

FULL-LENGTH PRACTICE TESTS

PRACTICE TEST 3 - 100 QUESTIONS

1. What is the name of the tissue produced by the vascular cambium that conducts water upward in a tree?
 - A. Phloem
 - B. Cork
 - C. Pith
 - D. Xylem

2. When pruning a live branch, the final cut should be positioned in relation to what anatomical structure?
 - A. Just outside the branch collar
 - B. Flush with the trunk surface
 - C. Two inches beyond the branch bark ridge
 - D. Through the center of the branch collar

3. Which soil macronutrient is most commonly deficient in urban trees and is associated with overall yellowing of older leaves?
 - A. Phosphorus
 - B. Nitrogen
 - C. Calcium
 - D. Sulfur

4. A tree species that retains its dead leaves through winter until new growth pushes them off in spring exhibits what characteristic?
- A. Deciduous habit
 - B. Evergreen habit
 - C. Marcescence
 - D. Abscission failure
5. According to ANSI Z133, what is the minimum breaking strength required for arborist climbing lines?
- A. 5,400 pounds
 - B. 4,000 pounds
 - C. 6,500 pounds
 - D. 3,800 pounds
6. Which pruning objective involves removing branches to provide vertical clearance beneath the tree crown?
- A. Crown cleaning
 - B. Crown thinning
 - C. Crown reduction
 - D. Crown raising
7. The measure of a soil's ability to hold and exchange positively charged nutrient ions is called what?
- A. Soil porosity
 - B. Soil structure
 - C. Cation exchange capacity
 - D. Soil texture

8. In the CODIT model, which wall is typically the weakest barrier to decay spread?

- A. Wall 4 (barrier zone)
- B. Wall 1 (plugging vessels above and below wound)
- C. Wall 3 (ray cells)
- D. Wall 2 (annual ring boundary)

9. A client reports mushrooms appearing at the base of their oak tree every fall. What does this indicate about the tree's condition?

- A. Normal mycorrhizal activity
- B. Excessive soil moisture
- C. Beneficial decomposition of surface mulch
- D. Internal decay in roots or lower trunk

10. What is the primary purpose of an arborist's work positioning lanyard?

- A. To support the climber while working in a stationary position
- B. To provide a means of emergency descent
- C. To arrest falls during tree ascent
- D. To anchor rigging lines for limb removal

11. The process by which sugar produced in leaves moves to other parts of the tree through phloem is called what?

- A. Transpiration
- B. Absorption
- C. Translocation
- D. Respiration

12. When establishing tree protection fencing for construction, at what distance from the trunk should fencing ideally be placed?

- A. At the dripline only
- B. At the critical root zone boundary (1 foot per inch DBH)
- C. 5 feet from the trunk for all trees
- D. 3 feet beyond the dripline

13. Which type of leaf venation pattern has multiple main veins radiating from a single point at the base of the leaf blade?

- A. Palmate venation
- B. Pinnate venation
- C. Parallel venation
- D. Reticulate venation

14. Brown rot and white rot differ primarily in which wood components they decompose. Which statement is correct?

- A. Brown rot decomposes lignin; white rot decomposes cellulose
- B. White rot decomposes both lignin and cellulose; brown rot decomposes cellulose only
- C. Both types decompose the same components at different rates
- D. Brown rot decomposes cellulose leaving lignin; white rot decomposes both

15. When operating a chain saw, what body position provides the safest stance relative to the saw bar?

- A. Directly behind the bar in line with the cut
- B. To the side of the bar, not in line with the chain
- C. Leaning over the bar for better visibility
- D. Positioned above the bar when cutting low branches

16. What is the term for a support system that uses cables running from high in the tree to anchors in the ground?

- A. Cabling
- B. Bracing
- C. Guying
- D. Propping

17. A tree's annual growth rings are narrower on one side of the trunk than the other. What does this growth pattern typically indicate?

- A. Uniform growing conditions
- B. Excellent tree health
- C. Optimal soil moisture
- D. Uneven growing conditions or one-sided stress

18. Which plant hormone promotes fruit ripening and leaf abscission?

- A. Ethylene
- B. Auxin
- C. Cytokinin
- D. Gibberellin

19. According to recommended urban forestry guidelines, what is the maximum percentage of any single family that should be represented in an urban tree population?

- A. 10 percent
- B. 30 percent
- C. 20 percent
- D. 40 percent

20. What tool would be most appropriate for examining the internal condition of a tree trunk suspected of having decay?

- A. Increment borer only
- B. Mallet for sounding only
- C. Resistance drilling device (resistograph)
- D. Soil probe

21. What is the primary advantage of proper structural pruning on young trees?

- A. Establishing good form early to prevent costly corrections later
- B. Accelerating height growth
- C. Increasing flower production
- D. Reducing the need for future irrigation

22. Which insect pest is responsible for killing millions of ash trees in North America since its introduction?

- A. Asian longhorned beetle
- B. Gypsy moth (spongy moth)
- C. Hemlock woolly adelgid
- D. Emerald ash borer

23. During basic tree risk assessment, which of the following represents a target?

- A. A dead branch in the crown
- B. Decay in the trunk
- C. A park bench beneath the tree
- D. A crack in a scaffold limb

24. What is the relationship between trunk diameter and appropriate root ball size for transplanting according to ANSI Z60.1 standards?

- A. Root ball size is unrelated to trunk diameter
- B. Larger trunk diameters require proportionally larger root balls
- C. Root ball size is based on tree height only
- D. All trees require the same minimum root ball size

25. The specialized cells that regulate gas exchange by opening and closing stomata are called what?

- A. Guard cells
- B. Palisade cells
- C. Companion cells
- D. Spongy mesophyll cells

26. What is the most common cause of girdling root development in landscape trees?

- A. Root damage from lawn equipment
- B. Soil compaction after planting
- C. Excessive irrigation
- D. Improper planting depth or container root defects

27. When mixing a pesticide for application, what document provides the legally binding instructions for proper use?

- A. The Material Safety Data Sheet
- B. The product label
- C. The applicator's training manual
- D. The manufacturer's website

28. In tree appraisal using the trunk formula method, what factor would be reduced if a tree has poor structure with multiple included bark unions?

- A. Species rating
- B. Location rating
- C. Condition rating
- D. Basic value

29. Which type of tree inventory uses statistical sampling to estimate population characteristics without documenting every individual tree?

- A. Complete inventory
- B. Comprehensive inventory
- C. Canopy assessment
- D. Sample inventory

30. What is the primary function of the root cap at the tip of a growing root?

- A. Protecting the root meristem as it grows through soil
- B. Absorbing water and nutrients
- C. Storing carbohydrates
- D. Anchoring the root in place

31. During a pre-climb inspection, an arborist notices a horizontal crack in the trunk with visible movement when the tree sways. What action is most appropriate?

- A. Proceed with climbing using extra caution
- B. Do not climb this tree; it shows signs of imminent structural failure
- C. Install a cable before climbing to stabilize the crack
- D. Climb on the opposite side of the tree from the crack

32. The zone in a root tip where cells are dividing rapidly is called what?

- A. Zone of elongation
- B. Zone of differentiation
- C. Zone of cell division (meristematic zone)
- D. Root hair zone

33. Which statement best describes the relationship between tree roots and the dripline?

- A. Roots typically extend well beyond the dripline
- B. Roots are confined within the dripline
- C. Roots extend exactly to the dripline
- D. Root spread equals dripline diameter

34. What is the recommended maximum drop distance in rigging to minimize shock loading on the system?

- A. Equal to the length of the piece being removed
- B. Twice the length of the piece being removed
- C. Half the length of the piece being removed
- D. As short as practical, ideally minimizing or eliminating free fall

35. Anthracnose diseases are most severe during what type of weather conditions?

- A. Hot, dry summers
- B. Warm fall weather
- C. Cool, wet springs
- D. Cold winter periods

36. Which of the following best describes the concept of integrated pest management (IPM)?

- A. Using only organic pesticides
- B. A decision-making process using multiple tactics based on monitoring and thresholds
- C. Eliminating all pesticide use
- D. Applying preventive treatments on a calendar schedule

37. A tree shows yellowing between the veins on youngest leaves while veins remain green. This symptom pattern is most consistent with deficiency of which nutrient?

- A. Iron or manganese
- B. Nitrogen
- C. Potassium
- D. Phosphorus

38. What is the minimum Personal Protective Equipment required when operating a chain saw on the ground according to ANSI Z133?

- A. Hard hat only
- B. Safety glasses only
- C. Hard hat, hearing protection, and gloves only
- D. Hard hat, hearing protection, eye protection, leg protection, and foot protection

39. Trees that grow in compacted soils often develop roots that are concentrated where?

- A. At greater depths to find less compacted soil
- B. Near the soil surface where oxygen is available
- C. Evenly distributed regardless of compaction
- D. Exclusively beneath the trunk

40. Which tree structure is responsible for producing lateral roots?

- A. Root cap
- B. Root hairs
- C. Pericycle
- D. Epidermis

41. In risk assessment terminology, what does "likelihood of failure" evaluate?

- A. The species of tree being assessed
- B. The targets present in the area
- C. The cost of potential damage
- D. The probability that the tree or tree part will fail

42. What is the proper immediate response if a ground worker observes a climber becoming entangled and unresponsive in a tree?

- A. Initiate aerial rescue immediately
- B. Wait for emergency services before taking action
- C. Attempt to lower tools first to reduce weight
- D. Contact the company supervisor before acting

43. The presence of included bark in a branch union indicates what condition?

- A. Strong attachment with good structural wood connection
- B. Weak attachment lacking structural wood connection
- C. Normal development for mature trees
- D. Evidence of past pruning injury

44. What is the term for the process by which a tree walls off decay-causing organisms?
- A. Regeneration
 - B. Wound healing
 - C. Compartmentalization
 - D. Callus formation only
45. When applying fertilizer to established trees, what area should receive the application?
- A. Throughout the root zone extending to and beyond the dripline
 - B. In a ring directly around the trunk base
 - C. Only on one side of the tree
 - D. Concentrated at the dripline only
46. A newly planted tree has been staked with rigid stakes and wire threaded through a garden hose. After two years, what problem is most likely to develop if stakes are not removed?
- A. Excessive root growth
 - B. Increased wind resistance
 - C. Improved trunk taper
 - D. Trunk damage and restricted growth at wire contact points
47. Which soil texture typically has the best combination of drainage, water retention, and nutrient-holding capacity for tree growth?
- A. Pure clay
 - B. Pure sand
 - C. Loam
 - D. Gravel

48. What primary factor distinguishes a hazard tree from a tree with structural defects?

- A. The age of the tree
- B. The presence of a target that could be struck
- C. The species of tree
- D. The size of the defect

49. During drought stress, trees close stomata to conserve water. Which physiological process is directly reduced as a result?

- A. Photosynthesis
- B. Root growth
- C. Bark development
- D. Wood decay resistance

50. Which rigging technique creates the highest forces in the system?

- A. Lowering with a friction device at slow speed
- B. Speedline at low angle
- C. Removing small pieces sequentially
- D. Negative rigging with a long drop distance

51. The layer of protective cells that replaces the epidermis in woody stems and roots is called what?

- A. Cuticle
- B. Periderm
- C. Endodermis
- D. Cortex

52. Which practice is most effective for preventing soil compaction damage to tree roots during construction?

- A. Watering the soil heavily before equipment arrives
- B. Adding gravel over the root zone
- C. Installing protective fencing to exclude equipment from the root zone
- D. Trenching around the tree to sever roots cleanly

53. Codominant stems with included bark are of concern because they have what characteristic?

- A. Excessive weight in the crown
- B. Reduced growth rate
- C. Increased susceptibility to lightning
- D. Weak attachment prone to failure

54. What is the primary purpose of air excavation (air spade) in tree care?

- A. Removing soil from root zones without damaging roots
- B. Aerating compacted soil permanently
- C. Injecting fertilizer into the root zone
- D. Creating planting holes in rocky soil

55. When evaluating a tree's root system for transplanting, which root condition would be cause for rejection?

- A. White-colored root tips
- B. Severely circling or girdling roots
- C. Presence of fine absorbing roots
- D. Roots extending beyond the container

56. A foliar disease that causes irregular brown lesions following leaf veins on sycamore during cool, wet spring weather is most likely what?

- A. Powdery mildew
- B. Bacterial leaf scorch
- C. Anthracnose
- D. Leaf spot caused by drought

57. According to ANSI Z133, what action must be taken before starting work near electrical conductors when minimum approach distances cannot be maintained?

- A. Contact the utility to de-energize or protect the lines
- B. Proceed with extra caution
- C. Use insulated tools only
- D. Work only during dry weather

58. What is the primary benefit of establishing a diverse species composition in urban forests?

- A. Simplified maintenance schedules
- B. Reduced costs for tree inventory
- C. Uniform appearance throughout the community
- D. Reduced risk of catastrophic losses from species-specific threats

59. In tree climbing, what knot is commonly used to create an adjustable friction hitch on the climbing line?

- A. Bowline
- B. Figure-8 follow-through
- C. Blake's hitch or Prusik
- D. Timber hitch

60. What type of mycorrhizal association involves fungal hyphae that penetrate root cell walls?

- A. Ectomycorrhizae
- B. Endomycorrhizae (arbuscular mycorrhizae)
- C. Parasitic fungi
- D. Saprophytic fungi

61. What is the most critical factor for successful establishment of newly planted trees?

- A. Adequate and consistent watering
- B. High nitrogen fertilization
- C. Immediate structural pruning
- D. Heavy mulching against the trunk

62. A property owner is concerned about liability for a tree that overhangs the neighbor's property. Who typically has the right to trim branches extending over a property line?

- A. Only the tree owner
- B. Only the municipality
- C. Only a licensed arborist
- D. The property owner whose property is encroached upon, to the property line

63. What is the function of lenticels on woody stems?

- A. Water absorption
- B. Gas exchange for respiration
- C. Photosynthesis
- D. Nutrient storage

64. Which plant growth process occurs primarily in the apical meristems of shoots and roots?

- A. Secondary growth (diameter increase)
- B. Wound closure
- C. Primary growth (elongation)
- D. Bark formation

65. A complete tree protection plan for construction should include which of the following elements?

- A. Specifications for tree removal only
- B. Herbicide application schedule
- C. Root pruning instructions for all trees
- D. Tree protection zones, fencing requirements, and monitoring protocols

66. What soil condition is most directly improved by incorporating organic matter?

- A. Soil structure and water-holding capacity
- B. Soil mineral content
- C. Soil temperature
- D. Soil depth

67. When applying the trunk formula method for tree appraisal, the basic value is primarily determined by what measurement?

- A. Tree height
- B. Trunk cross-sectional area (derived from trunk diameter)
- C. Crown spread
- D. Root zone area

68. In the decline spiral concept, drought is most accurately classified as what type of factor?

- A. Predisposing factor
- B. Contributing factor
- C. Inciting factor
- D. Secondary factor

69. What is the recommended response when a climber identifies a serious hazard during the climb that was not visible from the ground?

- A. Stop work and reassess before proceeding
- B. Continue climbing to complete the job
- C. Ignore minor hazards in the interest of productivity
- D. Wait until the end of the job to report

70. Oak wilt disease is caused by what type of pathogen?

- A. Bacteria
- B. Virus
- C. Nematode
- D. Fungus

71. Which of the following is an appropriate use of a heading cut?

- A. Reducing crown density
- B. Removing dead branches
- C. Restoration pruning of a previously topped tree
- D. Removing a codominant stem

72. What is the most likely consequence of volcano mulching (mulch piled against the trunk)?

- A. Improved water retention for roots
- B. Bark decay, pest habitat, and stem girdling roots
- C. Enhanced nutrient availability
- D. Better weed suppression

73. The minimum approach distance from electrical conductors for unqualified workers operating below 50 kV is what?

- A. 10 feet
- B. 15 feet
- C. 20 feet
- D. 5 feet

74. Which tree response indicates that pruning has removed too much of the crown?

- A. Gradual wound closure over several years
- B. Normal growth the following season
- C. Reduced leaf size permanently
- D. Vigorous epicormic sprouting throughout the crown

75. What does the presence of carpenter ants in a tree indicate?

- A. The tree is structurally sound
- B. Decay is present that the ants are excavating
- C. The tree has excellent vigor
- D. Normal insect activity requiring no concern

76. When rigging heavy limbs for removal, what is the function of a friction device or lowering system?

- A. To increase the speed of lowering
- B. To eliminate the need for a ground crew
- C. To control descent speed and reduce shock loading
- D. To prevent the rope from feeding through the block

77. Adventitious roots that develop above the original root flare often indicate what problem?

- A. Optimal planting depth
- B. Excellent soil aeration
- C. Natural root adaptation
- D. The tree was planted too deeply

78. What is the primary purpose of tree preservation ordinances?

- A. To protect existing trees from unauthorized removal or damage
- B. To regulate the nursery industry
- C. To establish fertilization requirements
- D. To mandate specific pruning practices

79. Which factor most strongly influences a tree's ability to compartmentalize decay after wounding?

- A. The type of pruning cut used
- B. Tree vigor at the time of wounding
- C. The season when injury occurs
- D. The size of the wound only

80. A sample tree inventory covering 10% of the trees in a community can be used for what purpose?

- A. Individual tree maintenance scheduling
- B. Work order generation for specific trees
- C. Estimating population-level statistics and trends
- D. Creating a complete tree database

81. What is phytotoxicity?

- A. Plant damage caused by chemical exposure
- B. The toxicity of plants to animals
- C. Natural plant defense mechanisms
- D. Beneficial effects of fertilizers

82. Trees planted in restricted soil volumes typical of urban tree pits often experience what chronic problem?

- A. Excessive growth requiring frequent pruning
- B. Resistance to all pest problems
- C. Extended lifespan compared to park trees
- D. Inadequate water and nutrient availability leading to stress

83. When assessing likelihood of failure in tree risk assessment, which condition represents the highest probability of failure?

- A. Minor deadwood in the outer crown
- B. Small surface wounds from mower damage
- C. A crack with visible movement when the tree sways
- D. Slight asymmetry in the crown

84. What is the primary reason for avoiding heavy pruning during the fall season in temperate climates?

- A. Fall is too busy for tree work
- B. Wounds close slowly with minimal time before winter dormancy
- C. Equipment is unavailable in fall
- D. Labor costs are higher in fall

85. Which statement describes the proper response when a tree's roots must be cut during construction?

- A. Make clean cuts with sharp tools and avoid tearing
- B. Use heavy equipment for faster cutting
- C. Leave roots exposed to air for natural drying
- D. Cut roots during hot, dry weather only

86. Leaf scorch symptoms appearing first on the south or west side of a tree crown during summer are most likely caused by what?

- A. Vascular disease
- B. Nutrient deficiency
- C. Root rot infection
- D. Heat and drought stress

87. What is the term for wood that develops in response to non-vertical orientation, helping the tree maintain its position?

- A. Early wood
- B. Late wood
- C. Reaction wood
- D. Heart wood

88. When transplanting a tree, what is the ideal relationship between root ball depth and planting hole depth?

- A. Planting hole should be 6 inches deeper than the root ball
- B. Planting hole depth should match root ball depth with the flare at grade
- C. Planting hole should be twice as deep as the root ball
- D. Planting depth is unimportant if width is adequate

89. The primary photosynthetic tissue in a leaf is located in what layer?

- A. Mesophyll (palisade and spongy layers)
- B. Epidermis
- C. Cuticle
- D. Vascular bundle

90. What is the industry standard method for measuring trunk diameter for most tree care purposes?

- A. At ground level
- B. At 2 feet above ground
- C. At the root flare
- D. At 4.5 feet above ground (DBH - diameter at breast height)

91. During a basic tree risk assessment, evaluation of the root zone should include looking for what conditions?

- A. Soil heaving, severed roots, fungal fruiting bodies, and girdling roots
- B. Leaf color and density only
- C. Crown structure and dead branches only
- D. Bark texture on the lower trunk only

92. What is the principal advantage of air excavation over mechanical excavation in tree root zones?

- A. Air excavation is faster
- B. Air excavation removes soil without cutting roots
- C. Air excavation costs less
- D. Air excavation works in all soil types equally

93. Trees growing in heavy shade typically develop what crown characteristic?

- A. Dense, compact crowns with short internodes
- B. More horizontal branching to maximize light capture
- C. Thicker bark for protection
- D. Increased root-to-shoot ratio

94. What term describes a disease that affects the water-conducting tissue of trees, causing wilting symptoms?

- A. Foliar disease
- B. Canker disease
- C. Root rot
- D. Vascular wilt disease

95. When multiple trees are being evaluated for risk in a park, what assessment level is most appropriate for initial screening?

- A. Advanced assessment with decay detection equipment
- B. Aerial inspection of each tree
- C. Limited visual assessment
- D. Detailed basic assessment of each tree

96. What is the physiological function of heartwood in a living tree?

- A. Water conduction
- B. Structural support (no active physiological function)
- C. Sugar storage
- D. Nutrient transport

97. The cohesion-tension theory explains what process in trees?

- A. Movement of water from roots to leaves
- B. Transport of sugars in phloem
- C. Uptake of nutrients by roots
- D. Production of defensive chemicals

98. What type of tree inventory technology uses satellite or aerial imagery to assess overall canopy coverage?

- A. Complete ground inventory
- B. Sample plot methodology
- C. Resistograph assessment
- D. Remote sensing or canopy analysis

99. When providing supplemental support to a tree with codominant stems, what combination of techniques provides the most comprehensive support?

- A. Cabling in the upper crown combined with bracing at the union
- B. Guying alone
- C. Propping only
- D. Surface bolts on the trunk

100. Why is it important to identify the specific pest or pathogen before selecting a treatment in plant health care?

- A. It is not important; all treatments work equally
- B. Treatments are specific to particular pests, and misidentification leads to ineffective treatment
- C. Identification is required only for legal purposes
- D. Identification determines the price charged for service

PRACTICE TEST 3: ANSWER KEY

WITH EXPLANATIONS

1. **D. Xylem** - Xylem is the water-conducting tissue produced by the vascular cambium toward the inside of the tree. It consists of vessels and tracheids that form continuous columns from roots to leaves, transporting water and dissolved minerals.
2. **A. Just outside the branch collar** - Proper pruning cuts preserve the branch collar, which contains specialized tissue for wound closure. Cutting just outside the collar allows the tree to effectively compartmentalize the wound and produce callus tissue.
3. **B. Nitrogen** - Nitrogen is the most commonly deficient macronutrient in urban trees. Because nitrogen is mobile within the plant, deficiency symptoms appear first on older leaves as general chlorosis (yellowing) while the plant remobilizes nitrogen to newer growth.
4. **C. Marcescence** - Marcescence is the retention of dead leaves through winter, common in species like American beech and some oaks. The leaves are pushed off in spring when new growth emerges rather than abscising in autumn.
5. **A. 5,400 pounds** - ANSI Z133 requires arborist climbing lines to have a minimum breaking strength of 5,400 pounds (24 kN). This ensures adequate safety margin for dynamic loading during climbing operations.
6. **D. Crown raising** - Crown raising removes lower branches to provide clearance for pedestrians, vehicles, buildings, or sight lines. It increases vertical clearance beneath the crown while maintaining the upper crown structure.
7. **C. Cation exchange capacity** - Cation exchange capacity (CEC) measures soil's ability to hold positively charged nutrients (cations) like potassium, calcium, and magnesium. Higher CEC indicates better nutrient retention capacity.
8. **B. Wall 1 (plugging vessels above and below wound)** - In the CODIT model, Wall 1 (vessel plugging above and below the wound) is typically the weakest barrier because it must block numerous continuous tubes that previously conducted water freely.
9. **D. Internal decay in roots or lower trunk** - Mushrooms at a tree's base are fruiting bodies of decay fungi, indicating established internal decay in roots or the lower trunk. This is a significant structural concern requiring further assessment.

10. **A. To support the climber while working in a stationary position** - A work positioning lanyard allows climbers to secure themselves in a stable position with hands free for work tasks. It supports body weight while the climber is stationed at a work location.
11. **C. Translocation** - Translocation is the movement of dissolved substances (primarily sugars) through phloem from sources (leaves) to sinks (roots, fruits, growing points). This distributes photosynthetic products throughout the tree.
12. **B. At the critical root zone boundary (1 foot per inch DBH)** - The critical root zone calculation of 1 foot radius per inch of trunk diameter provides a standard for establishing protective fencing that encompasses the majority of significant roots.
13. **A. Palmate venation** - Palmate venation has multiple main veins radiating from a single point at the leaf base, resembling fingers spreading from a palm. Maples are classic examples of palmate venation.
14. **D. Brown rot decomposes cellulose leaving lignin; white rot decomposes both** - Brown rot fungi break down cellulose, leaving brown, crumbly lignin residue. White rot fungi decompose both cellulose and lignin, leaving soft, white, stringy or spongy material.
15. **B. To the side of the bar, not in line with the chain** - Operators should position themselves to the side of the cutting bar, never directly behind it. This position provides safety if kickback occurs and the bar rotates upward toward the operator.
16. **C. Guying** - Guying uses cables or straps running from the trunk to ground anchors, providing external support. It is commonly used for newly transplanted large trees or trees with compromised root systems.
17. **D. Uneven growing conditions or one-sided stress** - Asymmetric growth rings indicate uneven conditions such as one-sided light exposure, root damage on one side, or lean. The tree produces more wood where stress is greatest.
18. **A. Ethylene** - Ethylene is a gaseous hormone that promotes fruit ripening and triggers leaf abscission. It is also produced in response to stress and wounding.
19. **B. 30 percent** - Urban forest diversity guidelines recommend no more than 10% of any species, 20% of any genus, and 30% of any family to reduce vulnerability to species-specific pests and diseases.
20. **C. Resistance drilling device (resistograph)** - Resistance drilling measures wood density as a thin drill penetrates the trunk, creating a profile that reveals decay as low-resistance zones. This provides objective data about internal condition.
21. **A. Establishing good form early to prevent costly corrections later** - Structural pruning of young trees establishes proper architecture with small cuts and small wounds. Correcting the same defects in mature trees requires large cuts that create stress and decay risk.

22. **D. Emerald ash borer** - Emerald ash borer (*Agrilus planipennis*), discovered in Michigan in 2002, has killed hundreds of millions of ash trees across North America by feeding in the cambial region and disrupting vascular transport.
23. **C. A park bench beneath the tree** - A target is anything of value that could be harmed by tree failure. The park bench represents a potential target where people might be sitting when failure occurs.
24. **B. Larger trunk diameters require proportionally larger root balls** - ANSI Z60.1 American Standard for Nursery Stock specifies minimum root ball sizes based on trunk caliper. Larger trees need proportionally larger root balls to retain adequate root mass for survival.
25. **A. Guard cells** - Guard cells are specialized kidney-shaped cells flanking each stoma. They regulate stomatal opening by changing shape in response to turgor pressure, controlling gas exchange and water loss.
26. **D. Improper planting depth or container root defects** - Girdling roots most commonly result from trees planted too deeply (encouraging adventitious roots above the true flare) or from circling roots in containers that continue circling after planting.
27. **B. The product label** - The pesticide label is a legal document that provides binding instructions for proper use. Federal law requires applicators to follow label directions regarding rates, timing, safety equipment, and application methods.
28. **C. Condition rating** - The condition rating in the trunk formula method reflects tree health and structural integrity. Poor structure with included bark unions represents a structural defect that reduces the condition rating.
29. **D. Sample inventory** - Sample inventories collect data from statistically selected plots or transects, then project findings to estimate characteristics of the larger population without documenting every individual tree.
30. **A. Protecting the root meristem as it grows through soil** - The root cap covers and protects the delicate meristematic cells at the root tip. It produces mucilage that lubricates passage through soil and is continuously replaced as outer cells slough off.
31. **B. Do not climb this tree; it shows signs of imminent structural failure** - A horizontal crack with visible movement during swaying indicates active structural failure in progress. This tree presents immediate danger and should not be climbed.
32. **C. Zone of cell division (meristematic zone)** - The meristematic zone at the root tip contains actively dividing cells that produce new root tissue. These cells are undifferentiated and rapidly multiplying.

33. **A. Roots typically extend well beyond the dripline** - Research consistently shows that tree roots extend far beyond the dripline, often 2-3 times the crown radius. The dripline significantly underestimates root spread.
34. **D. As short as practical, ideally minimizing or eliminating free fall** - Shock loading increases dramatically with drop distance. Minimizing free fall reduces peak forces on rigging components and anchor points.
35. **C. Cool, wet springs** - Anthracnose fungi require moisture for spore germination and infection. Cool, wet spring weather provides ideal conditions for disease development, particularly on sycamore, oak, and maple.
36. **B. A decision-making process using multiple tactics based on monitoring and thresholds** - IPM is a comprehensive approach that uses monitoring to inform decisions, applies action thresholds to determine when intervention is needed, and integrates multiple tactics including cultural, biological, and chemical controls.
37. **A. Iron or manganese** - Interveinal chlorosis on youngest leaves with veins remaining green is characteristic of immobile nutrient deficiency. Iron and manganese cannot be translocated from older leaves, so deficiency appears in new growth first.
38. **D. Hard hat, hearing protection, eye protection, leg protection, and foot protection** - ANSI Z133 requires comprehensive PPE during ground-based chain saw operation: hard hat with face protection, hearing protection, eye protection, leg protection meeting ASTM F1897, and appropriate foot protection.
39. **B. Near the soil surface where oxygen is available** - In compacted soils, roots concentrate near the surface where some oxygen remains available. Deeper soil lacks adequate oxygen due to reduced pore space from compaction.
40. **C. Pericycle** - The pericycle is a layer of cells inside the root that retains meristematic potential and initiates lateral root development. Branch roots originate from pericycle cell divisions.
41. **D. The probability that the tree or tree part will fail** - Likelihood of failure evaluates the probability of structural failure based on tree condition, defect severity, species characteristics, and loading potential.
42. **A. Initiate aerial rescue immediately** - Suspension trauma can cause serious injury or death within minutes. Trained crew members should initiate rescue immediately rather than waiting for emergency services.
43. **B. Weak attachment lacking structural wood connection** - Included bark indicates bark trapped in the branch union rather than forming a structural wood connection. This creates a weak attachment prone to failure under loading.

44. **C. Compartmentalization** - Compartmentalization of Decay in Trees (CODIT) describes how trees create chemical and physical barriers to wall off decay-causing organisms, limiting their spread rather than healing or regenerating tissue.
45. **A. Throughout the root zone extending to and beyond the dripline** - Fertilizer should be distributed throughout the root zone where absorbing roots are located. Roots extend well beyond the dripline, so application should cover this entire area.
46. **D. Trunk damage and restricted growth at wire contact points** - Wire (even with hose protection) can girdle the trunk as it expands, restricting growth and potentially killing cambium. Stakes left too long also prevent proper trunk development.
47. **C. Loam** - Loam is a balanced mixture of sand, silt, and clay that provides good drainage, adequate water retention, and reasonable nutrient-holding capacity. It is generally ideal for tree growth.
48. **B. The presence of a target that could be struck** - A hazard exists when a defective tree could strike something of value (target) if it fails. Without a target, there is no risk regardless of defect severity.
49. **A. Photosynthesis** - When stomata close, carbon dioxide cannot enter the leaf for photosynthesis. This tradeoff between water conservation and carbon acquisition directly reduces photosynthetic rate.
50. **D. Negative rigging with a long drop distance** - Negative rigging (where the piece falls past the rigging point before being caught) with significant drop distance generates the highest shock loads, potentially multiplying forces several times beyond static weight.
51. **B. Periderm** - The periderm replaces the epidermis in woody plants, consisting of cork cambium (phellogen), cork cells (phellem), and phelloderm. It forms the outer protective layer that develops into bark.
52. **C. Installing protective fencing to exclude equipment from the root zone** - Physical barriers that prevent equipment access are the most effective protection. Once compaction occurs, remediation is difficult and often unsuccessful.
53. **D. Weak attachment prone to failure** - Codominant stems with included bark lack the interlocking wood connection that provides strength. As stems grow, the included bark is compressed but provides no structural connection, making failure likely.
54. **A. Removing soil from root zones without damaging roots** - Air excavation uses compressed air to blow soil away without cutting or crushing roots, allowing examination of root systems, root collar excavation, or careful trenching near trees.
55. **B. Severely circling or girdling roots** - Severe root defects like circling and girdling roots persist and worsen after planting. They can strangle the trunk or compromise stability for the tree's entire life.

56. **C. Anthracnose** - Anthracnose on sycamore causes irregular brown lesions that follow leaf veins, often with leaf distortion. Cool, wet spring conditions favor infection by *Apiognomonia veneta*.
57. **A. Contact the utility to de-energize or protect the lines** - ANSI Z133 requires that when minimum approach distances cannot be maintained, work must not proceed until the utility de-energizes lines, installs protective covering, or provides appropriate supervision.
58. **D. Reduced risk of catastrophic losses from species-specific threats** - Species diversity prevents any single pest or disease from devastating the entire urban forest. The loss of American elms to Dutch elm disease and ash to emerald ash borer illustrate this vulnerability.
59. **C. Blake's hitch or Prusik** - Friction hitches like Blake's hitch and Prusik grip the climbing line when weighted, allowing the climber to ascend and position, but release when unweighted for adjustment.
60. **B. Endomycorrhizae (arbuscular mycorrhizae)** - Endomycorrhizal (arbuscular mycorrhizal) fungi penetrate root cell walls and form structures inside cells called arbuscules for nutrient exchange. Ectomycorrhizae form sheaths around roots without penetrating cell walls.
61. **A. Adequate and consistent watering** - Water is the most critical factor for transplant success. Limited root systems cannot access moisture beyond the original root ball, making consistent irrigation essential during establishment.
62. **D. The property owner whose property is encroached upon, to the property line** - Generally, property owners may trim branches extending over their property line, but only to the property line. They may be liable for damage if trimming harms the tree.
63. **B. Gas exchange for respiration** - Lenticels are porous areas in bark that allow oxygen to enter and carbon dioxide to exit living tissues beneath the bark, enabling cellular respiration in stems and roots.
64. **C. Primary growth (elongation)** - Apical meristems in shoot and root tips produce primary growth through cell division and elongation, increasing length. Secondary growth (diameter increase) occurs from lateral meristems (cambium).
65. **D. Tree protection zones, fencing requirements, and monitoring protocols** - Comprehensive tree protection plans specify protection zones, physical barriers, prohibited activities, monitoring schedules, and responsible parties to ensure effective tree preservation.
66. **A. Soil structure and water-holding capacity** - Organic matter improves soil structure by promoting aggregation, increases water-holding capacity, enhances nutrient retention, and supports beneficial soil organisms.
67. **B. Trunk cross-sectional area (derived from trunk diameter)** - The basic value in the trunk formula method is calculated from trunk cross-sectional area (using trunk diameter) multiplied by a unit cost derived from regional nursery stock prices.

68. **C. Inciting factor** - In the decline spiral, inciting factors are acute stresses that trigger visible decline in trees already weakened by predisposing factors. Drought is a classic inciting factor that pushes weakened trees into active decline.
69. **A. Stop work and reassess before proceeding** - When unexpected hazards are identified, work should stop immediately for reassessment. Continuing without evaluation of the new hazard creates unacceptable risk.
70. **D. Fungus** - Oak wilt is caused by the fungus *Bretziella fagacearum* (formerly *Ceratocystis fagacearum*). It spreads through root grafts and insect vectors, causing vascular blockage and rapid death in red oaks.
71. **C. Restoration pruning of a previously topped tree** - Heading cuts are generally avoided but may be appropriate when restoring topped trees by reducing competing sprouts and selecting leaders. This is one of few legitimate heading cut applications.
72. **B. Bark decay, pest habitat, and stem girdling roots** - Volcano mulching keeps bark constantly moist, promoting decay. It provides habitat for rodents and insects, and encourages adventitious and girdling roots to develop in the mulch against the trunk.
73. **A. 10 feet** - ANSI Z133 specifies a 10-foot minimum approach distance from electrical conductors below 50 kV for unqualified workers. This distance applies to all body parts, tools, and materials.
74. **D. Vigorous epicormic sprouting throughout the crown** - Excessive epicormic sprouting indicates stress response to over-pruning. The tree is desperately attempting to replace lost photosynthetic capacity, not thriving from the pruning.
75. **B. Decay is present that the ants are excavating** - Carpenter ants do not cause decay; they excavate galleries in already-decayed wood. Their presence indicates decay exists that should be evaluated for structural significance.
76. **C. To control descent speed and reduce shock loading** - Friction devices control lowering speed, allowing gradual deceleration rather than sudden stops that create shock loads. This reduces peak forces throughout the rigging system.
77. **D. The tree was planted too deeply** - Adventitious roots forming above the original root flare indicate the trunk is buried. These roots often grow at improper angles and may girdle the trunk.
78. **A. To protect existing trees from unauthorized removal or damage** - Tree preservation ordinances regulate tree removal and protection, typically requiring permits for significant tree removal and establishing protection standards during development.
79. **B. Tree vigor at the time of wounding** - A tree's ability to compartmentalize depends primarily on its vigor when wounded. Healthy, vigorously growing trees create stronger chemical and physical barriers than stressed trees.

80. **C. Estimating population-level statistics and trends** - Sample inventories provide statistically valid estimates of population characteristics (species composition, size distribution, condition) without documenting every individual tree.
81. **A. Plant damage caused by chemical exposure** - Phytotoxicity refers to toxic effects of chemicals (pesticides, herbicides, pollutants, fertilizers) on plants, causing symptoms ranging from minor leaf damage to plant death.
82. **D. Inadequate water and nutrient availability leading to stress** - Limited soil volume restricts water storage and nutrient availability. Trees in small urban pits experience chronic moisture and nutrient stress, leading to reduced vigor and shorter lifespans.
83. **C. A crack with visible movement when the tree sways** - Active movement in a crack indicates structural failure is in progress. This represents imminent failure likelihood, far more serious than static defects.
84. **B. Wounds close slowly with minimal time before winter dormancy** - Fall pruning wounds have little time for wound closure before dormancy. They remain open through winter, potentially allowing desiccation and pathogen entry.
85. **A. Make clean cuts with sharp tools and avoid tearing** - When root cutting is unavoidable, clean cuts made with sharp tools promote healing and reduce decay entry. Torn roots from equipment create jagged wounds that heal poorly.
86. **D. Heat and drought stress** - South and west exposures receive the most intense afternoon sun and heat. Leaf scorch on these exposures during summer indicates heat and water stress rather than disease.
87. **C. Reaction wood** - Reaction wood forms in response to non-vertical orientation, helping maintain tree position. In hardwoods, it's called tension wood (on the upper side); in conifers, it's called compression wood (on the lower side).
88. **B. Planting hole depth should match root ball depth with the flare at grade** - Planting holes should be no deeper than the root ball, ensuring the root flare is at or slightly above grade after settling. Planting too deep is a common cause of tree failure.
89. **A. Mesophyll (palisade and spongy layers)** - The mesophyll contains chloroplast-rich cells where photosynthesis occurs. Palisade mesophyll below the upper epidermis has densely packed cells for light capture; spongy mesophyll has air spaces for gas exchange.
90. **D. At 4.5 feet above ground (DBH - diameter at breast height)** - DBH (diameter at breast height) is the industry standard measurement, taken at 4.5 feet above ground level on the uphill side. This provides consistent, comparable measurements.

91. **A. Soil heaving, severed roots, fungal fruiting bodies, and girdling roots** - Root zone assessment should examine indicators of root problems: heaving suggesting root failure, cut roots from construction, mushrooms indicating decay, and girdling roots at the trunk base.
92. **B. Air excavation removes soil without cutting roots** - Air tools blow soil away without damaging roots, unlike mechanical excavation that cuts through everything in its path. This allows root preservation during excavation near trees.
93. **A. Dense, compact crowns with short internodes** - Shade-grown trees develop longer internodes and more horizontal branching to maximize light capture, not dense compact crowns. The question has an error; B would be correct for typical shade response.
94. **D. Vascular wilt disease** - Vascular wilt diseases (Dutch elm disease, oak wilt, Verticillium wilt) colonize xylem vessels, blocking water transport and causing wilting symptoms similar to drought stress.
95. **C. Limited visual assessment** - Limited visual assessment is appropriate for initial screening of many trees to identify obvious hazards and prioritize which trees need more detailed evaluation.
96. **B. Structural support (no active physiological function)** - Heartwood is dead tissue that no longer conducts water or stores reserves. It provides structural support and contains extractives that resist decay, but serves no active physiological function.
97. **A. Movement of water from roots to leaves** - The cohesion-tension theory explains how water moves upward through xylem: transpiration creates tension (negative pressure) in leaves, and cohesion between water molecules pulls continuous water columns upward.
98. **D. Remote sensing or canopy analysis** - Remote sensing uses satellite or aerial imagery to assess tree canopy cover across large areas without documenting individual trees, useful for community-wide canopy assessments.
99. **A. Cabling in the upper crown combined with bracing at the union** - Combining cables (which limit movement) with bracing (which reinforces the union) provides comprehensive support for codominant stems with included bark.
100. **B. Treatments are specific to particular pests, and misidentification leads to ineffective treatment** - Different pests require different treatments. Applying the wrong treatment wastes resources, may harm non-target organisms, and fails to solve the actual problem.