conductor it is known as
 - a. direct contact
 - b. indirect contact
 - c. step potential
 - d. cross-wire contact

10. Working on the ground and leaning against an energized tree, completing a circuit, is what type of fault?
 - a. phase-to-ground
 - b. phase-to-phase
 - c. phase-to-neutral
 - d. neutral-to-ground

Did your job site hazard assessment detect any wires?

Are they within 10 feet of the tree? If so, an electrical hazard exists and the work can only be done by a qualified line-clearance arborist, line-clearance arborist trainee or incidental line clearance arborist. The electric utility must first make it safe for the qualified arborist or trainee. A line-clearance arborist trainee can only perform the work when under the direct supervision of a qualified line-clearance arborist.

Job site inspection — electrical hazards

All arborists must inspect the job site for electrical and other hazards before doing any tree work. When determining if an electrical hazard exists, you must consider all conductors, including telecom, fire alarm, cable television, and street light lines, energized with potentially fatal voltages. Although they may carry lower voltages than transmission, primary, or secondary distribution lines, they do have the potential to be energized with much higher voltages. This is particularly true under storm or other emergency conditions.

When inspecting trees for electrical hazards, special consideration should be given to decayed, defective, diseased, hanging, or broken branches. These branches could become loose when climbing or rigging in the tree and contact the wires or present a hazard to anyone working in the area.

Also consider potential hazards that could be created by your work. Look for any branches that could contact conductors if weight is added or removed while climbing. Look for any branches or leaders that could contact conductors when weight is added or removed during rigging operations. Look for any branches, leaders, or whole trees that might not be a current hazard but could become one during the removal process.



You must inspect the site for electrical and other job site hazards.

Example:

A tree to be removed is free of electrical hazards but in the vicinity of conductors. In this case, the work plan must cover how to keep the tree from creating an electrical hazard during the removal process, including how to deal with any structural defects that could cause the tree, or parts of the tree, to fail.

Many times, apparently harmless and inconspicuous objects can become energized and potentially lethal.

Under storm or other emergency conditions, the following are potential conductors and may be energized with lethal voltage:

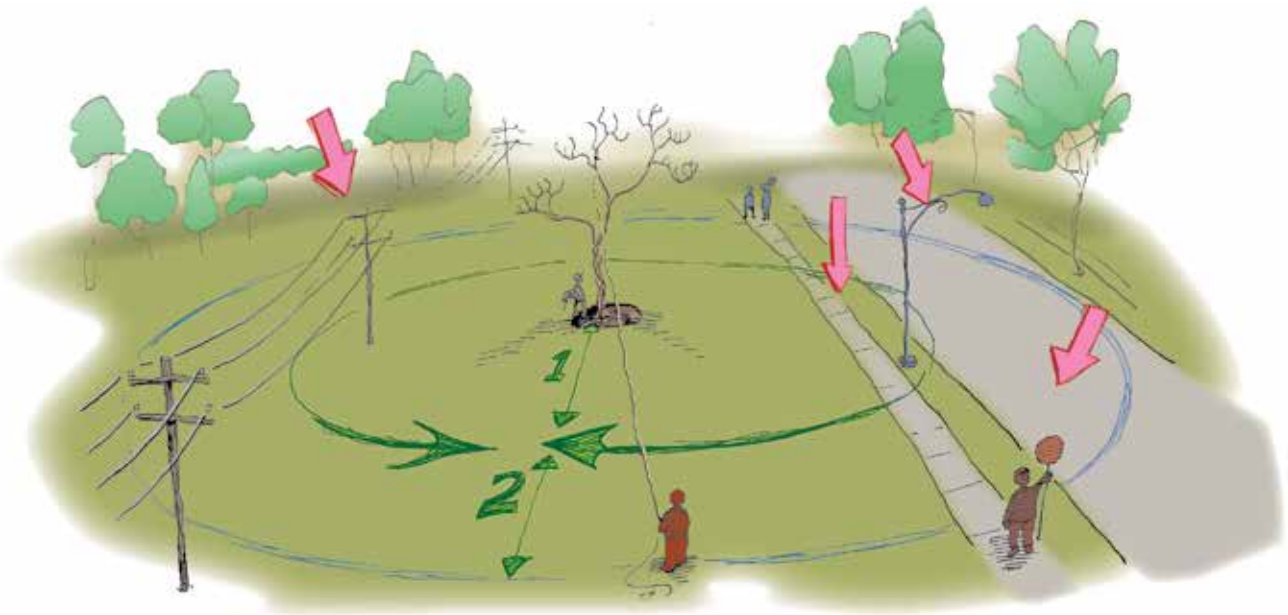
- guy wires
- metal fences
- street light poles
- telephone and CATV lines
- highway barriers, reflective road striping, and guardrails
- woody vines
- other plants



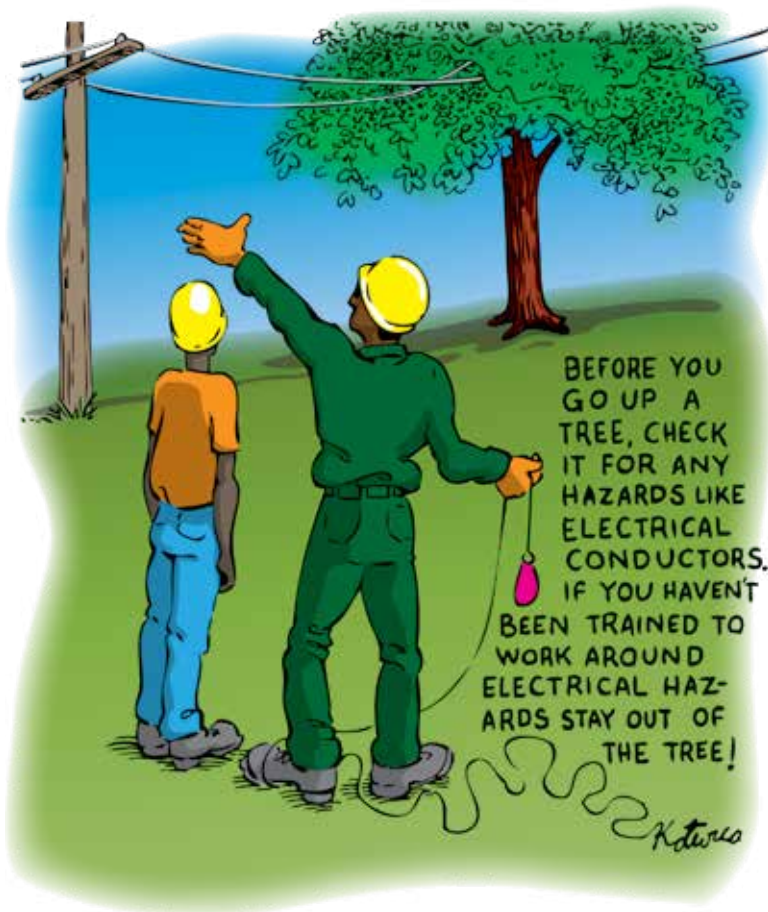
Example of an electrical hazard.



Vines growing up utility poles or trees can create an electrical hazard.



When searching for potential electrical hazards before removing a tree, include the length of fall in any direction.



If a tree is in contact with an energized conductor, burned or damaged leaves or branches may be visible at the contact points. The ends of twigs may be dead and scorched with the tips burned off. Leaves may also have a scorched or burned appearance. The end of a branch in contact with the wire may have a witches'-broom appearance. If the branch is periodically being blown into a conductor, it might have a slight, scorched notch created by the contact.

Minimum approach distances

ANSI Z133 safety standards and federal OSHA regulations establish **minimum approach distances (MADs)** from energized overhead wires based on the maximum nominal voltage in the lines. Maximum nominal voltage is generally considered the maximum operating voltage for which a line is designed.

Any non-qualified arborist must maintain, at minimum, a 10-foot clearance from any energized conductor rated at 50 kV phase-to-phase or less (Table 1).

Table 1. Minimum approach distances to energized conductors for arborists not qualified by training and experience to work within 10 feet (3.05 m) of electrical conductors.

Nominal Voltage (Phase-to-Phase)*	Minimum Approach Distance (MAD)	
	ft-in	m
kV		
50.0 and less	10-00	3.048
50.1 to 72.5	11-00	3.353
72.6 to 121.0	12-08	3.861
138.0 to 145.0	13-04	4.064
161.0 to 169.0	14-00	4.267
230.0 to 242.0	16-08	5.080
345.0 to 362.0	20-08	6.299
500.0 to 550.0	26-08	8.128
785.0 to 800.0	35-00	10.668

*Exceeds phase-to-ground per 29 CFR 1910.333.

Never work near electrical conductors unless:

- you have the proper training and understand exactly what you need to do;
- you can recognize the maximum nominal voltage phase-to-phase and minimum approach distance;
- you plan to use methods that reduce the danger from the electrical hazard; and,
- you are positive the job can be completed safely.

Work practices near an electrical hazard

PPE

A clean non-conductive, Class E helmet (hard hat) must be worn at all times when working near electrical conductors. Class E helmets are intended to reduce the force of impact of falling objects and to reduce the danger of contact with conductors.

Check the stamp or label on the inside of your hard hat for a Class E rating and an ANSI Z89.1 (American National Standard for Personnel Protection—Protective Headware for Industrial Workers—Requirements) notice. Class C hard hats offer no electrical protection and shall not be used. If your helmet has holes in it (by design), it probably does not meet Class E specifications.

Inspect helmets periodically for defects (cracks, excessive dirt, etc.) that would lower their protective ability. Even if you

are wearing a new, Class E helmet, you should never rely on a helmet as effective protection from energized conductors. Also, never rely on rubber gloves, rubber-soled shoes, or linemen's overshoes to protect you from accidental contact with energized conductors or objects.

Tools and equipment precautions

When working near energized conductors, pay special attention to tools and equipment being used. Remember that all arborist lines, (climbing, rigging, throw lines, tag lines) are conductive!



Keep wood or fiberglass tools and wood or fiberglass ladders clean and dry. When they become soiled or damp, they may lose the ability to function as non-conductive devices. Tools that become conductive can cause electric shock if they contact an energized conductor.

Conductive tools such as hand saws and climbing spurs (spikes, hooks) shall not be put in contact with energized conductors, either directly or indirectly. Electricity can travel both on the outside of the bark and/or through the sapwood. If a tree is in contact with an energized line, an indirect contact could occur when a conductive tool, such as climbing spikes, touches the bark and/or contacts the sapwood.

Do not use portable electric tools that use extension cords, or other similar electrical tools/cords, when an energized conductor is nearby. Completing a circuit between an energized conductor and an electric extension cord can cause an electric shock. Air, hydraulic, battery-operated and gas-powered tools are alternatives as long as the hoses are non-conductive.

Ground operations

Electrical hazards need to be considered, even when working on the ground. Remember, an electrical hazard exists if a tree you are felling will come within 10 feet of an electrical conductor, regardless of where you are standing.

When felling, a pull line can help direct the tree's fall. If there is a possibility of electrical contact, you must use a pull line, or an alternate method of tree removal if a pull line won't work. If the tree makes contact while you are still making a cut, you could get an electric shock resulting in injury or death.

When felling a small tree, you may be tempted to push it over in the direction you want it to fall. If a sudden gust of wind pushes the tree in a different direction causing it to fall into an energized conductor, you could get an electric shock through indirect contact.

Never overestimate your ability to control the direction of fall. Use an appropriate-sized pull line tied with a running bowline or other reliable knot. Also, always use a felling notch to help control the direction of fall in trees greater than five inches in diameter.

Step potential

Step potential describes a situation where your body may serve as a path for electrical current to flow from an area of higher electric potential to an area of lower potential. For example, step potential may exist around energized outriggers as current dissipates in the ground. This dissipation, or grounding, occurs over a distance due to the natural resistance in the soil. A zone of step potential can also occur around downed energized conductors, around the base of an energized tree, around the base of an energized utility pole, etc.

Electrical shock may occur if you create a path of lesser resistance. Your legs or other body parts can connect an area of higher voltage with an area of lower voltage. You literally face more risk if you take a larger step into or out of such an area. The step potential hazard area is larger in sandy soils and when a good conductor is allowing the current to travel into the ground (such as energized steel outriggers or an energized utility line touching the ground directly).

What should you do when you find conductors are actively “burning into” a part of a tree?

You recognize this situation by the distinctive notch burned into the limb or branch by the electrical conductor and you know that the condition has existed for some time, but what should you do about it?



Step potential can cause electric shock or electrocution.

Step potential

Lethal step potential voltages can be 30 feet or greater from the point of contact on the ground of an energized conductor or energized object such as a vehicle, tree or rope.

Here is some information: Often, the tree-to-wire contact is not a good ground. It does not draw sufficient current to cause the automatic line recloser to trip or a fuse cutout to open, allowing the wire to burn into the limb or branch. If this situation exists, you need to call the system operator/owner (utility) for assistance—even if you are a line-clearance arborist or line-clearance arborist trainee. The sapwood of the tree is a conductor. It may not be safe to climb the tree under those conditions, and simply because the situation has existed for a period time does not mean it is safe. Do not work until the utility makes it safe to do so.

Weather conditions and storm emergencies

Weather is an extremely important factor for line-clearance tree trimming operations. Trees, tools, and other objects become more conductive during rainy weather. Even muggy conditions (high humidity) can increase conductivity.

Wind is also an important factor. It can cause a limb to move suddenly in an unexpected direction, turning a routine cut into a disaster. Don't depend on the "lean" of the limb and gravity when a situation is critical. A properly placed rigging line could mean the difference between life and death.

You must not work near energized conductors during adverse weather conditions, such as thunderstorms, high winds, snowstorms, or ice storms. Immediately after a storm, use extra caution and have extra awareness of electric hazards. During emergency conditions, be particularly aware of any conductive object that you may contact, such as metal fences, guardrails, and even fallen limbs. A fallen conductor could energize them.



Use extra caution under adverse weather conditions. Think before acting.

During storm emergencies:

- Never assume wires are not energized because they have fallen!
- Know the location of all conductors, cables and wires and check them frequently.
- Keep yourself and others a safe distance away from a fallen conductor.
- Assume any conductor is energized until an authorized representative of the utility assures you that conditions are safe.
- Do not leave a fallen conductor unattended.
- Beware of step potential.



Beware de-energized lines can be re-energized by back-fed electricity from improperly installed generators.

OSHA requirements for training of line-clearance arborists

Line-clearance tree trimming, whether from an aerial lift or climbing requires specific knowledge and training beyond the scope of this manual. In the OSHA regulations that govern line-clearance tree trimming, there is a subclause that requires the employer to ensure that each employee has demonstrated proficiency in the work practices involved before that employee is considered as having completed the training required.

You cannot become qualified to clear lines without hands-on experience. You must have, or be developing as a trainee under the supervision of a qualified line-clearance arborist:

- Competence in climbing skills or aerial lift operations;
- The ability to safely rig limbs and properly use tools for line clearing; and,
- Experience in urban forestry and tree care operations.

You must continually show a high level of awareness of electrical conductors and how to deal with them. If you want to become a qualified line-clearance arborist, you must be able to safely perform line-clearance tree trimming operations when an electrical hazard exists.

You will learn skills for tree climbing and/or operation of an aerial lift as part of this apprenticeship program. The advanced skills required for line-clearance tree trimming are not part of this program. Your employer may, however, determine that you need this training and may provide it.

PRACTICE EXERCISES



1. If there are wires within ____ feet of a tree, an electrical hazard exists and the work can only be done by a qualified line-clearance arborist, line-clearance arborist trainee or incidental line clearance arborist.
2. You must consider all conductors, including telecom, fire alarm, cable television, and street light lines, energized with potentially fatal voltages.
TRUE FALSE
3. List five examples of things that could become charged with potentially fatal voltages in storm conditions.
 - a.
 - b.
 - c.
 - d.
 - e.
4. If a tree is in contact with an energized conductor, burned or damaged leaves or branches may be visible at the contact points.
TRUE FALSE
5. ANSI Z133 safety standards and federal OSHA regulations establish _____
_____ from energized overhead wires based on the maximum nominal voltage in the lines.
6. A clean non-conductive, Class E helmet (hard hat) must be worn at all times when working near electrical conductors.
TRUE FALSE
7. Class C hard hats offer the same electrical protection as Class E hard hats.
TRUE FALSE
8. You should never rely on rubber gloves, rubber-soled shoes, or linemen's overshoes to protect you from accidental contact with energized conductors or objects.
TRUE FALSE

9. When wood or fiberglass becomes soiled or damp, it may lose the ability to function as a non-conductive device.

TRUE FALSE

10. Electricity can travel both on the outside of the bark of a tree and/or through the sapwood.

TRUE FALSE

11. _____ may exist around energized outriggers as current dissipates in the ground.

12. A zone of step potential can occur around downed energized conductors, around the base of an energized tree, around the base of an energized utility pole, etc.

TRUE FALSE

13. If you come across a situation in which a conductor has burned a tree, you need to call the system operator/owner (utility) for assistance.

TRUE FALSE

14. You must not work near energized conductors during adverse weather conditions, such as thunderstorms, high winds, snow storms, or ice storms.

TRUE FALSE

15. You cannot become qualified to clear lines without hands-on experience.

TRUE FALSE

PRACTICE TEST QUESTIONS



1. What are minimum approach distances based on?
 - a. maximum amperage
 - b. maximum nominal voltage
 - c. minimum nominal ohms
 - d. height of conductors

2. Which of the following indicates that a tree might be contacting an energized conductor?
 - a. blackened, dead, and/or burned twigs, especially at the terminal ends
 - b. branches and twigs with witches' -broom appearance near conductors
 - c. branches, limbs, or trunks with burned notches
 - d. all of the above

3. Before climbing or doing any work in a tree you should
 - a. inspect and determine if there is an electrical hazard
 - b. contact the appropriate utility service provide
 - c. measure the voltage in conductors
 - d. all of the above

4. Why do you need to judge the maximum nominal voltage of a conductor?
 - a. To tell the utility dispatcher.
 - b. To determine the minimum approach distance.
 - c. To determine what safety standard to use.
 - d. all of the above

5. What should you do if a tree is contacting wires and a notch is being burned into the wood?
 - a. Climb and prune the tree if you are a line-clearance arborist.
 - b. Remove the tree from the ground or using an aerial device.
 - c. Contact the utility to have them make the situation safe.
 - d. Move on to the next tree; no need to contact anyone.

6. Never work near electrical conductors unless
 - a. you are properly trained and understand exactly what you need to do
 - b. you know the maximum nominal voltage phase to phase and the minimum approach distance
 - c. you are certain that the job can be done safely
 - d. all of the above

7. Why should you never use portable electric tools that use extension cords, or other similar electrical tools/cords, when an energized conductor is nearby?
 - a. Completing a circuit between an energized conductor and an electric extension cord can cause an electric shock.
 - b. The power cord of the portable electric tool is likely to arc to the tree and then could travel up and over to the power lines.
 - c. Electric tools create a magnetic field that could cause indirect contact with a service line.
 - d. all of the above

8. A situation where your body serves as a path for electrical current to flow from an area of higher electric potential to an area of lower potential is known as
 - a. direct contact
 - b. indirect contact
 - c. step potential
 - d. cross-wire contact

9. Which of the following is a condition that could create a step potential hazard?
 - a. energized outriggers
 - b. a downed electrical conductor
 - c. an energized utility pole
 - d. all of the above

10. To become a qualified line clearance tree trimmer you must have, or be developing as a trainee under the supervision of a qualified line-clearance arborist,
 - a. competence in climbing skills or aerial lift operations
 - b. the ability to safely rig limbs and properly use tools for line clearing
 - c. experience in urban forestry and tree care operations
 - d. all of the above

PERFORMANCE DEMONSTRATION



Identify common conductor types on a job site.

Requirements:

You must identify each type of line correctly, and state that types are not present, if they aren't.

- transmission lines (if in view from property)
- primary distribution lines
- secondary distribution lines
- service wires (if present)
- cable, telephone

Tree and Site Inspection

Learning Objectives

1. List the potential hazards on a job site.
2. List the potential hazards in a tree.
3. Describe methods of checking trees for hazards before ascending.
4. Demonstrate a site hazard inspection on a job site.
5. Demonstrate a tree hazard inspection on a job site, including the root zone.
6. Describe the procedure for reporting a hazard, if found.

When you arrive at a job site, you must inspect the job site and trees for any potential hazards. You will inspect the site for electrical hazards, tripping hazards, poisonous plants, insects or other animals that might create a problem, guy wires, and anything that might be damaged by your work or equipment. The trees will be inspected for anything that could pose a hazard to the workers or anything that affect the performance of the work. Potential hazards will be discussed in the **job briefing**, which will also cover **mitigation** measures that you will take to reduce or eliminate risks. If you identify any hazards, potential problems, or anything that might affect safety, you should bring it to the attention of your crew leader. If, in the opinion of the crew leader, anything is found that cannot be adequately mitigated, or will affect the crew's ability to do the job, it should be brought to the attention of the supervisor.

Site inspection

Look at the property layout. Look for areas to avoid and areas where work can be performed. Note any terrain concerns such as holes, slopes, hills, rocks, or muddy areas. Look for poisonous plants and plants with thorns.

Electric wires

Perhaps the most important element of the site inspection is locating any electrical wires. All wires and cables passing through a tree should be considered energized. Location of any electric wires is specifically discussed as part of the job briefing. Only a **qualified line-clearance arborist** or **qualified line-clearance arborist trainee** may perform the work if an electrical hazard exists.

Look for electrical hazards by locating conductors and inspecting for electrocution hazards, such as:

- branches contacting conductors
- pitted or blackened areas on branches caused by electrical arcing when wind-blown branches intermittently contact conductors
- branches that might contact a conductor if a climber's weight or rigging **load** is placed on them
- vines growing up telephone poles, guy wires, and service drops
- underground utility services

Slips, trips, and falls

A very common cause of injuries on the job is slips, trips, and falls. These include anything a worker could slip on or trip over, or anything that could cause a fall.

Look for potential causes of slips, trips, and falls, such as:

- heavy undergrowth in the work area
- slopes in the work area
- uneven terrain or holes in the ground
- client property such as dog ropes and toys
- steps
- company equipment and tools



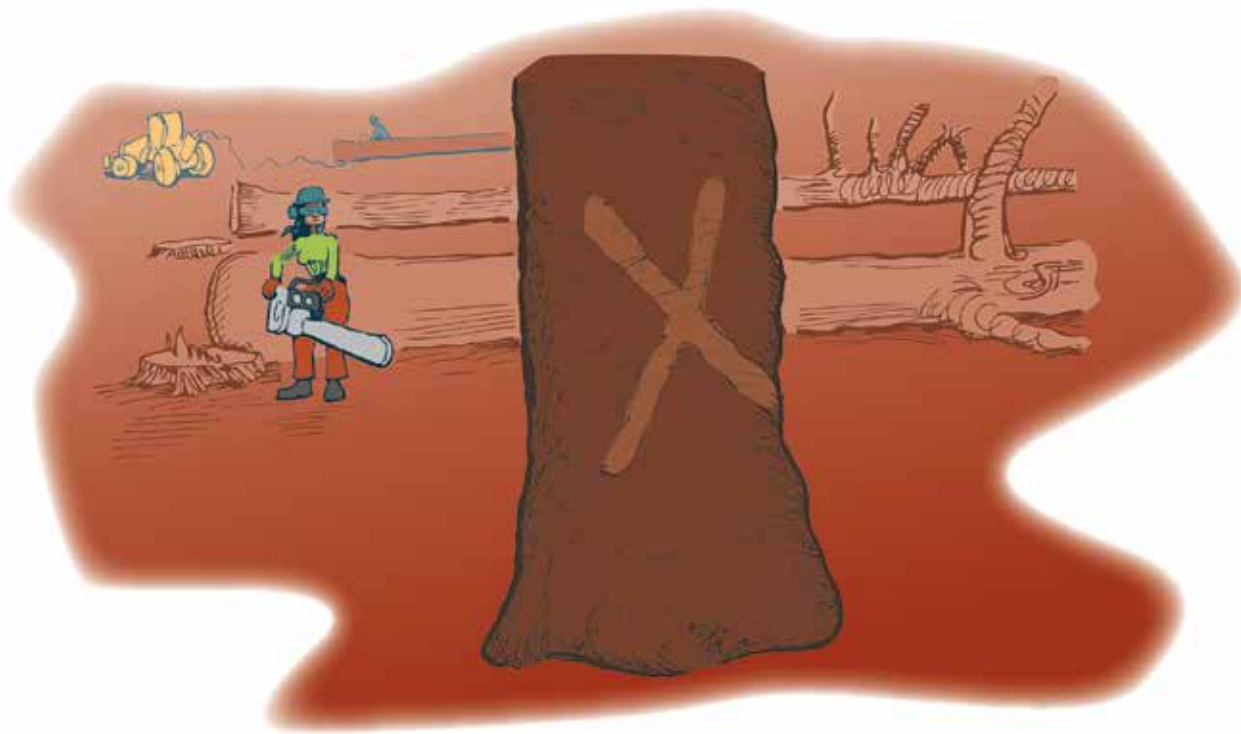
Identify the hazards at this work site.

Struck-bys

One of the most common cause of work site injuries, and even fatalities, is “**struck-by**” accidents. As the name implies, a struck-by accident includes all forms of workers (or the public) being struck by an object on the job. Common objects involved with struck-by accidents in tree care operations are trees and branches, hand tools dropped by workers, equipment, and vehicles.

Look for struck-by work-site hazard areas, such as:

- restricted work areas/landing zones for dropping limbs and cutting brush
- restricted areas for dragging and chipping brush
- slopes in the working area that might allow a log to roll
- heavy undergrowth in the landing zone that could create **spring poles**



Tree inspection

In the third year of apprenticeship study, you will learn about **tree risk assessment**, and will learn about thorough tree inspection. In the meantime, you will learn to inspect each tree that you will work on, specifically for potential hazards to workers or others. Inspect each tree completely from the ground before you begin work. Walk around the tree to examine all parts of the tree from the roots to the branches. Be aware of the movement or sway of the tree. If the tree does not move as it should, there may be a hidden problem. If soil or vines cover portions of the trunk, they should be moved or removed for examination of the trunk and root collar. Vines and soil often hide hazardous situations.

Look for tree hazards, such as:

- broken branches, hangers, or dead branches
- cracks, cankers, hollows, and other visible signs of tree failure/decay
- signs of internal decay, such as **conks** or mushrooms on the root flare or trunk
- signs of root rot such as mushrooms, loose bark on root flare and roots,
- fungal **hyphae** growth under loose bark (looks like black shoe strings)
- ground heaving on one side, leaning trees

Roots

Some tree care operations, especially **rigging** for removal, put a tremendous **load** on a tree. If the roots or the base of the tree is not structurally sound, the tree could fail with climbers aloft.

All trees need a substantial root system to keep them standing. Only a small portion, however, is visible above the soil surface. Trees should have a flare at the base. If this is not present, soil or mulch may be hiding symptoms of decay in the stem or roots.

When the root flare is not visible, remove soil from the **root collar** and inspect roots for decay. If more than 50 percent of the root system is decayed or missing, alternative methods to climbing should be considered before beginning work.

Signs and symptoms on or above the **root flare** or **buttress roots** can give an indication of the condition of the rest of the root system. Any root decay visible near the trunk could indicate extensive root loss. Fungal **fruiting bodies**, including mushrooms and conks, may indicate decay. It may be necessary to investigate further by using a **probe**—a stiff metal wire, knife, or sturdy stick—to feel for soft, decayed wood. Another option is to use a mallet for **sounding** the trunk or buttress roots, listening for differences in tone that could indicate decay.

Construction injury

Look for signs of construction injury on trees. Trees may have had severe root cutting, or grade changes may have root death or decay, making the trees unstable. If possible, ask the client for the tree's history. Look for trees with no root flare (i.e., looks like a telephone pole), indicating a grade fill that might have killed roots. Pay attention to new driveways, foundations, walkways, underground utilities, or anything that might have required roots to be cut for installation. Keep in mind that damage from root injury may not show up for a few years.

Ground heaving

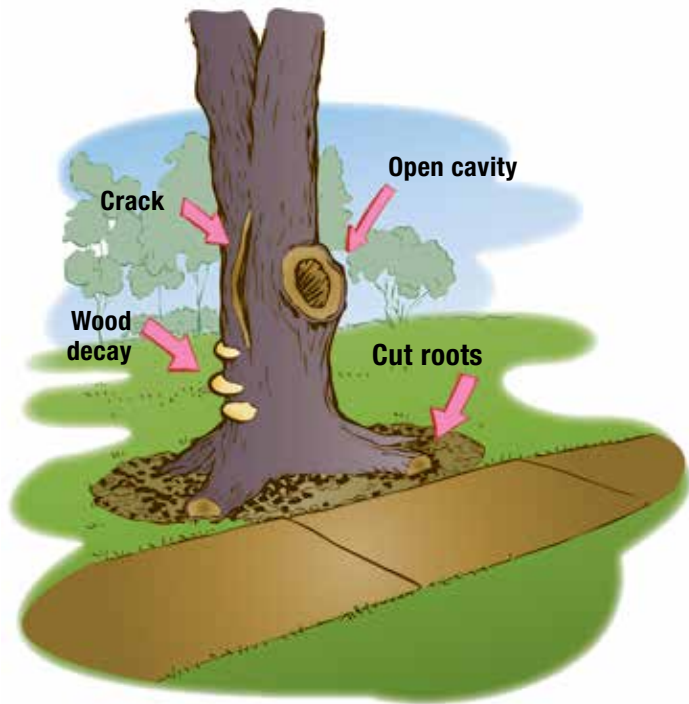
The lifting of soil adjacent to a tree may indicate that the tree has started to fall over. Trees in wet areas are prone to this type of failure. Construction-damaged trees and those with root rot may also have this problem. Additional weight in these trees may make them fail.



Ground heaving due to a leaning tree. Tree lean caused by root loss in this example.

Hand pull test

One way to check for problems with tree stability is to conduct a **hand pull test**. Install a light-duty line such as a throwline high in the tree in question. Then pull on the line in several directions, if practical, while watching for movement at the base of the tree. A large, mature tree should not move with this amount of force. Movement may indicate decay at the base or missing roots. Take care when conducting this test. An extremely unstable tree could be pulled to the point of failure. All workers must stay out of the test area.



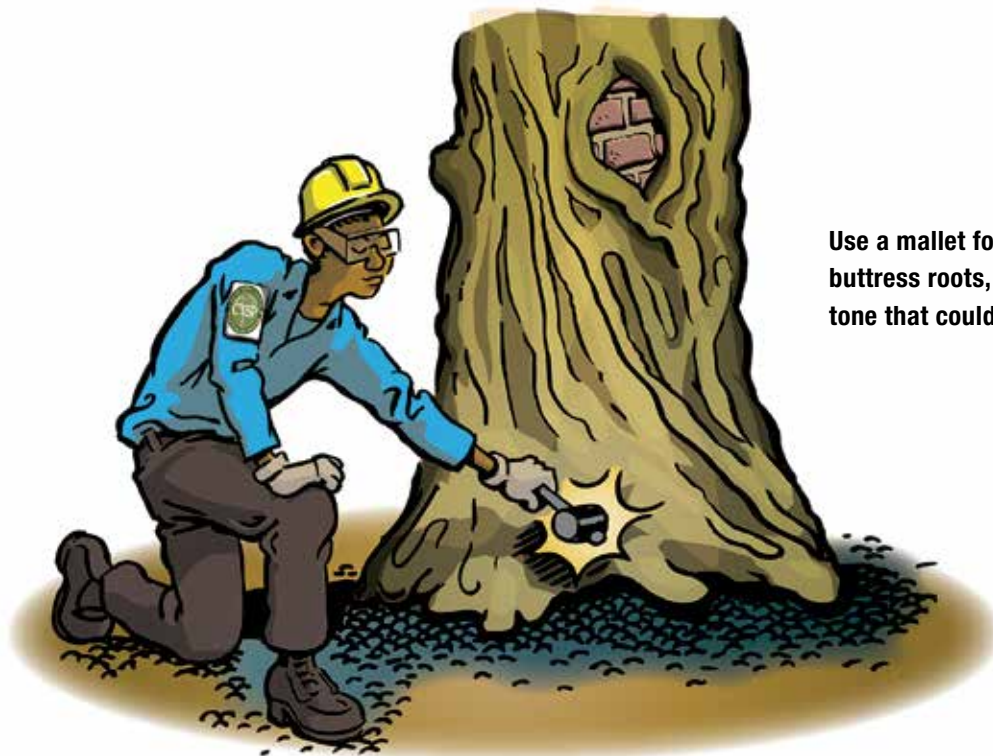
Some trunk and root hazards are cracks, cavities, wood decay, cut roots, etc.

Trunk

You must inspect the trunk of each tree carefully. The lower stem is the area between ground level and four feet above ground. It is the easiest portion of the tree to examine. Defects found here may indicate either a root or stem problem. Look for loose bark, open cavities, cracks, mushrooms, conks, and depressions or swellings in the stem. These can indicate a serious decay.

If decay is present, the extent of weak wood should be determined before work begins. Examination can be done by probing with a knife, stiff wire, or a drill. The “hot spot” is where the trunk usually breaks.





Use a mallet for sounding the trunk or buttress roots, listening for differences in tone that could indicate decay.

Cankers

Cankers are diseased areas of the bark caused by fungi or bacteria. Symptoms are generally a sunken, dead area on the bark. Cankers can cause a weakening of the outer layers of wood. Canker rots can cause both a canker and wood decay. If decay is present and spreads into the wood, a weak area is created because both the inner and outer **growth rings** are affected.

Cracks

Cracks can occur on limbs, trunks, and roots, and can be a sign of weakness, especially when associated with decay. When cracks go deeply into the wood of trunks, inner wood decay may be present. Trunk cracks associated with wood decay may indicate that the tree is twisting and beginning to fall apart. When cracks are discovered on opposite sides of a decayed tree, the tree should be considered seriously weakened.

Sapwood decay

Sapwood decay or decay of the outer wood may occur prior to the death of a tree. After a tree dies, the problem tends to be greater. Trees that keep their bark after death tend to have more sapwood decay since the bark holds in moisture. Sapwood decay causes a greater degree of strength loss than does internal decay. A sign of sapwood decay is the presence of many tiny mushrooms or fungal fruiting bodies on the outside of a branch or stem.

Sapwood decay can affect trunks or branches. A branch with sapwood decay should never be trusted to support weight and should be considered a potential hazard.

Limbs and branches

Inspect limbs for loose bark, cracks, fungal fruiting structures, and decay. Limb scars indicate a history of limb failure and the potential for more failures. **Codominant stems**—forked branches or stems of nearly equal diameter—can be a weak area, especially when there is **included bark** in the **branch union**. Included bark is bark that become embedded between the stems or branches, weakening the attachment.

Limbs or sprouts that arise from **topping** cuts are often poorly attached due to the angle of growth and possible internal decay. Do not tie into them when climbing.

Bees, wasps, and other animals

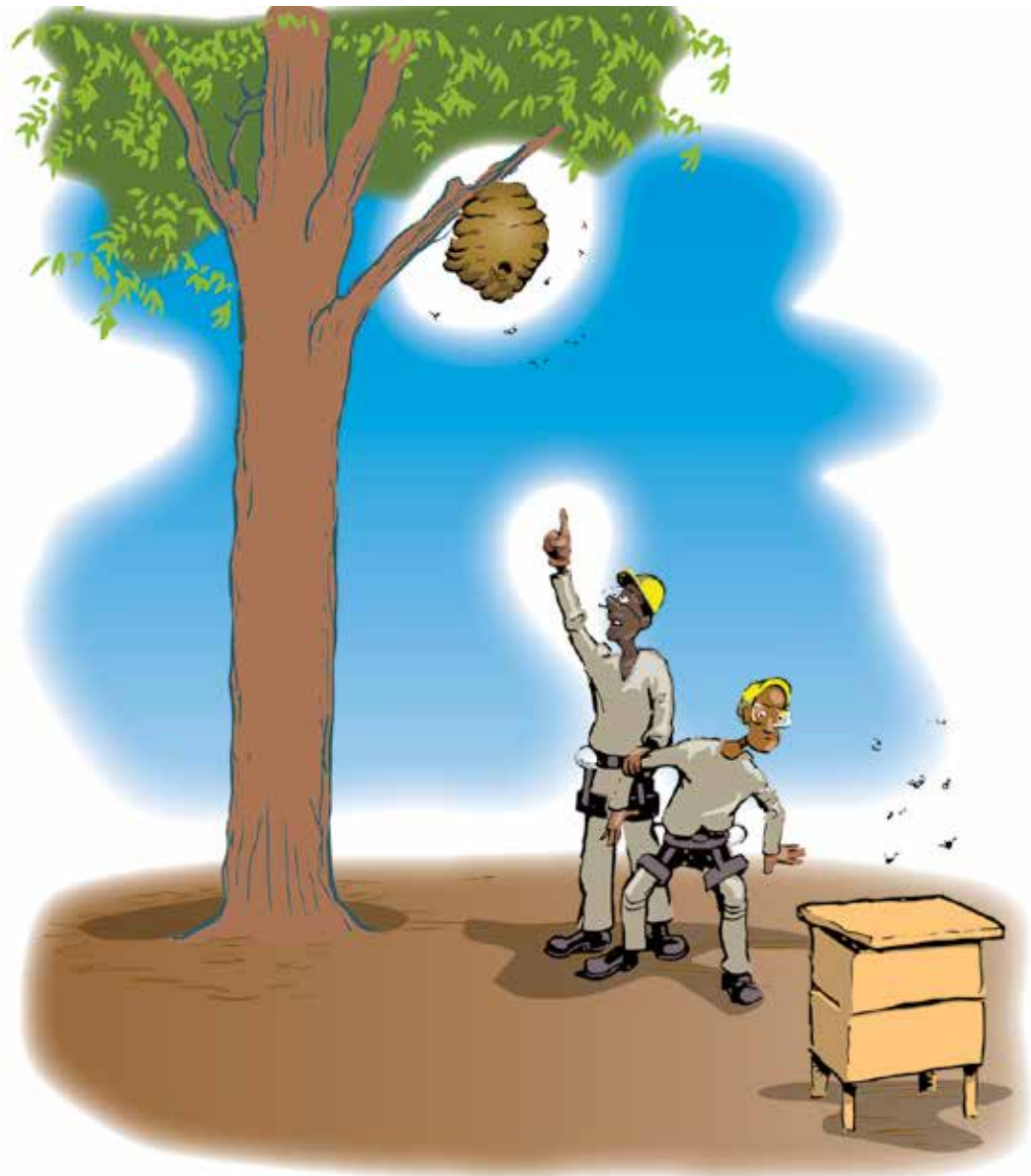
Many animals and stinging insects make their homes in trees. Locate possible nesting sites before getting too close. Look for round entrance holes and evidence of recent chewing of tissue. Always have an escape plan in mind if you spot stinging insects. Do not panic!

Look for signs of animals/insects that bite or sting, such as:

- paper wasp nests / bee hives
- buzzing noise, indicating a bee hive or swarms
- tree hollows or visible nests that could house squirrels, raccoons, or other animals
- palms that might harbor snakes, lizards, or rats



Tree limb hazards include watersprouts, hangers, cankers, dead branches, lightning damage and weak crotches.



Bees and wasps are always hazardous! They can be deadly when disturbed.

Some companies carry insect (bee and wasp) spray on the truck. Careful consideration should be given, however, before spraying a bee hive. Bees are important pollinators and bee hives can be quite valuable. Sometimes it is better to call in a bee specialist to remove the hive and bees.

Remember that most stinging insects are not active until the temperature becomes warm. In winter months they tend to move very slowly and fly very little. In general, they are less active in the morning than later in the day.

Be very careful around larger cavities. Many animals nest in cavities. Reaching in can result in a serious bite that could have more serious consequences. Bites from wild animals can create the need for rabies treatments.

Support cables

Before performing any tree care operation, locate the position of any support **cables**. Cables are most common where V-crotches are present, but they may be in any tree. Cables can be an indication of a structural weakness. Also, it is very important for climbers to know where any cables are located before working on trees.

Dead trees and branches

After a tree dies, the wood begins to weaken. If left alone, all dead trees will eventually start dropping limbs; roots will start decaying and trunks will eventually fall over. There is great variability between when a tree or branch dies and when it will fail, partially due to differences among species and climate. All trees must be judged individually based on the amount of root rot, trunk rot, and limb deterioration. As a rule, soft-wooded or decay-prone species are best removed within six months of their death. Stronger-wooded, less decay-prone species may last longer before becoming highly risky.

Special hazards

Some situations, often weather-related, can create special hazards that must be identified and mitigated.

Storm damage

Hazard identification in trees that are storm damaged presents many challenges for tree workers.

Extra care must be taken to evaluate any storm-damaged tree for possible “hidden” hazards before beginning work. Some things to look for before and during the climb include:

- Wires and cables hidden by leaves and branches. Trees may become energized when electric wires contact them. Wires, such as telephone lines, that contact electric wires can become energized. Consider all wires and cables as energized.



Cables could indicate structural weaknesses

- Cracked stems and branch unions
- Broken limbs and tree tops that may be hanging in trees
- Broken limbs held by support cables
- Points of pressure and tension on limbs or small trees underneath larger fallen trees

Storm damage often requires long working hours in high stress situations. Talk to your supervisor if you begin to feel over-tired. Fatigue leads to accidents. No tree work should be done after dark without adequate lighting.

Ice

Ice and snow present obvious slipping hazards. When temperatures are below freezing, inspect the work area and tree for ice. Ice and snow can also add enough weight to deform branches or bend entire trees over. Take care when removing portions of these trees as to not be injured by the spring poles they create, see Module 2, Arborist Equipment Fundamentals.

Wet limbs

Climbing wet trees, or in the rain, presents work hazards, such as visibility problems and slipping.

In addition to being slick, wet trees make defects harder to see.

Fallen trees

When trees fall, the trunk is usually cut near the base. After the cut, the stump and attached **root plate** may remain in the uplifted position, it may move part of the way back into the hole, or it may spring totally back into the hole. Care must be taken to make sure no one will be injured if the root plate moves. Movement may also throw the saw up and out-of-control.

Another problem with fallen trees is that they can fall on other tree limbs or saplings, putting them under great tension. These trees or branches under tension are called spring poles. They need to be cut carefully using specific techniques because they are potentially very hazardous, see Module 2, Arborist Equipment Fundamentals

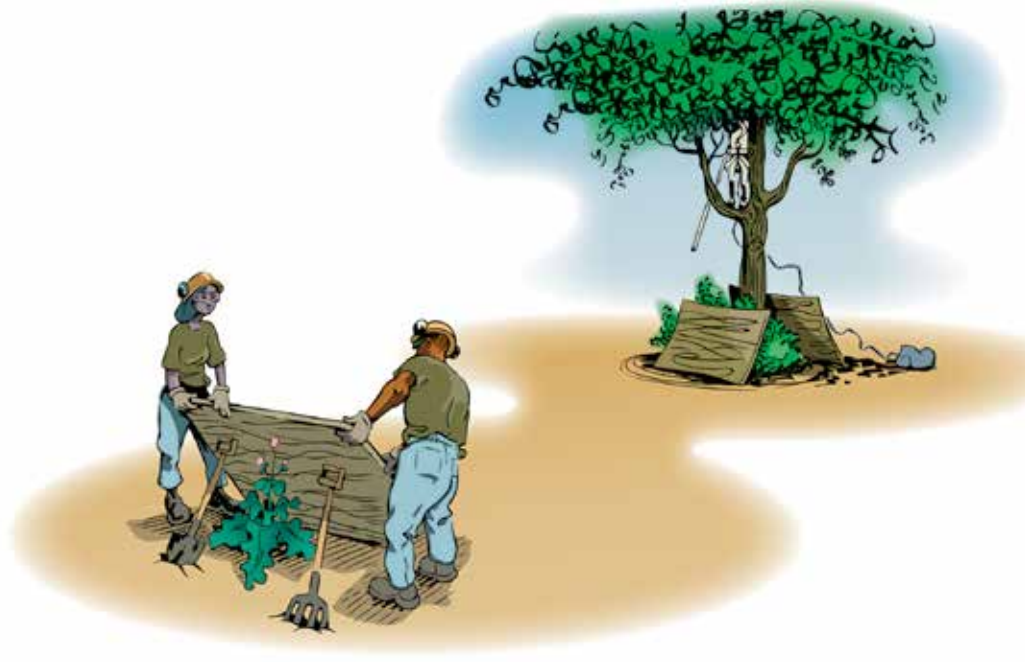
Palms

FronD skirts can dislodge and fall. Use caution when working on palms containing skirts with three or more years' worth of dead fronds.

Dead fronds are a serious fire hazard. Smoking while working in or near dead palm fronds is prohibited. Check the chain saw muffler to make sure it is intact and not releasing sparks.

Handle fronds with care as they can inflict serious cuts and puncture wounds that can result in infection.

Be aware that many types of animals (e.g. rats, snakes, bees, etc.) nest in palms, especially palms that have been neglected for several years. Have an escape plan in mind in case of attack!



Protecting property

Some work sites will have certain things that must be moved or protected before starting work. Examples include:

- property such as houses, garages, sheds, boats, cars, swing sets, outdoor grills, and bird baths
- hardscaping such as fences, walkways, driveways, pools, decks, patios
- landscaping
- wet soil/mud that might become compacted
- private septic systems
- utility services such as poles, conductors, service drops, meters, well casings, underground sprinkler system

Protection can be provided in many ways, for example:

- move the object when possible
- use rigging lines/devices to control and direct the descent of limbs and tree sections
- flag or place cones over sprinkler heads
- use protection such as hinged plywood for shrubs
- avoid wet/muddy areas to prevent soil compaction
- avoid driving or moving equipment over private septic systems

Most states require your company to call/notify their “Dig Safe” service before digging or excavating. As a result, if you will be digging or excavating for any reason, the utilities should already be marked. Make sure to locate the specific markings for each service when possible.

PRACTICE EXERCISES



MATCHING

_____	load	A	fruiting body of a decay fungus
_____	conk	B	two stems of similar size at a union, lacking a collar
_____	root collar	C	hanging, dead fronds on a palm tree
_____	fruiting bodies	D	reproductive structure of a fungus
_____	buttress roots	E	bark that becomes embedded in a branch union
_____	probe	F	flared area at the base of a tree
_____	sounding	G	general term for weight or force
_____	codominant stems	H	tapping a tree with a soft-headed mallet
_____	included bark	I	stiff wire, stick, or other device used to estimate decay
_____	frond skirts	J	large, support roots at the base of the tree

1. If you identify any hazards, potential problems, or anything that might affect safety, you should bring it to the attention of your crew leader.

TRUE FALSE

2. One of the most common causes of work site injuries, and even fatalities, is “struck-by” accidents.

TRUE FALSE

3. List four “struck-by” work-site hazard areas.

a.

b.

c.

d.

4. Potential hazards will be discussed in the _____, which will also cover _____ measures that you will take to reduce or eliminate risks.
5. Perhaps the most important element of the site inspection is locating any _____.
6. All wires and cables passing through a tree should be considered _____.
7. A very common cause of injuries on the job is _____, _____, and _____.
8. You should never move or remove soil or vines that cover portions of the trunk or root flare.
TRUE FALSE
9. If the roots or the base of the tree is not structurally sound, the tree could fail with climbers aloft.
TRUE FALSE
10. The lifting of soil adjacent to a tree may indicate that the tree has started to fall over.
TRUE FALSE
11. Use a mallet for _____ the trunk or buttress roots, listening for differences in tone that could indicate decay.
12. It may be necessary to investigate cavities by using a _____—a stiff metal wire, knife, or sturdy stick—to feel for soft, decayed wood.
13. One way to check for problems with tree stability is to conduct a _____.
14. Fungal _____, including mushrooms and conks, may indicate decay.
15. When the root flare is not visible, remove soil from the _____ and inspect roots for decay.
16. Diseased areas of the bark that are generally a sunken and discolored are called _____.
17. Before performing any tree care operation, locate the position of any support _____.
18. Fallen trees may have fallen on other tree limbs or saplings, putting them under great tension, creating hazardous _____.
19. Trunk cracks associated with wood decay may indicate that the tree is twisting and beginning to fall apart.
TRUE FALSE

20. When cracks are discovered on opposite sides of a decayed tree, the tree should be considered totally stable.
TRUE FALSE
21. Trees with no root flare are an indication of being firmly anchored with deep roots.
TRUE FALSE
22. The lower stem in the area between the lowest branch and four feet above ground rarely is where tree trunks fail.
TRUE FALSE
23. Sapwood decay causes a greater degree of strength loss than does internal decay.
TRUE FALSE
24. A sign of sapwood decay is the presence of many tiny mushrooms or fungal fruiting bodies on the outside of a branch or stem.
TRUE FALSE
25. Codominant stems can be a weak area, especially when there is included bark in the branch union.
TRUE FALSE
26. Limbs or sprouts that arise from topping cuts are usually strongly attached.
TRUE FALSE
27. List five ways of protecting property on a work site.
- a.
 - b.
 - c.
 - d.
 - e.

28. List four signs of animals that bite or sting.

a.

b.

c.

d.

29. List five potential site-related hazards on work site.

a.

b.

c.

d.

e.

30. List five potential tree-related hazards on work site.

a.

b.

c.

d.

e.

PRACTICE TEST QUESTIONS



1. If, in the opinion of the crew leader, anything is found during the work site inspection that cannot be adequately mitigated or will affect the crew's ability to do the job
 - a. it should be brought to the attention of the client
 - b. it should be brought to the attention of the supervisor
 - c. the crew leader must change the work order
 - d. the crew must complete the job no matter what

2. When assessing site hazards, what is the significance of a tree with no root flare; i.e., one that looks like a telephone pole?
 - a. It is an indication that fill has been added, which may have killed some roots.
 - b. It is an indication that the tree is unusually deep-rooted and probably quite stable.
 - c. It has no significance as far as hazard assessment.
 - d. It is an indication that fill has been added around the tree which provides extra stability.

3. Struck-by accidents can be avoided by
 - a. setting up a work zone with proper cones, signs and flags
 - b. working within the cones when dragging and chipping brush
 - c. staying out from under trees where limbs are being dropped
 - d. all of the above

4. If you will be digging or excavating for any reason
 - a. the utilities should be marked
 - b. you must set up cones around the area
 - c. traffic warning signs are required
 - d. all of the above

5. A method of providing protection for work site property is
 - a. move the object when possible
 - b. flag or place cones over sprinkler heads
 - c. use rigging techniques when lowering branches
 - d. all of the above

6. A problem created when trees fall on other tree limbs or saplings, putting them under great tension is called
 - a. codominant stems
 - b. spring poles
 - c. struck-bys
 - d. conks

7. A precaution to take when working near dead palm fronds is
 - a. never climb underneath them
 - b. avoid smoking near them
 - c. be sure the chain saw isn't sparking
 - d. all of the above

8. If more than 50 percent of the root system of a tree is decayed or missing you should
 - a. consider alternatives to climbing the tree
 - b. alert your crew leader
 - c. perform a hand pull test
 - d. all of the above

9. Bark that becomes embedded between stems or branches, weakening the attachment is called
 - a. codominant stems
 - b. branch bark ridge
 - c. included bark
 - d. branch collar

10. A danger associated with cutting the trunk of a windfallen tree is
 - a. the root plate could suddenly move back into the ground
 - b. the root plate could become a spring pole
 - c. the trunk could become a spring pole
 - d. all of the above

11. Most stinging insects are least active in
 - a. the middle of the day
 - b. warm weather
 - c. the winter
 - d. the summer

12. Before spraying a beehive with insecticide, it is important to consider that
 - a. bees are important pollinators
 - b. insecticide won't kill honey bees
 - c. they will never sting if you remain calm
 - d. only the males attack

13. Codominant stems are especially weak if they contain
 - a. a branch union
 - b. a branch bark ridge
 - c. included bark
 - d. a branch collar

13. Ground heaving, especially associated with a leaning tree, may be an indication that
 - a. the tree is about to fail
 - b. strong buttress root formation
 - c. a strong and stable root flare
 - d. the root collar has been excavated

14. A danger associated with working in post-storm conditions is
 - a. fallen electric wires hidden by downed trees
 - b. spring poles created by fallen trees
 - c. broken limbs hanging in tree tops
 - d. all of the above

15. A method to check for tree stability is
 - a. a root collar excavation
 - b. probing and sounding the tree base and roots
 - c. the hand pull test
 - d. all of the above

PERFORMANCE DEMONSTRATION



SITE INSPECTION

Demonstrate a site hazard inspection on a job site.

Requirements:

You must thoroughly inspect the work site and verbally narrate inspection. Point out what is being looked for and what is identified. If something is not applicable, or not identified, you must say so to receive credit for that item. This demonstration is to be done without a checklist. Points will be subtracted for items that are addressed but the hazard missed, if present.

- electric wires (all: house drop, distribution lines, etc.)
- guy wires
- support cables in trees
- uneven terrain, holes, rocks, muddy areas
- vines on tree trunks or heavy undergrowth
- places vehicles must not drive (e.g. septic tanks)
- traffic issues
- restricted work areas
- poisonous plants
- animals/stinging insects
- heavy undergrowth in work area
- potential for slips, trips, or falls
- potential for struck-by accidents
- spring poles
- weather-related hazards
- fallen trees with raised root plate
- property to be protected

PERFORMANCE DEMONSTRATION



TREE INSPECTION

Demonstrate a tree hazard inspection on a job site, including the root zone.

Requirements:

You must thoroughly inspect a tree and verbally narrate inspection. Point out what is being looked for and what is identified. If something is not applicable, or not identified, you must say so to receive credit for that item. This demonstration is to be done without a checklist. Points will be subtracted for items that are addressed but the hazard missed, if present.

- examination of roots and root area
- examination of root flare/root collar
- examination of lower trunk/trunk “hot zone”
- examination of lower branches
- examination of upper canopy
- mention of looking for signs of decay
- mention of looking for cracks
- mention of looking for cavities or cankers
- mention of looking for leans/ground heaving
- mention of looking for codominant stems
- mention of looking for signs of biting animals/stinging insects
- mention of looking for weather-related hazards
- mention of looking for support cables
- mention of looking for broken branches
- mention of looking for dead branches
- mention of looking for hangers
- consideration of further investigation (root collar excavation, moving of obstruction of view, hand pull test)
- identification of potential drop zone(s)

Job Briefing

Learning Objectives

1. Describe why job briefings are an important part of every job.
2. Discuss all of the elements of a job briefing.
3. Lead a job briefing out on an actual job site.

Your supervisor tells you what the work plan is by conducting a job briefing. The job briefing is an essential part of every job for every worker on the crew. Every member of the crew must have a clear understanding of what has to be done and how; what are the potential hazards and how they are to be managed, what PPE is needed, and who does what.

You participate in a job briefing before starting work so that you understand what is to be done. Ask questions if you don't understand any part of the job briefing or how to perform the job safely. Be sure your questions are answered thoroughly and that you understand the answers. If you find or create a new hazard during work activities, tell your immediate supervisor and alert crewmembers.

The job briefing is the communication of at least the following:

- **Work** to be done and procedures involved
- **Hazards** associated with the job
- **Electrical** hazards
- **Precautions** and mitigation measures
- **Assignments** – who does what
- **Personal protective equipment**

One way to help you remember all the elements of a job briefing is the sentence: **“Work haz electrical precautions, assignments, and PPE.”** Some companies have different variations on this, but the important thing is that all the elements are covered.



The job briefing is an essential part of every job for every worker on the crew.

Work plan

The work plan determines who does what, when, and how. The work plan is created to accomplish the tasks on the work order. Be certain you understand exactly what is to be done to every tree. If you don't understand the work plan, stop and ask your crew leader.



Mitigating potential hazards

The job briefing includes ways to reduce tree and work-site hazards.

Reducing slip, trip, and fall hazards

- have a good “branch management” system to avoid debris pileups in the work area
- avoid working on slopes when there are other alternatives
- keep vehicles and chippers close to the work area when possible to the limit distance for dragging brush
- avoid or move work-site trip hazards (holes, brush, logs, tools)
- establish a hand tool area at the job site for tools that are not being used at the moment but will be needed again
- stow tools on the truck when no longer needed
- always be aware of your surroundings

Reducing struck-by hazards

- establish the landing zone/drop zone at the job briefing
- clean the landing zone/drop zone of underbrush when possible
- always wear personal protective equipment (PPE)
- be aware of the climber's activities
- consider that a climber may drop a branch, hanger, or hand tool at any time
- coordinate ground operations with climbing operations by communicating your presence to climbers whenever you enter the “landing zone” with a command/response system
- be certain all personnel understand their roles when felling and are properly positioned
- when felling trees, always give a warning before commencing the back cut and be sure fellow workers are clear

PRACTICE EXERCISES



1. Your supervisor tells you what the work plan is by conducting a _____.
2. List three reasons a job briefing is important.
 - a.
 - b.
 - c.
3. List six elements of a job briefing.
 - a.
 - b.
 - c.
 - d.
 - e.
 - f.
4. The _____ determines who does what, when, and how.

5. List four ways to reduce slip, trip, and fall accidents.

a.

b.

c.

d.

6. List four ways to reduce struck-by accidents.

a.

b.

c.

d.

PRACTICE TEST QUESTIONS



1. If you do not understand the work plan, you should
 - a. stop and ask your crew leader
 - b. do the best you can
 - c. do what everyone else is doing
 - d. work on a different task

2. Which of the following is not necessarily included in the job briefing?
 - a. electrical hazards
 - b. PPE required
 - c. pruning specifications
 - d. mitigations and precautions

3. The consequences of failure to conduct a job briefing could be
 - a. somebody getting injured or killed
 - b. property getting damaged
 - c. a wrong tree being removed
 - d. all of the above

PERFORMANCE DEMONSTRATION



JOB BRIEFING

Lead a job briefing out on an actual job site.

Requirements:

You must cover the six required elements below without looking for help from the crew leader or prompting from crew members. Order of the elements is not important for points. Be prepared to answer questions.

- **W**ork to be done and procedures involved
- **H**azards associated with the job
- **E**lectrical hazards
- **P**recautions and mitigation measures
- **A**ssignments – who does what
- **P**ersonal protective equipment

Additional points given for suggestions for work site set-up; suggestions for protecting property; and guidance for completing work.

Groundworker Responsibilities

Learning Objectives

1. Describe the steps taken to prepare for work on a tree trimming/removal site.
2. Discuss the role of the groundworker in protecting the public.
3. Discuss how a groundworker cooperates with climbers aloft.
4. Explain the role of a groundworker in a rigging operation.
5. Explain the drop zone in a tree trimming/removal operation.
6. Summarize groundworker responsibilities.
7. Demonstrate sending a line up to a climber/aerial lift operator.
8. Demonstrate sending a tool up to a climber/aerial lift operator.
9. Demonstrate proper lifting techniques.
10. Demonstrate the proper way to put away and store a rope.
11. Discuss the importance of thorough site clean-up.
12. Ensure that all tools and gear are on the truck before leaving a job site.

Preparing the equipment and gear

Once the tree and site have been inspected and the job briefing is completed, the groundworker(s) will begin preparing the equipment and gear. Take the required tools, equipment, and gear off the truck and establish a designated area for it.

Make sure the rescue kit is out of the vehicle and easily accessible to the work site. Before beginning any work, it may be a good idea to install a second climbing line, called an **access line**, in tall trees being worked on to speed up the response time if there's an emergency aloft. This line should be installed out of the way of the work and, like the climber's line, must be kept clear of debris on the ground.

Set up an area for chain saw refueling and adjustment that is at least 10 feet away from where the saws will be used.

Action steps for chain saw fueling & maintenance

- Do not smoke when working around flammable liquids.
- Develop the habit of checking bar oil during maintenance and adding bar oil any time you add gas.
- Make sure you add fuel mix to the gas tank, and bar oil to the oil reservoir!
- If the saw isn't using oil, thoroughly clean the guide bar oil channel and check to see if the oiler starts working again. Never run a saw if the oiler isn't working.
- It's best to refuel saws over pavement but use a small tarp to guard against accidental fuel spills.
- Make sure you can control the fill rate when pouring gas into the saw and take every precaution not to overfill.
- Spilled fuel must be wiped off equipment before restarting.
- Always wear gloves when sharpening or adjusting the chain.
- Ideal chain tension allows the chain to rotate freely without drooping off the guide bar.
- Climbers will probably want you to start and check the climbing saw before you send it into the tree. (Be sure it is turned off and chain brake is engaged before sending up.)

Controlling pedestrian and vehicular traffic

You might be assigned to control pedestrian and/or vehicular traffic. Hand signaling devices such as sign paddles or flags can be used when control is needed, such as if your crew needs to stop traffic in one lane completely to safely remove a limb or move a vehicle. Flag signaling should be used only in low-speed or low-volume traffic.

Flag signalers, or **flaggers**, are responsible for public safety. You need to be courteous but firm, mentally alert, and well trained in traffic-control procedures. To stop traffic, extend the "Stop" paddle or hold the flag away from the body with one hand and signal stop with the other. To direct stopped traffic to proceed, lower the flag or turn the paddle to the "Slow" sign, and motion to proceed with the other hand. To alert traffic to slow, extend the "Slow" sign or hold the flag horizontally and motion to slow down with free hand, palm down, with arm moving up and down. Never attempt to stop traffic by blocking the roadway with your body or by stepping in front of a car that is not slowing down!



The flagger is ordinarily positioned on the road shoulder in front of the cones or within the coned area.

If you will be positioned on the roadway, then you should wear a high visibility vest or other "high-vis" clothing. If

you need to chip brush with a vest on, then make sure the vest can tear away easily.

Coordinating with climbers

Often your first responsibility after establishing the work area is assisting the climber into the tree. You might belay the climber into the tree or manage the climbing line, or you might help set up and support a ladder, removing it as soon as the climber is secured in the tree.

If you use a ladder, it should be positioned securely against the trunk or a major limb of the tree. A good rule of thumb for setting the angle of a ladder is that your outstretched fingertips should just reach its rails with your toes at the ladder base. Support the ladder until the climber is secured in the tree and off the ladder, then remove the ladder from the immediate area of the work. If the ladder is not to be used again, stow it on the truck.

Once a climber is in a tree and tied off, you will likely send equipment up on the climbing line. This might include rigging lines, pruning tools such as a pole saw, and, often, a chain saw. Later in this module you will learn some knots for sending equipment and tools up to climbers.

When a climber is aloft, or a worker is aloft in a bucket, remember that you must stay alert. They are up there working and will be dropping branches to the ground. You cannot ever allow yourself to become distracted when working below. You must maintain

Often your first responsibility after establishing the work area is preparing the equipment and assisting the climbers.



Support the ladder.

visual contact and communication, not only to avoid an accident, but to coordinate with workers aloft and assist when possible.

When the climber or bucket operator begins working above, your goal on the ground is to try to keep pace with the work in the tree. For pruning, this means keeping the area under the tree, the landing zone or drop zone, relatively clear of debris. This requires clear communication and coordination between workers aloft and on the ground to avoid the possibility of a struck-by accident. Accumulation of brush cannot be allowed to create a hazard on the worksite, but neither can you venture into the drop zone to retrieve limbs while the climber or bucket operator is cutting or lowering limbs. An example of good communication would be the groundworker calling out “Going under!” and waiting for the climber’s response of “All clear!” to ensure that it is safe to enter the drop zone.

For a tree removal operation, especially one involving a lot of rigging, this means trying to keep the drop zone clear of large entanglements, keeping the climber’s line clear of brush, and possibly sending up and handling lines.

Logical work sequence

A good tree crew works with precision and efficiency. The order of operations is a part of the work plan, and every worker should know the role and duties. You must think ahead and anticipate what needs to happen next to keep the workflow efficient and productive. Have you ever seen one ground worker thoroughly rake beneath a tree that has just been pruned, only to watch another ground worker drag a pile of brush across the freshly raked area? Wasted time and effort such as this can be minimized if you everyone is working together and understands the work sequence.

The work you do on the ground must be highly coordinated with what’s happening above. Depending upon the tree, it may be safe and efficient for you to prune what you can on the tree’s lower branches while the climber is still ascending and getting into position.



Effective communication is key to avoiding accidents such as struck-by injuries resulting from a climber dropping a limb while a groundworker is below.



Wasted time and effort such as this can be minimized if you everyone is working together and understands the work sequence.

Or, you may be able to work on other nearby plants, while still being available to assist the climber with sending up tools or other needs.

The worker aloft typically prefers to remove the largest manageable pieces to speed the job along. That means that on the ground, you will have to cut and move wood, clear brush, and reduce large pieces for the chipper.

In most tree pruning or removal operations, a great deal of the work is in handling the brush and logs. Brush must be cut into manageable sizes and moved out of the drop zone to the brush-chipping area. Always stack the brush with the butt end facing the chipper. If the brush is facing different directions, it will become tangled and will be very difficult to chip. Chipper operation is covered in the training next module.

Often logs or firewood will be generated, especially in a tree removal operation. Sometimes firewood is cut and stacked for the client. Other times it will be loaded on the truck and taken away. You will learn the proper techniques for lifting heavy loads and for preventing a back injury.

After pruning and/or cutting is completed and the brush has been removed, the area can be raked. Raking up isn't hard to do. You just have to be thorough and logical in your approach. Rake toward where the debris will go. Rake downhill, not uphill. Rake into piles to carry, perhaps using a tarp. Usually, the final step is sweeping or blowing the pavement. Most important of all, do a good job. The quality of the clean-up is what lasts in the client's mind.

Preventing back injury

Back injury is the leading cause of lost-time injuries in arboriculture. Even a minor back injury can lay you up for days, removing the ability to enjoy even the simplest of activities. It can have a profound effect on how you feel mentally and can hurt your ability to earn an income. If you don't take care of your back, you're likely to experience painful but temporary injuries like strains and sprains. If you continue to abuse your back, it can lead to permanent, chronic conditions that you will deal with for the rest of your life.

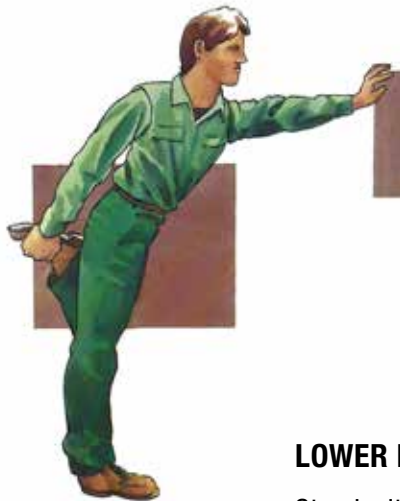
The common causes of back injury include:

- improper method for dragging brush
- lifting heavy or awkward loads
- slipping
- over-reaching
- falling from equipment
- entering/exiting truck cab without looking

Most back injuries, and all the pain and inconvenience that go with them, are preventable.

Your job requires strength and agility, just like an athlete's. Like an athlete, you can keep your back healthy by:

- warming up with stretches;
- exercising;
- following a good diet; and,
- using proper lifting techniques.



THIGHS

Hold on to a stationary object. Raise your left leg behind you, clasp your ankle with your right hand. Pull your leg toward your back until you feel your thigh begin to stretch. Hold for a count of 10 and repeat with your other leg.

LOWER BACK

Stand with feet shoulders' width apart. Go into a squatting position with your arms between your knees and feet flat on the ground. Hold for a count of 10.



LOWER BACK and HAMSTRING

Face a raised object, place your left foot on it. Keep your right leg straight and rest your hands on your left knee. Slowly bend your left leg, repeat 3 times with both legs.

NECK

Lower your head, attempting to touch your chin to your chest. Feel the back of your neck stretch. Slowly raise your head, holding your chin up as far as possible. Repeat the front to back movement.





PROPER LIFTS:

MODIFIED DIAGONAL LIFT

For moving heavy tool boxes or large chain saws, stand with your feet apart, one foot in front of the other. Keep the body slightly over the load with knees bent. Lock your back curve in the natural position, tightening your stomach muscles. Bend your hips and use your leg muscles to straighten.

DIAGONAL LIFT

Stand with feet apart, straddling the wood, one foot slightly in front of the other, on a diagonal, bend at your knees and hips. Grasp the far side of the wood with the hand that is on the same side as the forward foot. Grasp the opposite side with your other hand. Keep head and shoulders up. Lift with your knees and hips, coming to a standing position.



DEEP SQUAT LIFT

Do not place one foot ahead of the other. Using proper body mechanics, squat over the object. Lift the load with arms and cradle it close to your body.

ONE KNEE LIFT

This technique helps bring the load close to your body. Place one foot beside the front of the load. Grip the item firmly at the near and far corners. Lift or roll the object to the top of your thigh. This lift should be avoided if you have a history of knee problems.



Action steps for proper lifting

1. Decide in advance how to lift the object.
2. Consider the distance the object is to be moved.
3. Keep the load close to your body.
4. To change direction, move with your feet rather than twisting your back.
5. Bend at the knees.
6. Try to keep your back in the natural curve.
7. Don't handle anything too heavy or bulky without help.
8. Use mechanical devices to move large objects

Knowing the ropes

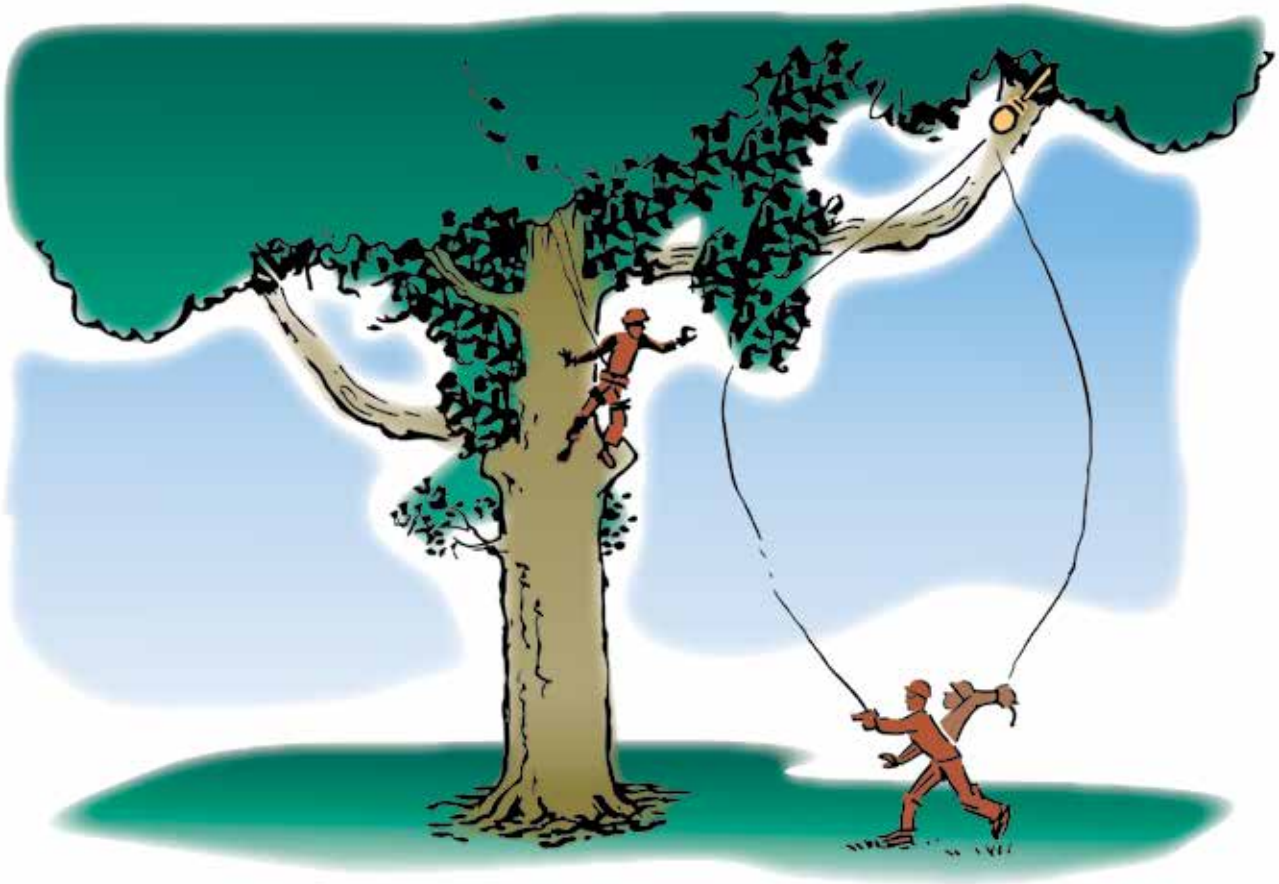
As a ground person, you play a critical role handling lines and even setting up rigging. You will need to understand the basics of ropes and knots including the parts of a line; how to send a rope up to the climber by tying it on the climber's line; and how to help set up rigging on the ground. You will need to know how to run the lines for rigging.

It is important to keep lines and gear used for rigging separate from lines and gear used for climbing. Rigging loads and stresses lines in ways that can reduce their strength. Never use the climber's line for rigging or sending up/lowering anything other than another rope, a chain saw, or a hand tool.

Because a climber's line is literally his or her life line, it must be cared for carefully. Old climbing lines can be "retired" and used as lines used for pulling or controlling the swing of cut branches—taglines. Equipment used for rigging can never be used again for climbing!



Using a barrel to keep rigging lines "clean".



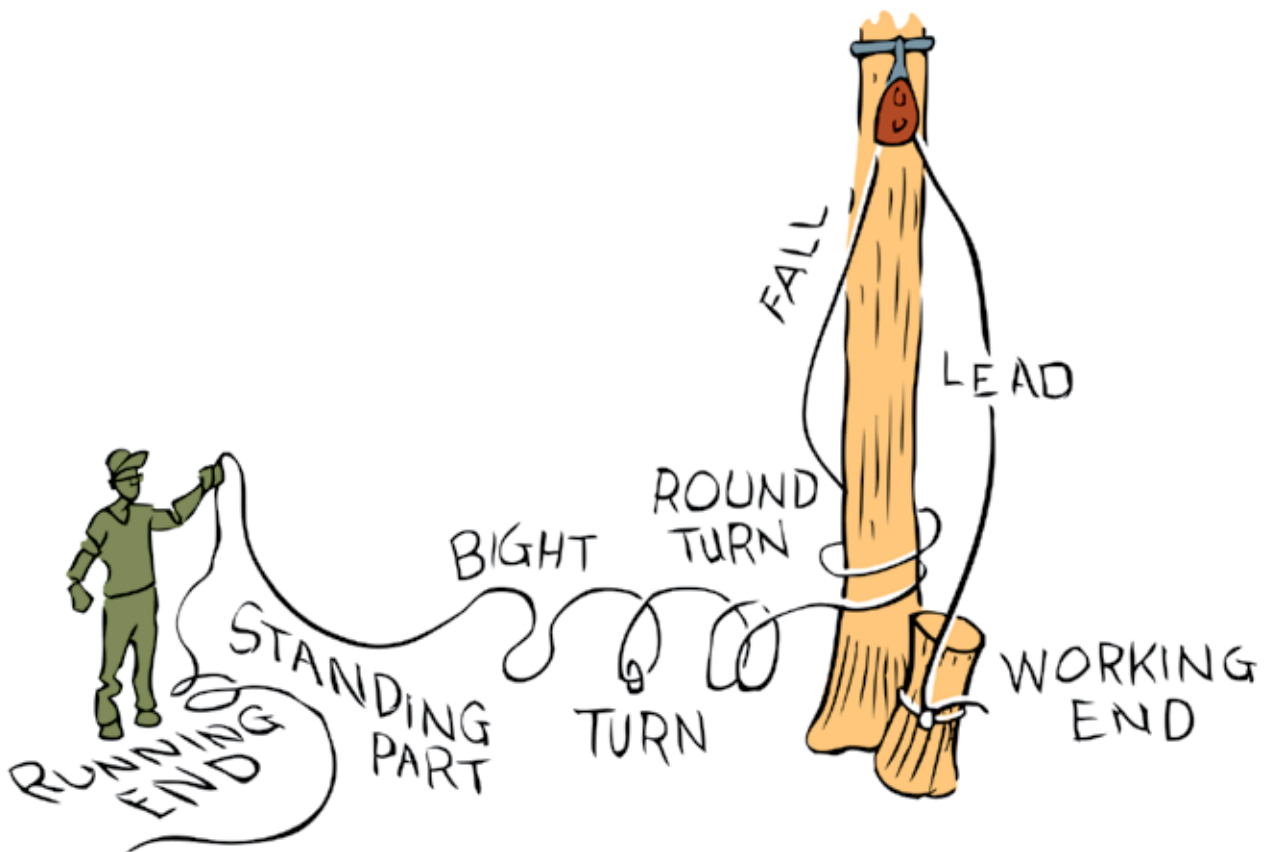
“Whipping” a line to the climber.

Never let lines get underfoot. They should be stowed on the truck soon after you’re done with them. Dirt on the ground can damage ropes, and they can be a trip hazard. Keep the lines clear of brush and out of brush piles. Keep lines untangled from one another. With synthetic fiber lines, rope-on-rope friction can quickly damage or destroy a line.

Sometimes you will need to “whip” a rigging line back to the climber in the tree as shown in the illustration. With a little practice you will be able to do this consistently and usually on the first attempt.

Limbs being removed are often controlled with a tagline—a rope tied to the end of the limb. The tagline might be used to control the swing of a cut limb, or to pull the limb in the desired direction. Usually the climber attaches the tagline, but sometimes it can be done by a groundworker. A line can be thrown over the limb, then a **running bowline** can be tied from the ground and pulled up the line into place, securing the tagline.

For rigging operations, a groundworker controls the rate of descent of a tied-off and cut limb by using friction. One way to introduce friction is to take a few wraps of the **running end** of the rigging line around the trunk of the tree. Experience will tell you how many wraps are needed for the load on the line.



The parts of a line.

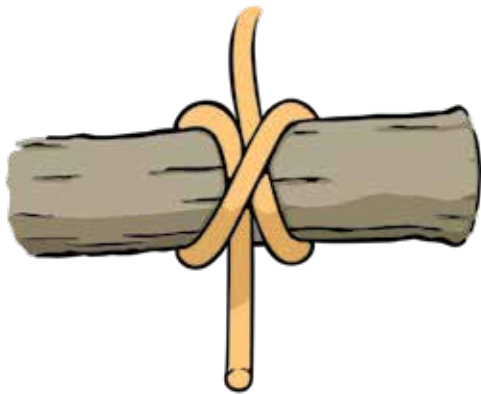
You will also learn how to attach various anchors and **friction-control devices** to the base of a tree, and the knots needed to do so. Using a friction control device is much more efficient than taking wraps because you don't have to keep running in circles around the tree. These devices also provide more consistent friction and more control of the line. You can also "let it run" when using a friction-control device. Letting it run means allowing the cut piece to fall quickly for a short distance so that it drops below the climber, then slowing the piece gradually and controlling it to the ground.

Whenever you are running the rigging lines, you should wear gloves that are designed to allow the rope to glide freely through your hands without burning you. Never wrap a rigging line around any part of your body to improve your grip or introduce more friction.

Groundworkers need to know a few basic knots. The knots are often described using the terminology of the parts of a line. The parts of a line are illustrated here for you.

Tie, dress, and set

Every knot that you tie should be properly tied, dressed, and set. Tying the knot required the appropriate combination of loops, wraps, and bights. Dressing the knot is aligning the parts. Setting the knot is tightening it to make ready for use.



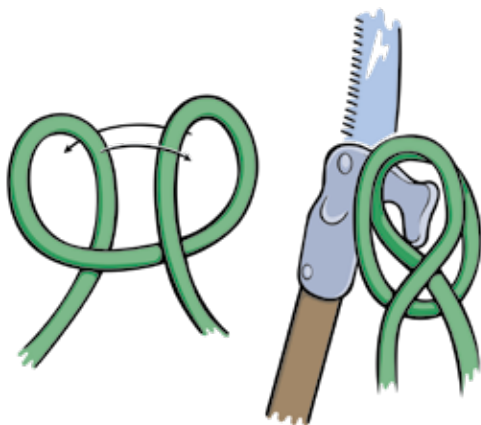
clove hitch – has a variety of uses, from tying on tools to creating an anchor. In most applications, it must be backed up with two half hitches because of its tendency to loosen.



bowline – a very secure knot for tying off the end of a line to an object; all the bowlines can be “broken” and untied even after being loaded very heavily.



running bowline – often used to secure taglines to limbs or stems while on the ground or from a distance.



mid-line clove hitch – often used to tie hand tools on the climber’s line.



butterfly knot – Commonly used to create a midline anchor point in a line when the pull will be perpendicular to the line. This way, strain will be placed equally on both legs since the knot is symmetrical.



Figure 8 knot – Typically used as a stopper knot to avoid having an end of the rope pull through a knot, such as the end of the climber’s line.



square knot – used to join two ropes of equal diameter.



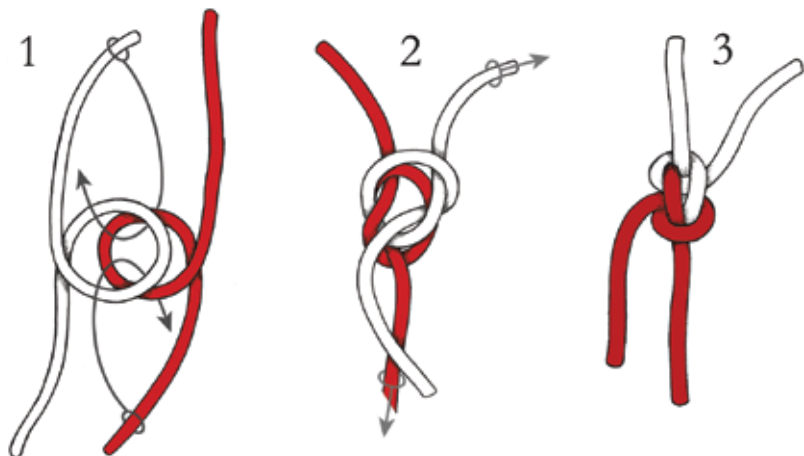
sheet bend – used to attach two lines together, particularly when they are different sizes. The sheet bend can be used to attach a rigging line to the climber’s line to send it up to the climber. The slipped sheet bend is a variation that is easy to untie.



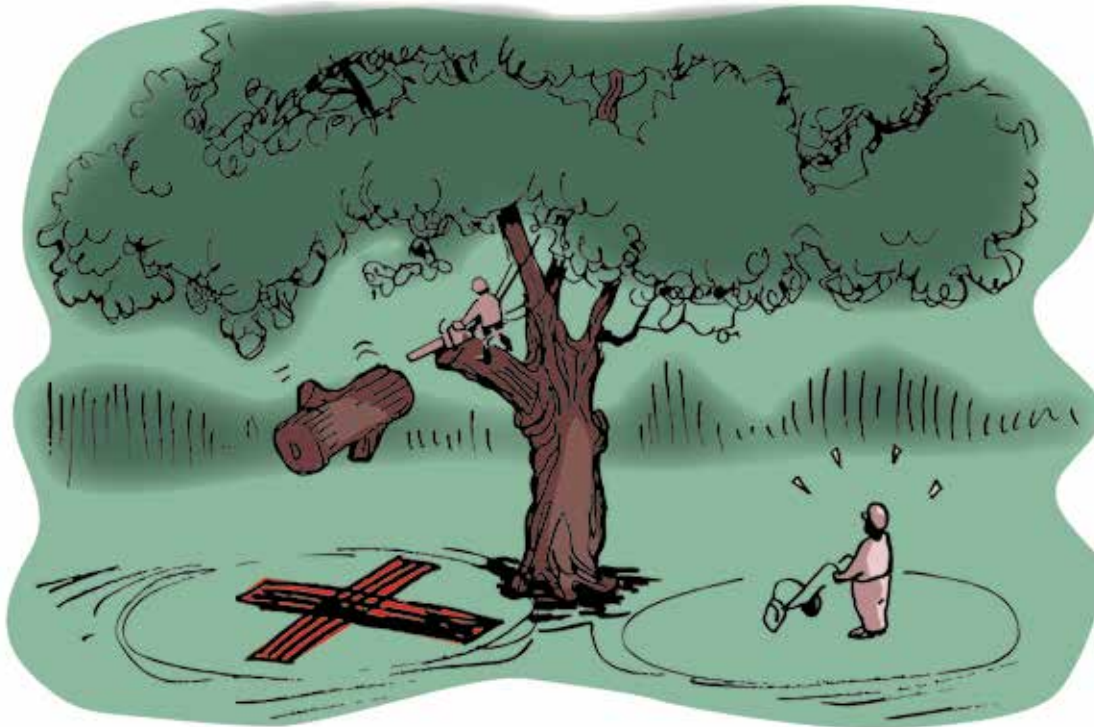
gasket hitch – secures a coil of rope for storage.



timber hitch – commonly used to secure a fixed eye sling as an anchor, usually with a minimum of 5 tucks.



zeppelin bend – used to attach two lines together; good for use on lines that will be heavily loaded.



Stay out of landing zone whenever possible. When you need to enter, be certain other crewmembers know. Maintain constant communication with any climbers or aerial lift operators.

Landing zone/drop zone

Falling debris causes many fatalities and serious injuries. About one-half of all “struck-by” fatalities involve falling tree debris. Often a crewmember on the ground is struck by debris dropped by a co-worker aloft.

The work plan and job briefing should establish the **landing zone/drop zone**. This is the area under the tree where debris will fall or be lowered. Entry into the landing zone requires very careful planning, coordination, and constant communication between crew members.

Before dropping limbs or branches, whether they are roped or not, the worker aloft must check to see that the landing zone is free of people and property that might be injured or damaged. The ground crew must know what is happening in the tree and take the proper precautions, especially when the climber’s or bucket operator’s vision is obstructed, or attention is focused on a difficult task.

Respect for property

Exercise respect for property—the client’s property, public property, and company property. Careless damage to property is a quick way to ensure that your company is never invited back. Take measures to ensure that

everything is protected and well-cared-for, and that the site is cleaned up to a level that is as good as or better than it was when you started. Remember: many clients do not recognize all aspects of arboricultural quality, but everyone knows a good clean-up job when they see it.

Final check

At the end of every job, the entire crew should do a final check. Ensure that all of the work has been completed and that the quality of the work meets national standards as well as company standards. The client should not only be satisfied but should also be pleased with the work and your company's professionalism.

Make sure that the site is thoroughly cleaned up, including chipping all brush; raking leaves, twigs, and sawdust out of lawns and landscaped beds; sweeping and/or blowing off all paved surfaces; and ensuring that nothing has been spilled.

Finally, ensure that all equipment and tools have been put away and that nothing has been missed. Stow the chain saws, climbing gear, ropes, pruning tools, and safety equipment. Count to ensure that you have the same number of cones, signs, rakes, brooms, and scoop shovels that you came with. Leaving anything behind not only makes your company appear less professional, it can be costly in lost equipment or time taken to retrieve it.

PRACTICE EXERCISES



1. Once the job briefing is completed, you should take the required tools, equipment, and gear off the truck and establish a designated area for it.
TRUE FALSE
2. The rescue kit should always be left on the trunk in case it is needed.
TRUE FALSE
3. You must never smoke when refueling a chain saw.
TRUE FALSE
4. The bar oil must be checked every third time you refuel a chain saw.
TRUE FALSE
5. The area for chain saw refueling and adjustment that is at least ____ feet away from where the saws will be used.
6. Before beginning any work in large trees, it may be a good idea to install a second climbing line, called an _____ in case of an emergency.
7. Securing, slowing, or using friction to hold a climber's line using a cleat, carabiner, or other device is called _____.
8. A good rule of thumb for setting the angle of a ladder is that your outstretched fingertips should just reach its rails with your toes at the ladder base.
TRUE FALSE
9. Once a climber is tied in and beginning work, it is okay to leave the area and go do something else.
TRUE FALSE
10. When the climber or bucket operator begins working above, your goal on the ground is to keep the area under the tree, the landing zone or drop zone, relatively clear of debris.
TRUE FALSE
11. Working on the ground requires clear communication and coordination with workers aloft to avoid the possibility of a struck-by accident.
TRUE FALSE

12. The leading cause of lost-time injuries in arboriculture is _____.
13. The climber's line can be used for light rigging.
TRUE FALSE
14. Old climbing lines can be "retired" and used as taglines.
TRUE FALSE
15. Using a friction control device is much more efficient than taking wraps because you don't have to keep running in circles around the tree.
TRUE FALSE
16. You should never wrap a rigging line around any part of your body to improve your grip or introduce more friction.
TRUE FALSE
17. _____ means allowing the cut piece to fall quickly for a short distance so that it drops below the climber, then slowing the piece gradually and controlling it to the ground.
18. The area under the tree where debris will fall or be lowered is called the _____ or the _____.
19. Leaving anything behind is not a big deal because someone can be sent to retrieve it.
TRUE FALSE
20. Careless damage to property is a quick way to ensure that your company is never invited back.
TRUE FALSE
21. List three things to remember when raking.
- a.
 - b.
 - c.

22. List six common causes of back injuries.

- a.
- b.
- c.
- d.
- e.

23. A rope tied to the end of a limb and used to control the swing or direction is called a _____.

24. List four things that you can do to help keep your back healthy.

- a.
- b.
- c.
- d.

25. A line can be thrown over the limb, then a _____ can be tied from the ground and pulled up the line into place, securing the tagline.

PRACTICE TEST QUESTIONS



1. Ideal saw chain tension
 - a. shows a gap between the bottom of the bar and the chain
 - b. will not allow chain rotation without the engine running
 - c. allows free rotation of the chain without drooping
 - d. is when the chain can barely move on the bar manually

2. Before sending a chain saw up to a climber, you should
 - a. be sure it is gassed and oiled
 - b. check the chain tension
 - c. start it briefly and stop it
 - d. all of the above

3. During a rigging operation a groundworker's job is to
 - a. keep the drop zone clear of large entanglements
 - b. keeping the climber's line clear of brush
 - c. send up and handle rigging lines
 - d. all of the above

4. Which of the following is not acceptable for safe lifting?
 - a. holding the load as close to your body as possible
 - b. keeping your head, shoulders and back bent forward over the load as you lift
 - c. tightening your stomach muscles as you lift
 - d. lifting with your legs

5. Poor communication between a climber and a ground worker is likely to result in what type of accident?
 - a. fall
 - b. rope burn
 - c. struck-by
 - d. back sprain

6. When should the one-knee lift not be used?
 - a. if you have a history of knee problems
 - b. if you want to lift over your head
 - c. if you want to avoid lifting
 - d. when rolling a log down a hill

7. When using the diagonal lift, where should your feet be?
 - a. one foot beside the object
 - b. feet together
 - c. feet straddling the object
 - d. feet apart

8. What is the minimum distance the chain saw refueling and adjustment area should be from where the saw will be used?
 - a. 5 feet
 - b. 10 feet
 - c. 15 feet
 - d. 20 feet

9. The flagger ordinarily positions him/herself:
 - a. on the shoulder in front of the cones
 - b. in the road in front of the cones
 - c. within the coned area
 - d. either a. or c.

10. Every knot that you use should be properly
 - a. wrapped on the bight
 - b. tied, dressed, and set
 - c. tightened as much as possible
 - d. all of the above

11. In most pruning and removal operations, the groundworker(s) will
 - a. cut and drag the brush
 - b. chip brush
 - c. cut firewood
 - d. all of the above

12. When lifting, you should
 - a. bend at the knees
 - b. keep the load close to your body
 - c. avoid twisting the back
 - d. all of the above

13. A knot that can be tied on the ground and then pulled up a line and snugged around a limb is the
 - a. midline clove hitch
 - b. running bowline
 - c. timber hitch
 - d. square knot

14. In rigging, allowing a cut piece to fall quickly for a short distance so that it drops below the climber, then slowing the piece gradually and controlling it to the ground is known as
 - a. letting it run
 - b. friction stopping
 - c. friction holding
 - d. end running

15. A good knot to use to send a rigging line up to a climber is the
 - a. cow hitch
 - b. timber hitch
 - c. sheet bend
 - d. bowline

16. A good knot to use for sending a tool or water bottle up to the climber is a
 - a. midline clove hitch
 - b. running bowline
 - c. timber hitch
 - d. square knot

17. Many clients do not recognize all aspects of arboricultural quality, but everyone knows
 - a. a good clean-up job
 - b. how to make a pruning cut
 - c. how to cut firewood
 - d. all of the above

18. A knot used to secure a coil of rope for storage is
- a. cow hitch
 - b. gasket hitch
 - c. sheet bend
 - d. bowline
19. If you need to enter the landing zone/drop zone, you should
- a. communicate with the climber or bucket truck operator aloft
 - b. check to see that nothing is falling
 - c. ensure that the worker aloft has acknowledged you
 - d. all of the above
20. A knot that is never used by itself, but is used to back up other hitches is
- a. half hitch
 - b. cow hitch
 - c. timber hitch
 - d. sheet bend

PERFORMANCE DEMONSTRATIONS



ASSISTING THE CLIMBER

Demonstrate sending a line up to a climber.

Requirements:

You must tie a line of a different diameter than the climber's line onto the climber's line, to send it up into the tree to the climber.

- must use a sheet bend
- properly tied, dressed, and set

Demonstrate sending a tool up to a climber.

Requirements:

You must tie a tool (pole saw/pruner, handsaw in a scabbard, hand tool) onto the climber's line, to send it up into the tree to the climber.

- must use a midline clove hitch
- properly tied, dressed, and set

PROPER LIFTING TECHNIQUES

Demonstrate proper lifting techniques.

Requirements:

You must demonstrate the four techniques that are illustrated and described in this module using proper body positioning and technique.

- modified diagonal lift
- diagonal lift
- one knee lift
- deep squat lift

STOWING A ROPE

Demonstrate the proper way to put away and store a rope.

Requirements:

You must clear the rope of debris; 1) efficiently coil and tie it and 2) lay it into a rope bag; and put it away in the proper place.

- using a rope bag
- coiling and tying with a gasket hitch

Emergency Response Basics

Learning Objectives

1. Discuss the common ways that accidents can occur on a job site.
2. Discuss the common ways that accidents can occur in a tree.
3. Explain why emergency response training is important to avoiding panic and taking the right action.
4. Describe the equipment that should be carried for emergency response and aerial rescue.
5. Describe the steps to take in an emergency situation.
6. With a team of coworkers, demonstrate effective emergency response to an accident on the ground.

The best way to deal with accidents in the workplace is to avoid them in the first place. There are many ways a worker could get hurt in working in tree care operations. You've already learned about slips, trips, and falls and how to prevent them. You also learned how to avoid struck-by accidents and back injuries. You should be aware that accidents can happen in the tree. Climbers could contact electrical lines, cut themselves with a chain saw, or be struck by a cut limb. Later you will learn the safety procedures for using chain saws, chippers, and other equipment. A common theme in avoiding accidents is staying alert to the situation, following your safety training, and maintaining good communication.



Even with the best training and communication, there is always the possibility of an accident occurring. That is why your training and communication should include procedures for dealing with emergencies. Many people will go into a degree of panic from the shock of witnessing an accident. But good training can kick in, letting crew members know what to do and how to do it. Better yet, an experienced crew will work together and react systematically in an emergency situation.

Training is key. Workers should be trained in first aid and everyone on the crew should know where the first aid kit is and should be able to access it quickly. Training in CPR can also be useful. Training in aerial rescue is also important and pre-installing an access line can be a tremendous time saver.

Your training and communication should include procedures for dealing with emergencies.

What many companies fail to include in their training regimen are the steps to take immediately after an accident.

1. **Quickly assess the situation.** Determine the nature of the accident, how many people are involved, and the help needed.
2. **Contact emergency services** (911 or other) and provide key information. Are there electrical hazards? Is it an aerial accident? What is the location?
3. **Stay on the phone** with emergency services to provide additional information and to receive instructions.
4. **Assist emergency services in locating you.** You may position a crew member by the street to wave down the emergency vehicle(s).
5. **Initiate first aid or rescue procedures, as appropriate.** Aerial rescue should never be initiated without first determining that there is no electrical or other hazard that can put the rescuer at risk.

If there are multiple crew members on site, several of these procedures can be conducted simultaneously. This is why it is very important to “rehearse” emergency response protocol so that crew members will react automatically.

Emergency phone numbers

Keep emergency phone numbers in your cell phone and/or vehicle. It is true that for medical emergencies, you will call 911. You will still need an emergency phone number list because, after calling 911, you will need to call your office to report the incident and ask for instructions. In non-threatening or other types of emergencies, you may need to contact the local hospital, poison control center, etc.

Rescue kit

Keep a rescue kit on the truck. The rescue kit includes a climbing line and climbing gear (including climbing spikes) to access an injured worker aloft. It may also include a sharp knife for cutting a rope, if necessary. Some companies include other emergency equipment in the kit as well. You should take the rescue kit off the truck at the start of each job to have it available if it is needed.

First aid

All tree crews are required to carry a first-aid kit that meets ANSI standards. Be certain your first-aid kit is easy to find and fully stocked before an emergency occurs. Check the kit often and replenish contents as needed.

Preventive practices

Recognize potential hazards and the signs of health problems before an emergency develops.

Learn how to recognize and prevent:

- reactions and diseases from animal bites and stings
- symptoms of heat illness
- symptoms of hypothermia
- symptoms of frostbite
- reactions from contact with poisonous plants

Administering first aid

Always follow your basic first-aid training. You do not have a legal obligation to provide aid if you are concerned about your health or well-being. As a first-aid provider, you are a trained “Good Samaritan.” You should only provide aid within the scope of your training. Usually this means basic first aid and CPR.

Analyze emergency situations before you act. If a condition exists that could injure you during the attempt to administer first aid, such as an electrical hazard, you need to stop and evaluate the potential for success versus the potential for injury. Don’t become a second victim!

If a hazard with the potential to cause injury is still present, secure the area. When someone with greater training arrives, such as a person with advanced first-aid training, off-duty nurse, or the emergency response team, report what happened and follow their instructions.

Not yet first-aid trained?

Follow the instructions of those who do have training. Try to be helpful and do not panic.

Be prepared to:

- secure the area if a hazard exists
- call 911 and remain on the phone until emergency services arrive
- enlist the help of others to call 911 and be certain that they made the call
- relay instructions from the 911 operator to the first aid provider
- assist in providing first aid by following the instructions of the provider

PRACTICE EXERCISES



1. Training is key. Workers should be trained in first aid and everyone on the crew should know where the first aid kit is and should be able to access it quickly.
TRUE FALSE
2. If you have the best training and communication, there is no possibility of an accident occurring.
TRUE FALSE
3. Three common causes of injuries on the work site are _____, _____, and _____.
4. Operating chain saws and chippers can lead to serious accidents if safety procedures are not followed.
TRUE FALSE
5. A potential cause of _____ accidents is failure to maintain constant communication and visual contact between groundworkers and workers aloft.
TRUE FALSE
6. List the five basic steps for how to proceed in an emergency situation.
 - a.
 - b.
 - c.
 - d.
 - e.
7. Before beginning any work in large trees, it may be a good idea to install a second climbing line, called an _____ in case of an emergency.
8. You should take the _____ off the truck at the start of each job to have it available if it is needed.

9. Rehearsing emergency response protocol can help crew members to react automatically and not panic in an actual emergency.
TRUE FALSE
10. You don't need to know any emergency numbers to call if you just call 911.
TRUE FALSE
11. All tree crews are required to carry a first-aid kit that meets _____ standards.
12. You should check the first aid kit often and replenish contents as needed.
TRUE FALSE
13. You have a legal obligation to provide aid if you are concerned about your health or well-being.
TRUE FALSE
14. You should only provide first aid within the scope of your training
TRUE FALSE
15. If a condition exists that could injure you during the attempt to administer first aid, such as an electrical hazard, you need to stop and evaluate the potential for success versus the potential for injury.
TRUE FALSE

PRACTICE TEST QUESTIONS



1. Which of the following should be included in a rescue kit?
 - a. climbing gear
 - b. climbing line
 - c. climbing spikes
 - d. all of the above

2. Which of the following supplemental training should be included in emergency response training?
 - a. first aid
 - b. CPR
 - c. aerial rescue
 - d. all of the above

3. If you do not have first aid training, you should not panic and should be helpful by
 - a. calling 911 and remain on the phone until emergency services arrive
 - b. relaying instructions from the 911 operator to the first aid provider
 - c. assisting in providing first aid by following the instructions of the provider
 - d. all of the above

PERFORMANCE DEMONSTRATIONS



EMERGENCY RESPONSE

With a team of coworkers, demonstrate effective emergency response to an accident on the ground.

Requirements:

You must lead an emergency response rehearsal. You should handle each of the steps without prompting or needing to ask crew leader questions; you should be able to answer crew member questions appropriately; and you are responsible for assuring an efficient demonstration.

- participate in determining the emergency situation
- plan the scenario
- assist in setting up the scenario
- ensure that the necessary gear and equipment is in place
- assign roles for each participant
- explain safety measures to avoid any accidents during the rehearsal
- direct emergency steps
- coordinate emergency response
- lead evaluation of team performance
- suggest measures for improvement

Important Terms

access line—a second climbing line hung in a tree in case it is needed to reach a victim in an emergency

aerial rescue—bringing an injured worker down from a tree or aerial lift device

ANSI Z133—the safety standard for tree care operations in the United States

approved—acceptable to federal, state, provincial, or local enforcement authorities

arboriculture—the art, science, technology, and business of commercial, public, and utility tree care

arborist—an individual engaged in the profession of arboriculture who, through experience, education, and related training, possesses the competence to provide for or supervise the management of trees and other woody plants

ampere—unit of measure of electric current

belay—means of securing or slowing a climbing line using a device or wraps around a cleat, carabiner, or other object

bight—curve or bend in a rope

branch union—point where a branch originates from the trunk or another branch (crotch)

buttress roots—large, support roots at the base of the tree

cable—1)(n.) steel wires twisted together, used in tree support systems; 2)(v.) to install steel cable or synthetic rope between branches within a tree to limit movement and provide supplemental support

canker—diseased area on stems and branches, often shrunken and discolored

cant hook—long-handled tool with a blunt, metal end used to handle logs

carabiner—connecting device made of aluminum or steel, that is opened and closed by a spring-loaded gate; used in climbing and rigging

chain saw pants —trousers manufactured with a protective e layer designed to slow or stop a chain saw chain

chaps—form of leg protection or personal protective equipment (PPE) worn when operating a chain saw

chocks—see wheel chocks

climbing helmet—head protection consisting of a hard, protective shell equipped with an adjustable suspension system and a chinstrap

codominant stems/codominant branches— two or more branches of similar diameter, arising from a common union and lacking a collar

command-and-response system—system of communication between a worker aloft and ground workers used to ensure safety

conductive—capable of carrying an electric current

conductor—any metal, wires, cables, or other materials capable of carrying electric current

conk—fruiting body of a decay fungus

current—the movement of electrons

cycles to failure—number of times a rope or other piece of equipment can be used with a given load before mechanical failure

decay—the degradation of woody tissue caused by microorganisms

de-energizing—freeing from any electrical connection to a power source

dielectric—insulating (nonconducting) material

direct contact—any part of the body touching an energized conductor

drop zone—the area beneath worker aloft where there is the potential for struck-by injuries from falling objects

electrical hazard—object or situation that poses risk of injury or death due to direct or indirect contact with an electrical conductor

emergency response—predetermined set of procedures by which emergency situations are assessed and handled

energized conductor—electrical conductor through which electrical current is flowing

escape route—in felling operations, pre-determined direction for chain saw operator to move while tree is falling

fall protection—equipment and techniques designed to ensure a worker will not fall from a tree or an aerial lift

fall-arrest harness—a fully-body harness with a dorsal or sternal attachment, equipped with a shock-absorbing lanyard, designed to absorb the shock of a fall, reducing the forces exerted on the body

fault—any unintended path for current to flow

flagger—worker positioned for traffic control using caution flags and/or sign paddles

first aid—emergency care or treatment of the injuries or illnesses of a person to stabilize his or her condition before medical help is available

friction-control device—device used to introduce friction on a line for control in rigging or climbing

frond skirt—several years' accumulation of hanging, dead fronds on a palm tree; hazard to worker below or underneath

fruiting body—reproductive structure of a fungus (mushroom or conk)

growth rings—rings of xylem that are visible in a cross section of the stem, branches, and roots of some trees; typically represent one year of growth (annual rings)

guy wires—cables that provide supplemental, mechanical support.

hand pull test—using a light-duty line to pull on a tree in several directions, while watching for movement at the base of the tree

hanger—broken or cut branch that is hanging in a tree

hard hat—protective hat made of a rigid material and a suspension system to absorb impact from above

hazard—1) a likely source of harm 2) in trees, a tree or tree part identified as a likely source of harm. 3) in tree care or forestry operations, the presence of a condition or situation that may cause harm or injury

hazard assessment—systematic process of identifying hazardous and non-hazardous conditions

hyphae—root-like vegetative growth of fungi

included bark—bark that becomes embedded in a union (crotch) between branch and trunk or between codominant stems; causing a weakness in the union

indirect contact—any part of the body touching a conductive object that is in contact with an electrical conductor

job briefing—meeting of workers at the beginning of every job to communicate work procedures, electrical and other hazards, safety precautions, PPE, and job assignments

kickback—sudden, uncontrolled, backward or upward movement of a chain saw

kickback quadrant—upper quadrant of the tip of a chain saw bar

landing zone—work site area where cut branches are dropped or lowered (drop zone)

leg protection—type of personal protective equipment worn to protect the legs from chain saw injuries

load—general term for weight, force, pressure, or bending moment

loop—shape formed when a rope crosses itself

maul—a heavy, long-handled, hammerlike tool with a single edge, used to drive wedges or split wood

minimum approach distance—closest distance that a tree worker, tool, equipment, or tree part is permitted near overhead electrical conductors

minimum breaking strength—minimum load under which a new, unused rope or other piece of equipment will fail

mitigation—reducing the likelihood of a hazard, or reducing the consequences of it

nonconductive—a material property not capable of conducting heat or electricity

ohm—unit of measure of electrical resistance

OSHA—the legislative act and body dealing with health and safety in the workplace in the United States

outriggers—projecting or extendible structures used for stabilization on aerial devices, cranes, and other vehicles that support elevated or outstretched loads

personal protective equipment (PPE)—personal safety gear such as helmet, safety glasses, hearing protection, gloves, and leg protection, including chaps

phase wires—the wires—other than ground or neutral—that are used to conduct electricity

phase-to-ground—in an electric utility system, the electrical potential between an energized conductor and the ground

phase-to-neutral—in an electric utility system, the electrical potential between an energized conductor and the neutral wire

phase-to-phase—in an electric utility system, the electrical potential between two energized conductors or between an energized conductor and a neutral conductor

power—the rate of energy conversion that occurs when current flows through a load

primary distribution line—high-voltage distribution electric supply line, usually 2,400 to 34,500 volts, that carries electricity from distribution substations to distribution transformer

probe—a stiff, small-diameter rod, stick, or other device used to estimate the extent of decay

qualified line-clearance arborist—an individual who, through related training and on-the-job experience, is familiar with the equipment and hazards in line clearance and has demonstrated the ability to perform the special techniques involved. This individual may or may not currently be employed by a line-clearance contractor

qualified line-clearance arborist trainee—an individual undergoing line-clearance training under the direct supervision of a qualified line-clearance arborist

rescue kit—climbing gear and emergency equipment that should be set out on every job site and available to conduct an aerial rescue and apply first aid

resistance—a property of materials that resists or restricts the flow of current

rigging—using ropes and hardware to control the descent and direction of branches when dismantling a tree or pruning large limbs

root collar—flared area at the base of a tree where the trunk and roots meet (root crown)

root plate—part of the root system near the tree base; often refers to roots and soil upturned from a windthrown tree

running end—end of a rope not in use; opposite from working end

safety—process of preventing injury, damage, or loss

safety culture—a shared group of values or accepted social norms among workers regarding worker safety

safety glasses—eye protection that must be worn when conducting tree care operations

safety factor—structural capacity of a system beyond the expected normal or actual loads

sapwood decay—decay of the sapwood (outer xylem) of a tree

secondary distribution lines—lower-voltage (generally 110 to 750 volts) electric supply lines that carries electricity from distribution transformers to service lines

service wires—usually three-wire lines (triplex), connecting secondary distribution lines on the pole to the customer's meter (service)

shall—as used in many standards, denotes mandatory requirement

should—as used in many standards, denotes an advisory recommendation

sounding—tapping a tree with a soft-headed mallet or other appropriate tool and listening for tones that indicate dead bark, cavities, or cracks

spring pole—hazard created when a tree falls on a branch or young tree, putting it under extreme tension

standing part—inactive part of a rope

step potential—the voltage between the feet of a person standing near an energized grounded object

struck-by accidents—result of a person being hit by a falling tree, branch, tool, vehicle, or piece of equipment

topping—reduction of tree size using internodal cuts without regard to tree health or structural integrity; an unacceptable pruning practice

transformer—a device that increases (steps-up) or decreases (steps-down) voltage

transmission lines—wires used to transmit electricity from generating stations to the distribution network or between distribution substations, often carrying in excess of 69,000 volts

tree risk assessment—a systematic process used to identify, analyze, and evaluate tree risk

volt—unit of measure of electrical pressure

voltage—electrical pressure; a force resulting from negatively charged particles repelling each other

watt—unit of measure of electric power

wheel chock—wedge-shaped object placed in front of or behind vehicle wheels to stop unintentional movement

work plan—the plan for how to complete the job, including work assignments

work zone—defined area of a job site, marked with caution signs and/or cones, where potential hazards exist, and safety measures are in place to avoid accidents

working end—the end of the rope being used for climbing or rigging

Answers to Practice Exercises and Practice Test Questions

ANSI Z133

PRACTICE EXERCISES

1. “The Z” refers to the American National Standards Institute (ANSI) Z133. **TRUE** **FALSE**
2. ANSI Z133 is the safety standard for tree care operations in the United States. **TRUE** **FALSE**
3. ANSI Z133 was developed by the government (OSHA) to establish standards for the industry.
TRUE **FALSE**
4. The stated purpose of ANSI Z133 is to provide safety standards for **arborists** and other workers engaged in **arboricultural** operations.
5. A **shall** statement denotes a mandatory requirement. A **should** statement denotes an advisory recommendation.
6. Portions of the Z133 standard have been adopted by the Occupational Safety and Health Administration (OSHA). **TRUE** **FALSE**
7. In the event of a lawsuit claiming negligence, the courts will look to see if the work practices met the applicable ANSI standard clauses. **TRUE** **FALSE**
8. List four potential consequences for failure to comply with Z133.
 - a. **injury**
 - b. **fatality**
 - c. **OSHA citation**
 - d. **company consequences**

PRACTICE TEST QUESTIONS

1. Which of the following are NOT covered by Z133
 - a. general safety and electrical hazards
 - b. chain saw and chipper operation
 - c. **tree biology and identification**
 - d. climbing and tree removal

2. The ANSI Z133 standards are developed by
 - a. **industry representatives**
 - b. ISA
 - c. TCIA
 - d. OSHA

3. In ANSI standards, a “shall” statement denotes a(n)
 - a. advisory recommendation
 - b. **mandatory requirement**
 - c. federal regulation
 - d. legal obligation

Personal Protective Equipment and Communications

PRACTICE EXERCISES

1. List the basic PPE for general tree care operations.
 - a. **helmet/hard hat**
 - b. **safety glasses**
 - c. **gloves**
 - d. **sturdy work boots**

2. Your first line of defense against the hazards of tree care is your attitude and your training. **TRUE** **FALSE**

3. Wearing appropriate PPE allows you to violate safety procedures. **TRUE** **FALSE**

4. An appropriate type of eye protection for tree care is safety glasses with side shielding. **TRUE** **FALSE**

5. An appropriate type of gloves for tree care operations is the gauntlet type. **TRUE** **FALSE**

6. If your hard hat has a face shield, you need not wear safety glasses. **TRUE** **FALSE**

7. List three options for hearing protection.
 - a. **ear muffs**
 - b. **ear muffs attached to helmets**
 - c. **ear plugs**

8. Helmets for line-clearance tree trimming operations or working within 10 feet of electrical conductors must be Class **E**.
9. List three options for leg protection.
 - a. **chaps**
 - b. **chain saw pants**
 - c. **chainsaw overalls**
10. Studies indicate that non-verbal communication can make up as much as 90% of communication.

TRUE FALSE
11. A good practice for active listening is to repeat or summarize what you have heard, acknowledging the other person's viewpoint. **TRUE FALSE**
12. Tree care crews today can be made up of workers from several different countries, and may be diverse in age, gender, race, and socio-economic background. **TRUE FALSE**
13. A proven and effective communication system uses voice **command and response** system.
14. Worker helmets can be fitted with communications systems, but they allow for one-way communication only.

TRUE FALSE
15. If the climber alerts workers below by saying, "Stand clear!" each of the workers below should exit the drop zone and respond, "**Clear!**"

PRACTICE TEST QUESTIONS

1. Which of the following is NOT an active listening tactic?
 - a. pay attention to the person speaking
 - b. make eye contact with the person speaking
 - c. defer judgment based on what you are hearing
 - d. **while the other person is speaking, plan how you will respond**
2. Which of the following is NOT a way to overcome language barriers?
 - a. use gestures or hand signals
 - b. **speak louder in your own language**
 - c. use smart phone apps
 - d. draw simple pictures

3. What PPE is required for operating a chain saw?
 - a. **work boots; helmet; eye protection; leg protection; hearing protection**
 - b. eye protection; leg protection; non-gauntlet gloves; face protection
 - c. work boots; helmet; eye protection; hearing protection
 - d. non-gauntlet gloves; face protection; hearing protection; helmet
4. What PPE is required for operating a chipper?
 - a. work boots; helmet; eye protection; leg protection; hearing protection
 - b. eye protection; leg protection; non-gauntlet gloves; face protection
 - c. **work boots; helmet; eye protection; hearing protection**
 - d. non-gauntlet gloves; face protection; hearing protection; helmet
5. Which of the following is NOT an allowable choice of eye protection for someone who wears eyeglasses?
 - a. wear goggles over prescription glasses
 - b. **helmet with a built-in face shield**
 - c. prescription safety glasses
 - d. contact lenses and standard safety glasses

Work Site Set-up

PRACTICE EXERCISES

1. If you are not working along a road, you have nothing to do for work site set-up. TRUE FALSE
2. If your work site or your vehicles project into traffic lanes, then you have to take precautions using U.S. Department of Transportation (DOT) guidelines. TRUE FALSE
3. Specifications for work site setup in vehicular traffic areas are provided in the U.S. Department of Transportation's Manual on Uniform Traffic Control Devices (MUTCD). TRUE FALSE
4. The closest advance-warning sign should be about **200** feet away on low speed roads.
5. Keeping tools together in one place will help minimize the chances of a worker tripping of them or leaving anything behind at the end of the day. TRUE FALSE
6. When your work obstructs any part of the roadway, advance-warning signs are required well down the road from the site, in both traffic directions on a two-way road. TRUE FALSE
7. All workers are required to wear high-visibility apparel when working near traffic only if the speed limit is greater than 25 mph. TRUE FALSE

8. You should use the truck's four-way flashers and beacon light, if equipped, while you're setting up the signs and cones. **TRUE** FALSE
9. Vehicles and detached chippers need only be chocked when parked on a slope of at least two percent incline. TRUE **FALSE**
10. List three goals for traffic control.
 - a. **to create a safe and efficient work site**
 - b. **to hinder traffic as little as possible**
 - c. **to guide vehicles and pedestrians in a clear and positive manner**

PRACTICE TEST QUESTIONS

1. Which of the following is NOT true about rural areas compared to urban areas?
 - a. **lower speed limits**
 - b. lower traffic volume
 - c. less turning traffic
 - d. fewer pedestrians
2. A good rule of thumb is to space cones
 - a. 50 feet apart for each 10 mph of speed limit
 - b. 100 feet apart on rural roads, 200 on urban roads
 - c. 200 feet apart for all speed limits
 - d. **the same number of feet apart as the speed limit**
3. A good reason for keeping tools and equipment at a designated area on the work site is to
 - a. avoid them becoming tripping hazards
 - b. avoid wasted time looking for a tool
 - c. reduce the chances of anything getting left behind
 - d. **all of the above**

Electrical Hazards Basics

PRACTICE EXERCISES

<u>I</u>	current	A	measure of power
<u>F</u>	voltage	B	restriction of the flow of current
<u>E</u>	ampere	C	unintended path of current flow
<u>J</u>	volt	D	conductor lines (other than neutral and ground)
<u>B</u>	resistance	E	measure of current
<u>G</u>	ohm	F	electrical pressure
<u>A</u>	watt	G	measure of resistance
<u>H</u>	conductor	H	capable of carrying electric current
<u>D</u>	phase	I	movement of electrons
<u>C</u>	fault	J	measure of voltage

1. Most utility outages in the US and Canada are caused by trees. **TRUE** **FALSE**
2. The degree of training in electrical hazards that arborists need is determined by the risk to the employee for hazard(s) involved. **TRUE** **FALSE**
3. Those who work in line clearance generally have a much lower degree of training than those who may have occasion to work around the service wires that supply houses with power. **TRUE** **FALSE**
4. A fundamental property of charged particles is that particles with the same charge tend to **repel** each other and particles with different charge tend to **attract** each other.
5. When current passes through the resistance of a body, **heat** is generated inside the tissue or organs.
6. While it is the current that actually causes the damage, is the voltage that determines how much current will flow. **TRUE** **FALSE**
7. If a current of only 100 milliamps were to pass through your chest cavity it could interfere with the heart beat and cause death. **TRUE** **FALSE**
8. The highest voltage lines are usually at the bottom of the pole. **TRUE** **FALSE**
9. Telephone, cable television, fiber optics, and fire alarm wires are usually at the lowest position on the pole. **TRUE** **FALSE**
10. Larger and/or more numerous insulators indicate lower voltages. **TRUE** **FALSE**
11. Taller poles, towers, or structures indicate higher voltages. **TRUE** **FALSE**

12. The conductors—other than ground or neutral—that are used to conduct electricity are known as **phase wires**.
13. If you contact any two phase wires simultaneously, your voltage is almost twice what it would be if you contacted a phase wire and a neutral (or ground) wire. **TRUE** **FALSE**
14. Tree workers have been killed by contact with 120-volt house drops. **TRUE** **FALSE**
15. Weather proofing may look like insulation, but it does not function as insulation from electrical shock. **TRUE** **FALSE**
16. **Transmission lines** are conductors usually carrying more than 69 kV that run from the generating plant to the transmission substation.
17. **Primary distribution lines** carry 2.4 kV to 34.5 kV from distribution substations to local areas where it is stepped down by a transformer to low voltage.
18. **Service lines** usually three-wire lines (triplex), connect secondary distribution lines on the pole to the customer's meter (service).
19. A **direct contact** is made when any part of the body touches or contacts an energized electrical conductor.
20. An **indirect contact** is made when any part of the body touches any conductive object, including tools, tree branches, trucks, equipment, or other object that is in contact with an energized electrical conductor.

PRACTICE TEST QUESTIONS

1. Ohms are the unit of measure for
 - a. electrical pressure
 - b. flow of current
 - c. electrical resistance**
 - d. electrical wattage
2. Amperes are the unit of measure for
 - a. electrical pressure
 - b. flow of current**
 - c. electrical resistance
 - d. electrical wattage
3. Volts are the unit of measure for
 - a. electrical pressure**
 - b. flow of current
 - c. electrical resistance
 - d. electrical wattage

4. Which of the following lines carry the highest voltage?
 - a. primary distribution
 - b. secondary distribution
 - c. transmission**
 - d. service wires

5. Utility wires—other than ground or neutral—that are used to conduct electricity are known as
 - a. faults
 - b. phases**
 - c. transformers
 - d. transmission lines

6. A house drop is another name for
 - a. primary distribution
 - b. secondary distribution
 - c. transmission
 - d. service wires**

7. If any part of the body touches or contacts an energized electrical conductor, it is known as
 - a. direct contact**
 - b. indirect contact
 - c. step potential
 - d. cross-wire contact

8. If you directly or indirectly become the link completing the circuit between the tree, or other grounding source (such as a ground wire) and the power line
 - a. death or injury will result**
 - b. you will not get shocked
 - c. you might suffer a small burn
 - d. you will be insulated from the current

9. If any part of the body touches any conductive object, including tools, tree branches, trucks, equipment, or other object that is in contact with an energized electrical conductor it is known as
 - a. direct contact
 - b. indirect contact**
 - c. step potential
 - d. cross-wire contact

10. Working on the ground and leaning against an energized tree, completing a circuit, is what type of fault?
- phase-to-ground
 - phase-to-phase
 - phase-to-neutral
 - neutral-to-ground

Electrical Hazards on the Job Site

PRACTICE EXERCISES

- If there are wires within **10** feet of a tree, an electrical hazard exists and the work can only be done by a qualified line-clearance arborist, line-clearance arborist trainee or incidental line clearance arborist.
- You must consider all conductors, including telecom, fire alarm, cable television, and street light lines, energized with potentially fatal voltages. **TRUE FALSE**
- List five examples of things that could become charged with potentially fatal voltages in storm conditions.
 - chain-link fences
 - guy wires
 - telephone and cable wires
 - vehicles
 - metal swing sets
 - many others
- If a tree is in contact with an energized conductor, burned or damaged leaves or branches may be visible at the contact points. **TRUE FALSE**
- ANSI Z133 safety standards and federal OSHA regulations establish **minimum approach distances** from energized overhead wires based on the maximum nominal voltage in the lines.
- A clean non-conductive, Class E helmet (hard hat) must be worn at all times when working near electrical conductors. **TRUE FALSE**
- Class C hard hats offer the same electrical protection as Class E hard hats. **TRUE FALSE**
- You should never rely on rubber gloves, rubber-soled shoes, or linemen's overshoes to protect you from accidental contact with energized conductors or objects. **TRUE FALSE**
- When wood or fiberglass becomes soiled or damp, it may lose the ability to function as a non-conductive device. **TRUE FALSE**
- Electricity can travel both on the outside of the bark of a tree and/or through the sapwood. **TRUE FALSE**

11. **Step potential** may exist around energized outriggers as current dissipates in the ground.
12. A zone of step potential can occur around downed energized conductors, around the base of an energized tree, around the base of an energized utility pole, etc. **TRUE FALSE**
13. If you come across a situation in which a conductor has burned a tree, you need to call the system operator/owner (utility) for assistance. **TRUE FALSE**
14. You must not work near energized conductors during adverse weather conditions, such as thunderstorms, high winds, snow storms, or ice storms. **TRUE FALSE**
15. You cannot become qualified to clear lines without hands-on experience. **TRUE FALSE**

PRACTICE TEST QUESTIONS

1. What are minimum approach distances based on?
 - a. maximum amperage
 - b. maximum nominal voltage**
 - c. minimum nominal ohms
 - d. height of conductors
2. Which of the following indicates that a tree might be contacting an energized conductor?
 - a. blackened, dead, and/or burned twigs, especially at the terminal ends
 - b. branches and twigs with witches' -broom appearance near conductors
 - c. branches, limbs, or trunks with burned notches
 - d. all of the above**
3. Before climbing or doing any work in a tree you should
 - a. inspect and determine if there is an electrical hazard**
 - b. contact the appropriate utility service provider
 - c. measure the voltage in conductors
 - d. all of the above
4. Why do you need to judge the maximum nominal voltage of a conductor?
 - a. To tell the utility dispatcher.
 - b. To determine the minimum approach distance.**
 - c. To determine what safety standard to use.
 - d. all of the above

5. What should you do if a tree is contacting wires and a notch is being burned into the wood?
 - a. Climb and prune the tree if you are a line-clearance arborist.
 - b. Remove the tree from the ground or using an aerial device.
 - c. Contact the utility to have them make the situation safe.**
 - d. Move on to the next tree; no need to contact anyone.

6. Never work near electrical conductors unless
 - a. you are properly trained and understand exactly what you need to do
 - b. you know the maximum nominal voltage phase to phase and the minimum approach distance
 - c. you are certain that the job can be done safely
 - d. all of the above**

7. Why should you never use portable electric tools that use extension cords, or other similar electrical tools/ cords, when an energized conductor is nearby?
 - a. Completing a circuit between an energized conductor and an electric extension cord can cause an electric shock.**
 - b. The power cord of the portable electric tool is likely to arc to the tree and then could travel up and over to the power lines.
 - c. Electric tools create a magnetic field that could cause indirect contact with a service line.
 - d. all of the above

8. A situation where your body serves as a path for electrical current to flow from an area of higher electric potential to an area of lower potential is known as
 - a. direct contact
 - b. indirect contact
 - c. step potential**
 - d. cross-wire contact

9. Which of the following is a condition that could create a step potential hazard?
 - a. energized outriggers
 - b. a downed electrical conductor
 - c. an energized utility poles
 - d. all of the above**

- 10 To become a qualified line clearance tree trimmer you must have, or be developing as a trainee under the supervision of a qualified line-clearance arborist,
- competence in climbing skills or aerial lift operations
 - the ability to safely rig limbs and properly use tools for line clearing
 - experience in urban forestry and tree care operations
 - all of the above**

Tree and Site Inspection

PRACTICE EXERCISES

MATCHING

<u>G</u> load	<u>A</u> fruiting body of a decay fungus
<u>A</u> conk	<u>B</u> two stems of similar size at a union, lacking a collar
<u>F</u> root collar	<u>C</u> hanging, dead fronds on a palm tree
<u>D</u> fruiting bodies	<u>D</u> reproductive structure of a fungus
<u>J</u> buttress roots	<u>E</u> bark that becomes embedded in a branch union
<u>I</u> probe	<u>F</u> flared area at the base of a tree
<u>H</u> sounding	<u>G</u> general term for weight or force
<u>B</u> codominant stems	<u>H</u> tapping a tree with a soft-headed mallet
<u>E</u> included bark	<u>I</u> stiff wire, stick, or other device used to estimate decay
<u>C</u> frond skirts	<u>J</u> large, support roots at the base of the tree

- If you identify any hazards, potential problems, or anything that might affect safety, you should bring it to the attention of your crew leader. **TRUE** FALSE
- One of the most common causes of work site injuries, and even fatalities, is “struck-by” accidents. **TRUE** FALSE
- List four “struck-by” work-site hazard areas.
 - restricted work areas/landing zones for dropping limbs and cutting brush**
 - restricted areas for dragging and chipping brush**
 - slopes in the working area that might allow a log to roll**
 - heavy undergrowth in the landing zone that could create spring poles**
- Potential hazards will be discussed in the **job briefing**, which will also cover **mitigation** measures that you will take to reduce or eliminate risks.

5. Perhaps the most important element of the site inspection is locating any **electrical wires**.
6. All wires and cables passing through a tree should be considered **energized**.
7. A very common cause of injuries on the job is **slips, trips, and falls**.
8. You should never move or remove soil or vines that cover portions of the trunk or root flare. **TRUE FALSE**
9. If the roots or the base of the tree is not structurally sound, the tree could fail with climbers aloft.
TRUE FALSE
10. The lifting of soil adjacent to a tree may indicate that the tree has started to fall over. **TRUE FALSE**
11. Use a mallet for **sounding** the trunk or buttress roots, listening for differences in tone that could indicate decay.
12. It may be necessary to investigate cavities by using a **probe**—a stiff metal wire, knife, or sturdy stick—to feel for soft, decayed wood.
13. One way to check for problems with tree stability is to conduct a **hand pull test**.
14. Fungal **fruiting bodies**, including mushrooms and conks, may indicate decay.
15. When the root flare is not visible, remove soil from the **root collar** and inspect roots for decay.
16. Diseased areas of the bark that are generally a sunken and discolored are called **cankers**.
17. Before performing any tree care operation, locate the position of any support **cables**.
18. Fallen trees may have fallen on other tree limbs or saplings, putting them under great tension, creating hazardous **spring poles**.
19. Trunk cracks associated with wood decay may indicate that the tree is twisting and beginning to fall apart.
TRUE FALSE
20. When cracks are discovered on opposite sides of a decayed tree, the tree should be considered totally stable.
TRUE FALSE
21. Trees with no root flare are an indication of being firmly anchored with deep roots. **TRUE FALSE**
22. The lower stem in the area between the lowest branch and four feet above ground rarely is where tree trunks fail. **TRUE FALSE**
23. Sapwood decay causes a greater degree of strength loss than does internal decay. **TRUE FALSE**
24. A sign of sapwood decay is the presence of many tiny mushrooms or fungal fruiting bodies on the outside of a branch or stem. **TRUE FALSE**
25. Codominant stems can be a weak area, especially when there is included bark in the branch union.
TRUE FALSE

26. Limbs or sprouts that arise from topping cuts are usually strongly attached. TRUE FALSE
27. List five ways of protecting property on a work site.
- move the object when possible
 - use rigging lines/devices to control and direct the descent of limbs and tree sections
 - flag or place cones over sprinkler heads
 - use protection such as hinged plywood for shrubs
 - avoid wet/muddy areas to prevent soil compaction
 - avoid driving or moving equipment over private septic systems
28. List four signs of animals that bite or sting.
- paper wasp nests / bee hives
 - buzzing noise, indicating a bee hive or swarms
 - tree hollows or visible nests that could house squirrels, raccoons, or other animals
 - palms that might harbor snakes, lizards, or rats
29. List five potential site-related hazards on work site. **There are many more than five.**
- electrical wires
 - stinging insects and biting animals
 - poisonous plants
 - traffic
 - holes, uneven terrain, slopes
 - guy wires
 - spring poles
 - others
30. List five potential tree-related hazards on work site. **There are many more than five.**
- cracks
 - decay
 - hangers
 - dead branches
 - codominant stems
 - stinging insects and biting animals
 - others

PRACTICE TEST QUESTIONS

1. If, in the opinion of the crew leader, anything is found during the work site inspection that cannot be adequately mitigated or will affect the crew's ability to do the job
 - a. it should be brought to the attention of the client
 - b. it should be brought to the attention of the supervisor**
 - c. the crew leader must change the work order
 - d. the crew must complete the job no matter what

2. When assessing site hazards, what is the significance of a tree with no root flare; i.e., one that looks like a telephone pole?
 - a. It is an indication that fill has been added, which may have killed some roots.**
 - b. It is an indication that the tree is unusually deep-rooted and probably quite stable.
 - c. It has no significance as far as hazard assessment.
 - d. It is an indication that fill has been added around the tree which provides extra stability.

3. Struck-by accidents can be avoided by
 - a. setting up a work zone with proper cones, signs and flags
 - b. working within the cones when dragging and chipping brush
 - c. staying out from under trees where limbs are being dropped
 - d. all of the above**

4. If you will be digging or excavating for any reason
 - a. the utilities should be marked**
 - b. you must set up cones around the area
 - c. traffic warning signs are required
 - d. all of the above

5. A method of providing protection for work site property is
 - a. move the object when possible
 - b. flag or place cones over sprinkler heads
 - c. use rigging techniques when lowering branches
 - d. all of the above**

6. A problem created when trees fall on other tree limbs or saplings, putting them under great tension is called
 - a. codominant stems
 - b. spring poles**
 - c. struck-bys
 - d. conks

7. A precaution to take when working near dead palm fronds is
 - a. never climb underneath them
 - b. avoid smoking near them
 - c. be sure the chain saw isn't sparking
 - d. all of the above**

8. If more than 50 percent of the root system of a tree is decayed or missing you should
 - a. consider alternatives to climbing the tree
 - b. alert your crew leader
 - c. perform a hand pull test
 - d. all of the above**

9. Bark that becomes embedded between stems or branches, weakening the attachment is called
 - a. codominant stems
 - b. branch bark ridge
 - c. included bark**
 - d. branch collar

10. A danger associated with cutting the trunk of a windfallen tree is
 - a. the root plate could suddenly move back into the ground**
 - b. the root plate could become a spring pole
 - c. the trunk could become a spring pole
 - d. all of the above

11. Most stinging insects are least active in
 - a. the middle of the day
 - b. warm weather
 - c. the winter**
 - d. the summer

12. Before spraying a beehive with insecticide, it is important to consider that
- a. **bees are important pollinators**
 - b. insecticide won't kill honey bees
 - c. they will never sting if you remain calm
 - d. only the males attack
13. Codominant stems are especially weak if they contain
- a. a branch union
 - b. a branch bark ridge
 - c. **included bark**
 - d. a branch collar
13. Ground heaving, especially associated with a leaning tree, may be an indication that
- a. **the tree is about to fail**
 - b. strong buttress root formation
 - c. a strong and stable root flare
 - d. the root collar has been excavated
14. A danger associated with working in post-storm conditions is
- a. fallen electric wires hidden by downed trees
 - b. spring poles created by fallen trees
 - c. broken limbs hanging in tree tops
 - d. **all of the above**
15. A method to check for tree stability is
- a. a root collar excavation
 - b. probing and sounding the tree base and roots
 - c. the hand pull test
 - d. **all of the above**

Job Briefing

PRACTICE EXERCISES

1. Your supervisor tells you what the work plan is by conducting a **job briefing**.
2. List three reasons a job briefing is important.
 - a. **to give crew members a clear understanding of what has to be done and how**
 - b. **to discuss the potential hazards, how they are to be managed, and what PPE is required**
 - c. **to avoid accidents and incidents**
3. List six elements of a job briefing.
 - a. **Work to be done and procedures involved**
 - a. **Hazards associated with the job**
 - b. **Electrical hazards**
 - c. **Precautions and mitigation measures**
 - d. **Assignments – who does what**
 - e. **Personal protective equipment**
4. The **work plan** determines who does what, when, and how.
5. List four ways to reduce slip, trip, and fall accidents. **There are more than four.**
 - a. **have a good “branch management” system to avoid debris pileups in the work area**
 - b. **avoid working on slopes when there are other alternatives**
 - c. **keep vehicles and chippers close to the work area when possible to the limit distance for dragging brush**
 - d. **avoid or move work-site trip hazards (holes, brush, logs, tools)**
 - e. **establish a hand tool area at the job site for tools that are not being used at the moment but will be needed again**
 - f. **stow tools on the truck when no longer needed**

6. List four ways to reduce struck-by accidents. **There are more than four.**
 - a. **establish the landing zone/drop zone at the job briefing**
 - b. **clean the landing zone/drop zone of underbrush when possible**
 - c. **always wear personal protective equipment (PPE)**
 - d. **be aware of the climber's activities**
 - e. **consider that a climber may drop a branch, hanger, or hand tool at any time**
 - f. **coordinate ground operations with climbing operations by communicating your presence to climbers whenever you enter the "landing zone" with a command/response system**
 - g. **be certain all personnel understand their roles when felling and are properly positioned**
 - h. **when felling trees, always give a warning before commencing the back cut and be sure fellow workers are clear**

PRACTICE TEST QUESTIONS

1. If you do not understand the work plan, you should
 - a. **stop and ask your crew leader**
 - b. do the best you can
 - c. do what everyone else is doing
 - d. work on a different task
2. Which of the following is not necessarily included in the job briefing?
 - a. electrical hazards
 - b. PPE required
 - c. **pruning specifications**
 - d. mitigations and precautions
3. The consequences of failure to conduct a job briefing could be
 - a. somebody getting injured or killed
 - b. property getting damaged
 - c. a wrong tree being removed
 - d. **all of the above**

Groundworker Responsibilities

PRACTICE EXERCISES

1. Once the job briefing is completed, you should take the required tools, equipment, and gear off the truck and establish a designated area for it. **TRUE FALSE**
2. The rescue kit should always be left on the trunk in case it is needed. **TRUE FALSE**
3. You must never smoke when refueling a chain saw. **TRUE FALSE**
4. The bar oil must be checked every third time you refuel a chain saw. **TRUE FALSE**
5. The area for chain saw refueling and adjustment that is at least **10** feet away from where the saws will be used.
6. Before beginning any work in large trees, it may be a good idea to install a second climbing line, called an **access line** in case of an emergency.
7. Securing, slowing, or using friction to hold a climber's line using a cleat, carabiner, or other device is called **belaying**.
8. A good rule of thumb for setting the angle of a ladder is that your outstretched fingertips should just reach its rails with your toes at the ladder base. **TRUE FALSE**
9. Once a climber is tied in and beginning work, it is okay to leave the area and go do something else. **TRUE FALSE**
10. When the climber or bucket operator begins working above, your goal on the ground is to keep the area under the tree, the landing zone or drop zone, relatively clear of debris. **TRUE FALSE**
11. Working on the ground requires clear communication and coordination with workers aloft to avoid the possibility of a struck-by accident. **TRUE FALSE**
12. The leading cause of lost-time injuries in arboriculture is **back injury**.
13. The climber's line can be used for light rigging. **TRUE FALSE**
14. Old climbing lines can be "retired" and used as taglines. **TRUE FALSE**
15. Using a friction control device is much more efficient than taking wraps because you don't have to keep running in circles around the tree. **TRUE FALSE**
16. You should never wrap a rigging line around any part of your body to improve your grip or introduce more friction. **TRUE FALSE**
17. **Letting it run** means allowing the cut piece to fall quickly for a short distance so that it drops below the climber, then slowing the piece gradually and controlling it to the ground.

18. The area under the tree where debris will fall or be lowered is called the **landing zone** or the **drop zone**.
19. Leaving anything behind is not a big deal because someone can be sent to retrieve it. TRUE FALSE
20. Careless damage to property is a quick way to ensure that your company is never invited back.
TRUE FALSE
21. List three things to remember when raking.
- a. rake toward where the debris will go
 - b. rake downhill, not uphill
 - c. rake into piles/onto tarps
22. List six common causes of back injuries.
- a. improper method for dragging brush
 - b. lifting heavy or awkward loads
 - c. slipping
 - d. over-reaching
 - e. falling from equipment
 - f. entering/exiting truck cab without looking
23. A rope tied to the end of a limb and used to control the swing or direction is called a **tagline**.
24. List four things that you can do to help keep your back healthy.
- a. warming up with stretches;
 - b. exercising;
 - c. following a good diet; and,
 - d. using proper lifting techniques.
25. A line can be thrown over the limb, then a **running bowline** can be tied from the ground and pulled up the line into place, securing the tagline.

PRACTICE TEST QUESTIONS

1. Ideal saw chain tension
- a. shows a gap between the bottom of the bar and the chain
 - b. will not allow chain rotation without the engine running
 - c. allows free rotation of the chain without drooping
 - d. is when the chain can barely move on the bar manually

2. Before sending a chain saw up to a climber, you should
 - a. be sure it is gassed and oiled
 - b. check the chain tension
 - c. start it briefly and stop it
 - d. all of the above**

3. During a rigging operation a groundworker's job is to
 - a. keep the drop zone clear of large entanglements
 - b. keeping the climber's line clear of brush
 - c. send up and handle rigging lines
 - d. all of the above**

4. Which of the following is not acceptable for safe lifting?
 - a. holding the load as close to your body as possible
 - b. keeping your head, shoulders and back bent forward over the load as you lift**
 - c. tightening your stomach muscles as you lift
 - d. lifting with your legs

5. Poor communication between a climber and a ground worker is likely to result in what type of accident?
 - a. fall
 - b. rope burn
 - c. struck-by**
 - d. back sprain

6. When should the one-knee lift not be used?
 - a. if you have a history of knee problems**
 - b. if you want to lift over your head
 - c. if you want to avoid lifting
 - d. when rolling a log down a hill

7. When using the diagonal lift, where should your feet be?
 - a. one foot beside the object
 - b. feet together
 - c. feet straddling the object**
 - d. feet apart

8. What is the minimum distance the chain saw refueling and adjustment area should be from where the saw will be used?
- 5 feet
 - 10 feet**
 - 15 feet
 - 20 feet
9. The flagger ordinarily positions him/herself:
- on the shoulder in front of the cones
 - in the road in front of the cones
 - within the coned area
 - either a. or c.**
10. Every knot that you use should be properly
- wrapped on the bight
 - tied, dressed, and set**
 - tightened as much as possible
 - all of the above
12. In most pruning and removal operations, the groundworker(s) will
- cut and drag the brush
 - chip brush
 - cut firewood
 - all of the above**
13. When lifting, you should
- lift with your legs
 - keep the load close to your body
 - avoid twisting the back
 - all of the above**
14. A knot that can be tied on the ground and then pulled up a line and snugged around a limb is the
- midline clove hitch
 - running bowline**
 - timber hitch
 - square knot

15. In rigging, allowing a cut piece to fall quickly for a short distance so that it drops below the climber, then slowing the piece gradually and controlling it to the ground is known as
- letting it run**
 - friction stopping
 - friction holding
 - end running
16. A good knot to use to send a rigging line up to a climber is the
- cow hitch
 - timber hitch
 - sheet bend**
 - bowline
17. A good knot to use for sending a tool or water bottle up to the climber is a
- midline clove hitch
 - running bowline
 - timber hitch
 - square knot
18. Many clients do not recognize all aspects of arboricultural quality, but everyone knows
- a good clean-up job**
 - how to make a pruning cut
 - how to cut firewood
 - all of the above
19. A knot used to secure a coil of rope for storage is
- cow hitch
 - gasket hitch**
 - sheet bend
 - bowline
20. If you need to enter the landing zone/drop zone, you should
- communicate with the climber or bucket truck operator aloft
 - check to see that nothing is falling
 - ensure that the worker aloft has acknowledged you
 - all of the above**

21. A knot that is never used by itself, but is used to back up other hitches is
- half hitch
 - cow hitch
 - timber hitch
 - sheet bend

Emergency Response Basics

PRACTICE EXERCISES

- Training is key. Workers should be trained in first aid and everyone on the crew should know where the first aid kit is and should be able to access it quickly. **TRUE FALSE**
- If you have the best training and communication, there is no possibility of an accident occurring. **TRUE FALSE**
- Three common causes of injuries on the work site are **slips, trips, and falls**.
- Operating chain saws and chippers can lead to serious accidents if safety procedures are not followed. **TRUE FALSE**
- A potential cause of **struck-by** accidents is failure to maintain constant communication and visual contact between groundworkers and workers aloft.
- List the five basic steps for how to proceed in an emergency situation.
 - Quickly assess the situation.**
 - Contact emergency services**
 - Stay on the phone with emergency services**
 - Assist emergency services in locating you.**
 - Initiate first aid or rescue procedures, as appropriate.**
- Before beginning any work in large trees, it may be a good idea to install a second climbing line, called an **access line** in case of an emergency.
- You should take the **rescue kit** off the truck at the start of each job to have it available if it is needed.
- Rehearsing emergency response protocol can help crew members to react automatically and not panic in an actual emergency. **TRUE FALSE**
- You don't need to know any emergency numbers to call if you just call 911. **TRUE FALSE**

11. All tree crews are required to carry a first-aid kit that meets **ANSI** standards.
12. You should check the first aid kit often and replenish contents as needed. **TRUE** FALSE
13. You have a legal obligation to provide aid if you are concerned about your health or well-being.
TRUE **FALSE**
14. You should only provide first aid within the scope of your training. **TRUE** FALSE
15. If a condition exists that could injure you during the attempt to administer first aid, such as an electrical hazard, you need to stop and evaluate the potential for success versus the potential for injury.
TRUE FALSE

PRACTICE TEST QUESTIONS

1. Which of the following should be included in a rescue kit?
 - a. climbing gear
 - b. climbing line
 - c. climbing spikes
 - d. all of the above**

2. Which of the following supplemental training should be included in emergency response training?
 - a. first aid
 - b. CPR
 - c. aerial rescue
 - d. all of the above**

3. If you do not have first aid training, you should not panic and should be helpful by
 - a. calling 911 and remain on the phone until emergency services arrive
 - b. relaying instructions from the 911 operator to the first aid provider
 - c. assisting in providing first aid by following the instructions of the provider
 - d. all of the above

Learning Objectives

ANSI Z133

1. Explain the importance of the ANSI Z133 Safety Standards.
2. Describe the purpose of the ANSI Z133 Safety Standards.
3. Discuss the scope of the ANSI Z133 Safety Standards.
4. Describe the consequences of failure to comply with safety regulations, standards, or company safety rules.

Personal Protective Equipment (PPE)

1. List the PPE used by arborists in the field.
2. Demonstrate proper use of PPE for chipping brush.
3. Demonstrate proper use of PPE for operating a chain saw.
4. Describe the consequences of failure to wear appropriate PPE.

Communication

1. Discuss the importance of effective communication on the work site.
2. Explain the command-and-response system of worksite communication.
3. With a coworker, demonstrate the command-and-response system.

Work site set-up

1. Summarize the steps involved in setting up a safe work site.
2. List the safety precautions used to protect workers and the public when working along a street.
3. Set up a work site using all of the appropriate items.

Electrical Hazards Basics

1. Describe the hazards related to direct and indirect contact with electrical conductors.
2. Define common terms related to electrical work.
3. Explain minimum approach distances.
4. Discuss regulations and standards related to working near conductors.
5. Discuss precautions taken when working around electrical conductors.
6. Identify common conductor types on a job site.

Tree and Site Inspection

1. List the potential hazards on a job site.
2. List the potential hazards in a tree.
3. Describe methods of checking trees for hazards before ascending.
4. Demonstrate a site hazard inspection on a job site.
5. Demonstrate a tree hazard inspection on a job site, including the root zone.
6. Describe the procedure for reporting a hazard, if found.

Job Briefing

1. Describe why job briefings are an important part of every job.
2. Discuss all of the elements of a job briefing.
3. Lead a job briefing out on an actual job site.

Groundworker Responsibilities

1. Describe the steps taken to prepare for work on a tree trimming/removal site.
2. Discuss how a groundworker cooperates with climbers aloft.
3. Summarize groundworker responsibilities.
4. Explain the role of a groundworker in a rigging operation.
5. Explain the drop zone in a tree trimming/removal operation.
6. Discuss the role of the groundworker in protecting the public.
7. Demonstrate sending a line up to a climber/aerial lift operator.
8. Demonstrate sending a tool up to a climber/aerial lift operator.
9. Demonstrate proper lifting technique.
10. Demonstrate the proper way to put away and store a rope.
11. Discuss the importance of thorough site clean-up.
12. Ensure that all tools and gear are on the truck before leaving a job site.

Emergency Response Basics

1. Discuss the common ways that accidents can occur on a job site.
2. Discuss the common ways that accidents can occur in a tree.
3. Explain why emergency response training is important to avoiding panic and taking the right action.
4. Describe the equipment that should be carried for emergency response and aerial rescue.
5. Describe the steps to take in an emergency situation.
6. With a team of coworkers, demonstrate effective emergency response to an accident on the ground.

Importance

As you know, safety is the most important consideration in tree work. In this profession, mistakes in the field translate into injuries and near misses. Injuries can be serious, even tragic. Why are near misses important? Often the only difference between an injury and a near miss is a fraction of an inch or an instant of time.

Context

General Safety is first module in the Apprentice Program because if apprentices are to be put on the job right away, it is crucial that they learn that safety is the most important consideration. You really cannot overemphasize this point.

This module is intended to begin immediately with the most basic aspects of safety: a philosophy of putting safety first; an understanding of the regulations; and personal protective equipment (PPE). The module progresses from there in a way that should correspond to the on-the-job training they will be receiving. The emphasis is on groundworker duties and skills, and the content is designed to help make an apprentice safer and more effective from the start.

The next module, arborist equipment will expand upon this content and will begin to teach important safety concepts and skills related to vehicles, chippers, chain saws, and other equipment.

Practice Exercises and Practice Questions

Practice Exercises and Practice Questions are designed for the apprentice to work through independently. These can and should be completed “open book.” The answers are provided at the end of the module. You should, however, check to see that they have been done correctly.

Performance Assessments

The expectations for Performance Assessments are provided in the Apprentice Manual. Apprentices should have a clear understanding of these expectations and should undertake the performance demonstrations only after they feel that they can meet each expectation fully.

The expectations listed correspond to the assessment criteria in the performance rubrics that you will use to assess them.

PPE

This performance assessment is a very simple, but important, one. The apprentice needs to demonstrate wearing of the proper PPE first for chipping brush, then for chain saw operation. All PPE must be appropriate, approved (meeting all standards and company policies), functional, and worn correctly.

Communication

This is a fairly simple and straightforward performance demonstration. It can be conducted on an actual job site or set up at the company site. You will need a worker aloft to announce, “Stand clear!” in an actual or simulated work situation with a drop zone. The apprentice must 1) exit the drop zone; 2) check that all other workers have exited the drop zone and acknowledged the worker aloft; and 3) respond, “Clear!” or “All clear!” Note: a significant problem with this command-and-response system is that some workers have developed a habit of responding, “All clear!” without actually first confirming that all is clear. This demonstration is intended to emphasize that the response is never given until that confirmation takes place.

Work Site Set-up

This performance assessment is intended to take place on an actual work site, but it can also be simulated. You should select a site that requires signage and cones, as well as all of the routine elements of a work site situation.

All appropriate signage and cones must be properly placed; wheel chocks must be properly placed; a tool/ refueling area has to be established; the rescue kit must be off the truck; and other precautions (caution tape, flagger, etc.) are used as appropriate for the situation.

Conductor Identification

This performance assessment is intended to take place on an actual work site, but it can also be done on a different site. There must be power poles and lines of various types visible on the site. Most sites will not have transmission lines in view. The service wires on some home sites are buried.

The apprentice must identify each type of line correctly, and state that types are not present, if they aren't present.

Site Inspection

You will need to select an appropriate site for this performance demonstration. Although the site need not contain every element on the list below, it should contain many of them. If something is NOT present, the apprentice should indicate that during the inspection. The apprentice is expected to “narrate” the site inspection, while the two of you walk around together.

The apprentice must point out what is being looked for and what is identified. If something is not applicable, or not identified, the apprentice must say so to receive credit for that item. This demonstration is to be done without a checklist.

Points will be subtracted for items that are addressed but the hazard missed, if present. Elements of the site inspection include:

- electric wires (all: house drop, distribution lines, etc.)
- guy wires
- support cables in trees
- uneven terrain, holes, rocks, muddy areas
- vines on tree trunks or heavy undergrowth
- places vehicles must not drive (e.g. septic tanks)
- traffic issues
- restricted work areas
- poisonous plants
- animals/stinging insects
- heavy undergrowth in work area
- potential for slips, trips, or falls
- potential for struck-by accidents
- spring poles
- weather-related hazards
- fallen trees with raised root plate
- property to be protected

This list is long and inclusive by design. If the apprentice fails the assessment (even multiple times), the repetition will be a good learning opportunity and will reinforce the site inspection process.

Tree Inspection

You will need to select an appropriate tree and site for this performance demonstration. It should be a large, mature tree. Although the tree need not contain every element on the list below, it should contain several of them. If something is NOT present, the apprentice should indicate that during the inspection. The apprentice is expected to “narrate” the tree inspection to you.

The apprentice must point out what is being looked for and what is identified. If something is not applicable, or not identified, the apprentice must say so to receive credit for that item. This demonstration is to be done without a checklist.

Points will be subtracted for items that are addressed but the hazard missed, if present. Elements of the tree inspection include:

- examination of roots and root area
- examination of root flare/root collar
- examination of lower trunk/trunk “hot zone”
- examination of lower branches
- examination of upper canopy
- mention of looking for signs of decay
- mention of looking for cracks
- mention of looking for cavities or cankers
- mention of looking for leans/ground heaving
- mention of looking for codominant stems
- mention of looking for signs of biting animals
- mention of looking for weather-related hazards
- mention of looking for support cables
- mention of looking for broken branches
- mention of looking for dead branches
- mention of looking for hangers
- consideration of further investigation (root collar excavation, moving of obstruction of view, hand pull test)
- identification of potential drop zone(s)

This list is long and inclusive by design. If the apprentice fails the assessment (even multiple times), the repetition will be a good learning opportunity and will reinforce the tree inspection process.

Job Briefing

This performance assessment is intended to take place on an actual work site, but it can also be simulated. You should work with the apprentice to establish the scenario. The job briefing should be with a crew leader and at least one other crew member. It should take place after the site and tree inspection have been completed.

The apprentice must cover the six required elements below without looking for help from the crew leader or prompting from crew members. Order of the elements is not important for points. The apprentice should be prepared to answer crew member questions.

- Work to be done and procedures involved
- Hazards associated with the job
- Electrical hazards

- Precautions and mitigation measures
- Assignments – who does what
- Personal protective equipment

Additional points are given for suggestions for work site set-up; suggestions for protecting property; and guidance for completing work.

Assisting the Climber

This performance assessment is intended to take place on an actual work site, but it can also be simulated. It requires a climber in a tree with a climbing line.

1. The apprentice must tie a line of a different diameter than the climber's line onto the climber's line, to send it up into the tree to the climber.
 - must use a sheet bend
 - properly tied, dressed, and set
2. The apprentice must tie a tool (pole saw/pruner, handsaw in a scabbard, hand tool) onto the climber's line, to send it up into the tree to the climber.
 - must use a midline clove hitch
 - properly tied, dressed, and set

Proper Lifting Technique

The apprentice must demonstrate the four techniques that are illustrated and described in this module using proper body positioning and technique. You can select what is to be lifted for each technique. You must ensure that the apprentice is not permitted to use improper technique, causing injury.

- modified diagonal lift
- diagonal lift
- one knee lift
- deep squat lift

Stowing a Rope

The apprentice must demonstrate stowing a rope 1) using a rope bag and 2) coiling and tying with a gasket hitch. The apprentice must clear the rope of debris; and 1) lay it into a rope bag; and 2) efficiently coil and tie it. It must be put away in the proper place.

Emergency Response

The apprentice work with a team of coworkers and lead an emergency response rehearsal. You should work with the apprentice to determine the emergency situation and plan the scenario.

The apprentice should handle each of the steps without prompting or needing to ask crew leader questions. The apprentice should be prepared to answer crew member questions appropriately. The apprentice is responsible for assuring an efficient demonstration. The apprentice must:

- participate in determining the emergency situation
- plan the scenario
- assist in setting up the scenario
- ensure that the necessary gear and equipment is in place
- assign roles for each participant
- explain safety measures to avoid any accidents during the rehearsal
- direct emergency steps
- coordinate emergency response
- lead evaluation of team performance
- suggest measures for improvement

All performance assessments can be repeated as many times as necessary to receive a passing score. Two copies of each performance assessment are included here. If the apprentice fails the first of any assessment, be sure to photocopy the second copy to ensure there will be a clean copy in the event the apprentice fails two times.

Written Exam

The Introduction to Tree Biology written assessment consists of 20 multiple-choice questions. 70% is required for passing, meaning the apprentice must answer 14 questions correctly. The exam can be retaken as many times as necessary to receive a passing score.

Two copies of the exam are included here. If the apprentice fails the first exam, be sure to photocopy the second copy of the test to ensure there will be a clean copy in the event the apprentice fails two times.

General Safety Checklist

1	ANSI Z133 Practice Exercises	Completed and checked	<input type="checkbox"/>
2	ANSI Z133 Practice Questions	Completed and checked	<input type="checkbox"/>
3	PPE Performance Assessment	Passed	<input type="checkbox"/>
4	Communication Performance Assessment	Passed	<input type="checkbox"/>
5	PPE and Communication Practice Exercises	Completed and checked	<input type="checkbox"/>
6	PPE and Communication Practice Questions	Completed and checked	<input type="checkbox"/>
7	Work Site Set-up Performance Assessment	Passed	<input type="checkbox"/>
8	Work Site Set-up Practice Exercises	Completed and checked	<input type="checkbox"/>
9	Work Site Set-up Practice Questions	Completed and checked	<input type="checkbox"/>
10	Electrical Hazards Basics Practice Exercises	Completed and checked	<input type="checkbox"/>
11	Electrical Hazards Basics Practice Questions	Completed and checked	<input type="checkbox"/>
12	Electrical Hazards on the Job Site Practice Exercises	Completed and checked	<input type="checkbox"/>
13	Electrical Hazards on the Job Site Practice Questions	Completed and checked	<input type="checkbox"/>
14	Conductor Identification Performance Assessment	Passed	<input type="checkbox"/>
15	Tree and Site Inspection Practice Exercises	Completed and checked	<input type="checkbox"/>
16	Tree and Site Inspection Practice Questions	Completed and checked	<input type="checkbox"/>
17	Site Inspection Performance Assessment	Passed	<input type="checkbox"/>
18	Tree Inspection Performance Assessment	Passed	<input type="checkbox"/>
19	Job Briefing Practice Exercises	Completed and checked	<input type="checkbox"/>
20	Job Briefing Practice Questions	Completed and checked	<input type="checkbox"/>
21	Job Briefing Performance Assessment	Passed	<input type="checkbox"/>
22	Groundworker Responsibilities Practice Exercises	Completed and checked	<input type="checkbox"/>
23	Groundworker Responsibilities Practice Questions	Completed and checked	<input type="checkbox"/>
24	Assisting the Climber Performance Assessment	Passed	<input type="checkbox"/>
25	Proper Lifting Performance Assessment	Passed	<input type="checkbox"/>
26	Stowing a Rope Performance Assessment	Passed	<input type="checkbox"/>
27	Emergency Response Practice Exercises	Completed and checked	<input type="checkbox"/>
28	Emergency Response Practice Questions	Completed and checked	<input type="checkbox"/>
29	Emergency Response Performance Assessment	Passed	<input type="checkbox"/>
30	General Safety Written Assessment	Passed	<input type="checkbox"/>

PERFORMANCE ASSESSMENT RUBRIC - COMMUNICATION

Proficiency required for passing = 100 points

Circle one	Repeat	Pass
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With a coworker, demonstrate the command-and-response system.				no - 0 pts	Points
	Beginning - 25 points	Developing - 50 points	Proficient - 100 points		
worker aloft announces, "Stand clear!"	worker below responds, "Clear!" or "All clear!"	worker below exits the drop zone and responds, "Clear!" or "All clear!"	worker below exits the drop zone, checks that all other workers exit the drop zone, and responds, "Clear!" or "All clear!"		
TOTAL POINTS					
Specific feedback and ideas for improvement:					

PERFORMANCE ASSESSMENT RUBRIC - Work Site Set-up

Proficiency required for passing = 100 percent correct

Circle one

Repeat **Pass**

Set up a work site using all of the appropriate items.					
	Beginning - 25 points	Developing - 50 points	Proficient - 100 points	No	Yes
cones	at least two work site set-up items missed or improperly placed	at least one work site set-up item missed or improperly placed	all appropriate signage and cones are properly placed; wheel chocks are properly placed; a tool/ refueling area has been established; rescue kit is off the truck; other precautions (caution tape, flagger, etc.) used as appropriate	no - 0 pts	Points
signage	at least two work site set-up items missed or improperly placed	at least one work site set-up item missed or improperly placed	all appropriate signage and cones are properly placed; wheel chocks are properly placed; a tool/ refueling area has been established; rescue kit is off the truck; other precautions (caution tape, flagger, etc.) used as appropriate	no - 0 pts	Points
wheel chocks	at least two work site set-up items missed or improperly placed	at least one work site set-up item missed or improperly placed	all appropriate signage and cones are properly placed; wheel chocks are properly placed; a tool/ refueling area has been established; rescue kit is off the truck; other precautions (caution tape, flagger, etc.) used as appropriate	no - 0 pts	Points
tools/refueling area	at least two work site set-up items missed or improperly placed	at least one work site set-up item missed or improperly placed	all appropriate signage and cones are properly placed; wheel chocks are properly placed; a tool/ refueling area has been established; rescue kit is off the truck; other precautions (caution tape, flagger, etc.) used as appropriate	no - 0 pts	Points
rescue kit	at least two work site set-up items missed or improperly placed	at least one work site set-up item missed or improperly placed	all appropriate signage and cones are properly placed; wheel chocks are properly placed; a tool/ refueling area has been established; rescue kit is off the truck; other precautions (caution tape, flagger, etc.) used as appropriate	no - 0 pts	Points
other (caution tape, flagger, etc.)	at least two work site set-up items missed or improperly placed	at least one work site set-up item missed or improperly placed	all appropriate signage and cones are properly placed; wheel chocks are properly placed; a tool/ refueling area has been established; rescue kit is off the truck; other precautions (caution tape, flagger, etc.) used as appropriate	no - 0 pts	Points
Specific feedback and ideas for improvement:					

PERFORMANCE ASSESSMENT RUBRIC - CONDUCTOR IDENTIFICATION

Proficiency required for passing = 100 points

Circle one Repeat Pass

Identify common conductor types on a job site.		No	Yes
1	transmission lines (if in view from property)		
2	primary distribution lines		
3	secondary distribution lines		
4	service wires (if present)		
5	cable, telephone		
TOTAL POINTS			
Specific feedback and ideas for improvement:			

PERFORMANCE ASSESSMENT RUBRIC - SITE INSPECTION

Proficiency required for passing = 60 points

Circle one

Repeat Pass

Demonstrate a site hazard inspection on a job site.		No	Yes
1	electric wires (all: house drop, distribution lines, etc.)		10 points
2	guy wires		5 points
3	support cables in trees		5 points
4	uneven terrain, holes, rocks, muddy areas		5 points
5	vines on tree trunks or heavy undergrowth		5 points
6	places vehicles must not drive (e.g. septic tanks)		5 points
7	traffic issues		5 points
8	restricted work areas		5 points
9	poisonous plants		5 points
10	animals/stinging insects		5 points
11	heavy undergrowth in work area		5 points
12	potential for slips, trips, or falls		10 points
13	potential for struck-by accidents		10 points
14	spring poles		5 points
15	weather-related hazards		5 points
16	fallen trees with raised root plate		5 points
17	property to be protected		5 points
potential site hazards present but not identified			points subtracted
If apprentice addresses an issue above but misses the presence of the hazard, subtract 5 points for each occurrence.			
TOTAL POINTS			
Specific feedback and ideas for improvement:			

PERFORMANCE ASSESSMENT RUBRIC - TREE INSPECTION

Proficiency required for passing = 60 points

Circle one

Repeat Pass

Demonstrate a tree hazard inspection on a job site, including the root zone.		No	Yes
1	examination of roots and root area		5 points
2	examination of root flare/root collar		5 points
3	examination of lower trunk/trunk "hot zone"		5 points
4	examination of lower branches		5 points
5	examination of upper canopy		5 points
6	mention of looking for signs of decay		5 points
7	mention of looking for cracks		5 points
8	mention of looking for cavities or cankers		5 points
9	mention of looking for leans/ground heaving		5 points
10	mention of looking for codominant stems		5 points
11	mention of looking for signs of biting animals		5 points
12	mention of looking for weather-related hazards		5 points
13	mention of looking for support cables		5 points
14	mention of looking for broken branches		5 points
15	mention of looking for dead branches		5 points
16	mention of looking for hangers		5 points
17	consideration of further investigation (root collar excavation, moving of obstruction of view, hand pull test)		15 points
18	identification of potential drop zone(s)		5 points
potential tree hazards present but not identified			points subtracted
TOTAL POINTS			
Specific feedback and ideas for improvement:			

PERFORMANCE ASSESSMENT RUBRIC - Job Briefing

Proficiency required for passing = 80 percent correct

Circle one

Repeat Pass

Lead a job briefing out on an actual job site.				No	Yes
order covered is not important	Beginning - 5 points	Developing - 10 points	Proficient - 15 points	no - 0 pts	Points
work to be done and procedures involved	needed prompting more than once; looked for assistance from crew leader; unable to answer crew member questions	covered topic with minimal prompting; looked for assistance from crew leader; answered at least one crew member question	covered topic without prompting; did not need to ask crew leader questions; answered crew member questions appropriately		
hazards associated with the job					
electrical hazards					
precautions and mitigation measures					
assignments - who does what					
personal protective equipment					
additional proficiency points - up to 10 total	suggestion(s) for work site set-up - 2 points	suggestion(s) for protecting property - 3 points	guidance for how to complete work - 5 points		
Specific feedback and ideas for improvement:					

PERFORMANCE ASSESSMENT RUBRIC - ASSISTING THE CLIMBER

Proficiency required for passing = 100 percent correct

Circle one

Repeat Pass

Demonstrate sending a line up to a climber.		No	Yes
the line should be a different diameter from the climber's line	line should be attached with a sheet bend, properly tied, dressed, and set		50 points
Demonstrate sending a tool up to a climber.		No	Yes
the tool can be a pole saw/pruner, a handsaw in a scabbard, or a hand tool	tool should be attached with a midline clove hitch, properly tied, dressed, and set		50 points
TOTAL POINTS			
Specific feedback and ideas for improvement:			

PERFORMANCE ASSESSMENT RUBRIC - Proper Lifting Techniques

Proficiency required for passing = 70 percent correct

Circle one

Repeat **Pass**

Demonstrate proper lifting techniques.		Beginning - 5 points	Developing - 15 points	Proficient - 25 points	No	Yes
		made two or more errors with feet/back/body position or lifting technique	made one error with feet/back/body position or lifting technique	feet properly positioned; back incorrect position; load positioned properly; lifted with the legs; kept load close to body; did not twist body with load	no - 0 pts	Points
modified diagonal lift						
diagonal lift						
one knee lift						
deep squat lift						
Specific feedback and ideas for improvement:						

PERFORMANCE ASSESSMENT RUBRIC - STOWING A ROPE

Proficiency required for passing = 100 percent correct

Circle one

Repeat Pass

Demonstrate the proper way to put away and store a rope.		No	Yes
using a rope bag	rope is clear of debris; efficiently coiled, tied with a gasket hitch; put away in the proper place		50 points
coiling and tying with a gasket hitch	rope is clear of debris; efficiently laid into the rope bag, put away in the proper place		50 points
TOTAL POINTS			
Specific feedback and ideas for improvement:			

PERFORMANCE ASSESSMENT RUBRIC - Emergency Response

Proficiency required for passing = 80 percent

Circle one

Repeat Pass

With a team of coworkers, demonstrate effective emergency response to an accident on the ground.				No	Yes
				no - 0 pts	Points
	Beginning - 5 points	Developing - 7 points	Proficient - 10 points		
emergency response rehearsal					
participate in determining the emergency situation					
plan the scenario					
assist in setting up the scenario					
ensure that the necessary gear and equipment is in place					
assign roles for each participant					
explain safety measures to avoid any accidents during the rehearsal	needed significant prompting; asked crew leader several questions; had difficulty answering crew member questions; demonstration was not efficient	handled steps with minimal prompting; asked crew leader one question; answered most crew member questions appropriately; assured efficient demonstration	handled steps without prompting; did not need to ask crew leader questions; answered crew member questions appropriately; assured efficient demonstration		
direct emergency steps					
coordinate emergency response					
lead evaluation of team performance					
suggest measures for improvement					
Specific feedback and ideas for improvement:					

General Safety Exam

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Score _____

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 - b. eye protection; leg protection; non-gauntlet gloves; face protection
 - c. work boots; helmet; eye protection; hearing protection
 - d. non-gauntlet gloves; face protection; hearing protection; helmet

6. Which of the following is NOT an allowable choice of eye protection for someone who wears eyeglasses?
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14. If you directly or indirectly become the link completing the circuit between the tree, or other grounding source (such as a ground wire) and the power line
 - a. death or injury will result
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17. Why do you need to judge the maximum nominal voltage of a conductor?
- To tell the utility dispatcher.
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18. What should you do if a tree is contacting wires and a notch is being burned into the wood?
- Climb and prune the tree if you are a line-clearance arborist.
 - Remove the tree from the ground or using an aerial device.
 - Contact the utility to have them make the situation safe.
 - Move on to the next tree; no need to contact anyone.
19. Never work near electrical conductors unless
- you are properly trained and understand exactly what you need to do
 - you know the maximum nominal voltage phase to phase and the minimum approach distance
 - you are certain that the job can be done safely
 - all of the above
20. Which of the following is a condition that could create a step potential hazard?
- energized outriggers
 - a downed electrical conductor
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21. To become a qualified line clearance tree trimmer you must have, or be developing as a trainee under the supervision of a qualified line-clearance arborist,
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18. What should you do if a tree is contacting wires and a notch is being burned into the wood?
- a. Climb and prune the tree if you are a line-clearance arborist.
 - b. Remove the tree from the ground or using an aerial device.
 - c. Contact the utility to have them make the situation safe.**
 - d. Move on to the next tree; no need to contact anyone.
19. Never work near electrical conductors unless
- a. you are properly trained and understand exactly what you need to do
 - b. you know the maximum nominal voltage phase to phase and the minimum approach distance
 - c. you are certain that the job can be done safely
 - d. all of the above**
20. Which of the following is a condition that could create a step potential hazard?
- a. energized outriggers
 - b. a downed electrical conductor
 - c. an energized utility pole
 - d. all of the above**

21. To become a qualified line clearance tree trimmer you must have, or be developing as a trainee under the supervision of a qualified line-clearance arborist,
- competence in climbing skills or aerial lift operations
 - the ability to safely rig limbs and properly use tools for line clearing
 - experience in urban forestry and tree care operations
 - d. all of the above**
22. If, in the opinion of the crew leader, anything is found during the work site inspection that cannot be adequately mitigated or will affect the crew's ability to do the job
- it should be brought to the attention of the client
 - b. it should be brought to the attention of the supervisor**
 - the crew leader must change the work order
 - the crew must complete the job no matter what
23. When assessing site hazards, what is the significance of a tree with no root flare; i.e., one that looks like a telephone pole?
- a. It is an indication that fill has been added, which may have killed some roots.**
 - It is an indication that the tree is unusually deep-rooted and probably quite stable.
 - It has no significance as far as hazard assessment.
 - It is an indication that fill has been added around the tree which provides extra stability.
24. Struck-by accidents can be avoided by
- setting up a work zone with proper cones, signs and flags
 - working within the cones when dragging and chipping brush
 - staying out from under trees where limbs are being dropped
 - d. all of the above**
25. If you will be digging or excavating for any reason
- a. the utilities should be marked**
 - you must set up cones around the area
 - traffic warning signs are required
 - all of the above

26. A method of providing protection for work site property is
- move the object when possible
 - flag or place cones over sprinkler heads
 - use rigging techniques when lowering branches
 - d. all of the above**
27. A problem created when trees fall on other tree limbs or saplings, putting them under great tension is called
- codominant stems
 - b. spring poles**
 - struck-bys
 - conks
28. A precaution to take when working near dead palm fronds is
- never climb underneath them
 - avoid smoking near them
 - be sure the chain saw isn't sparking
 - d. all of the above**
29. Bark that becomes embedded between stems or branches, weakening the attachment is called
- codominant stems
 - branch bark ridge
 - c. included bark**
 - branch collar
30. A danger associated with cutting the trunk of a windfallen tree is
- a. the root plate could suddenly move back into the ground**
 - the root plate could become a spring pole
 - the trunk could become a spring pole
 - all of the above

31. Before spraying a beehive with insecticide, it is important to consider that
- a. **bees are important pollinators**
 - b. insecticide won't kill honey bees
 - c. they will never sting if you remain calm
 - d. only the males attack
32. Codominant stems are especially weak if they contain
- a. a branch union
 - b. a branch bark ridge
 - c. **included bark**
 - d. a branch collar
33. Ground heaving, especially associated with a leaning tree, may be an indication that
- a. **the tree is about to fail**
 - b. strong buttress root formation
 - c. a strong and stable root flare
 - d. the root collar has been excavated
34. A danger associated with working in post-storm conditions is
- a. fallen electric wires hidden by downed trees
 - b. spring poles created by fallen trees
 - c. broken limbs hanging in tree tops
 - d. **all of the above**
35. A method to check for tree stability is
- a. a root collar excavation
 - b. probing and sounding the tree base and roots
 - c. the hand pull test
 - d. **all of the above**

36. Ideal saw chain tension
- a. shows a gap between the bottom of the bar and the chain
 - b. will not allow chain rotation without the engine running
 - c. allows free rotation of the chain without drooping**
 - d. is when the chain can barely move on the bar manually
37. Before sending a chain saw up to a climber, you should
- a. be sure it is gassed and oiled
 - b. check the chain tension
 - c. start it briefly and stop it
 - d. all of the above**
38. During a rigging operation a groundworker's job is to
- a. keep the drop zone clear of large entanglements
 - b. keeping the climber's line clear of brush
 - c. send up and handle rigging lines
 - d. all of the above**
39. Poor communication between a climber and a ground worker is likely to result in what type of accident?
- a. fall
 - b. rope burn
 - c. struck-by**
 - d. back sprain
40. When should the one-knee lift not be used?
- a. if you have a history of knee problems**
 - b. if you want to lift over your head
 - c. if you want to avoid lifting
 - d. when rolling a log down a hill

41. What is the minimum distance the chain saw refueling and adjustment area should be from where the saw will be used?
- a. 5 feet
 - b. 10 feet**
 - c. 15 feet
 - d. 20 feet
42. The flagger ordinarily positions him/herself:
- a. on the shoulder in front of the cones
 - b. in the road in front of the cones
 - c. within the coned area
 - d. either a. or c.**
43. Every knot that you use should be properly
- a. wrapped on the bight
 - b. tied, dressed, and set**
 - c. tightened as much as possible
 - d. all of the above
44. In most pruning and removal operations, the groundworker(s) will
- a. cut and drag the brush
 - b. chip brush
 - c. cut firewood
 - d. all of the above**
45. When lifting, you should
- a. lift with your legs
 - b. keep the load close to your body
 - c. avoid twisting the back
 - d. all of the above**

46. A knot that can be tied on the ground and then pulled up a line and snugged around a limb is the
- a. midline clove hitch
 - b. running bowline**
 - c. timber hitch
 - d. square knot
47. In rigging, allowing a cut piece to fall quickly for a short distance so that it drops below the climber, then slowing the piece gradually and controlling it to the ground is known as
- a. letting it run**
 - b. friction stopping
 - c. friction holding
 - d. end running
48. A good knot to use to send a rigging line up to a climber is the
- a. cow hitch
 - a. timber hitch
 - b. sheet bend**
 - c. bowline
49. A good knot to use for sending a tool or water bottle up to the climber is a
- a. midline clove hitch**
 - b. running bowline
 - c. timber hitch
 - d. square knot
50. If you need to enter the landing zone/drop zone, you should
- a. communicate with the climber or bucket truck operator aloft
 - b. check to see that nothing is falling
 - c. ensure that the worker aloft has acknowledged you
 - d. all of the above**