FULL-LENGTH PRACTICE TESTS

PRACTICE TEST 11 - 100 QUESTIONS

1. What lateral meristem is responsible for producing cork cells that form the outer bark?

A. Vascular cambium

B. Apical meristem

C. Pericycle

D. Cork cambium (phellogen)

2. According to ANSI Z133, workers operating chain saws during felling must wear what lower body protection?

A. Steel-toed boots only

B. Leg protection designed to reduce chain saw injury

C. No specific leg protection required

D. Leather chaps only during winter

3. A soil that drains quickly but has low water-holding capacity and low nutrient retention is most likely what texture?

A. Clay

B. Silt loam

C. Sand

D. Clay loam

4. Trees that maintain a strong central leader with pyramidal form throughout their life have what growth habit?

A. Excurrent

B. Decurrent

C. Spreading

D. Rounded

5. What is the purpose of the three-cut method when removing large branches?

A. To speed up the pruning process

B. To create a flush cut

C. To leave a protective stub

D. To prevent bark tearing on the trunk

6. Crown reduction is performed to accomplish what objective?

A. Remove dead branches throughout crown

B. Reduce the height and/or spread of the tree

C. Increase crown density

D. Provide clearance beneath the crown

7. What does soil porosity measure?

A. The percentage of soil volume occupied by pore spaces

B. The nutrient content of soil

C. The color of soil particles

D. The age of soil formation

8. In the CODIT model, which wall is formed by the tree's response in ray cells to limit lateral decay spread?

A. Wall 1

B. Wall 2

C. Wall 3

D. Wall 4

9. White mycelial fans found beneath the bark of a declining tree are diagnostic of what disease?

A. Dutch elm disease

B. Armillaria root rot

C. Oak wilt

D. Bacterial leaf scorch

10. What is the minimum required diameter for a secondary or backup tie-in point when climbing?

A. 6 inches

B. 2 inches

C. Equal to primary tie-in

D. 4 inches of live, sound wood

11. Water molecules moving through xylem are held together by what property?

A. Cohesion (attraction between water molecules)

B. Root pressure

C. Osmotic gradient

D. Active transport

12. What problems result from applying mulch directly against tree trunks?

A. Improved moisture retention

B. Enhanced root development

C. Bark decay, rodent damage, and girdling root development

D. Better weed suppression

13. A pinnately compound leaf has leaflets arranged in what pattern?

A. Radiating from a single point

B. Along a central rachis (axis)

C. In whorls of three

D. Alternating on the stem

14. Thousand cankers disease affects what tree genus and is associated with what vector?

A. Quercus; bark beetles

B. Fraxinus; emerald ash borer

C. Ulmus; elm bark beetles

D. Juglans (walnut); walnut twig beetle

15. What should be done if a tie-in point shows any sign of weakness during load testing?

A. Select a different anchor point

B. Add more wraps to the friction hitch

C. Proceed with extra caution

D. Continue if the weakness seems minor

16. Dynamic cabling systems differ from standard cabling by providing what?

A. More rigid support

B. Ground anchoring

C. Shock absorption allowing some movement before engaging

D. Direct attachment to the trunk

17. The pericycle in roots is responsible for initiating the development of what structures?

A. Root hairs

B. Root cap

C. Mycorrhizal connections

D. Lateral roots

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

A. Auxin

B. Ethylene

C. Gibberellin

D. Cytokinin

19. An increment borer is used to collect samples for determining what?

A. Tree age and growth rate

B. Soil nutrients

C. Leaf chlorophyll content

D. Root depth

20. Boring insects damage trees by doing what?

A. Consuming leaf tissue

B. Sucking plant fluids

C. Tunneling into wood or bark tissue

D. Creating leaf galls

21. Wound compartmentalization is more effective in trees that are in what condition?

A. Stressed and declining

B. Dormant

C. Recently transplanted

D. Healthy and vigorously growing

22. Verticillium wilt typically causes what characteristic symptom pattern?

A. Uniform crown dieback

B. Wilting and dieback often on one side of the tree first

C. Root rot with mushrooms at base

D. Powdery coating on leaves

23. In tree risk assessment, what three factors combine to determine overall risk rating?

A. Likelihood of failure, likelihood of impact, and consequences

B. Species, age, and location

C. Height, diameter, and crown spread

D. Soil type, drainage, and exposure

24. Lenticels on bark and young stems function primarily for what purpose?

A. Water absorption

B. Photosynthesis

C. Gas exchange

D. Nutrient storage

25. A tree with sparse foliage, small leaves, early fall color, and twig dieback over several years is exhibiting what condition?

A. Normal seasonal changes

B. Acute disease infection

C. Nutrient toxicity

D. Decline syndrome from chronic stress

26. The palisade mesophyll layer is adapted for what function?

A. Efficient light capture for photosynthesis

B. Water storage

C. Structural support

D. Gas exchange primarily

27. Construction damage to tree roots typically becomes visible in the crown after what time period?

A. Immediately

B. 1-5 years or more

C. 10-15 years

D. Never becomes visible

28. Iron deficiency symptoms appear on what part of the tree first?

A. Oldest leaves

B. Bark

C. Youngest leaves

D. Roots

29. Trees described as "poor compartmentalizers" respond to wounding in what way?

A. Rapid wound closure

B. Effective barrier formation

C. Strong decay resistance

D. Weak barriers allowing extensive decay spread

30. What is the most critical factor in successful tree transplanting?

A. Maintaining adequate moisture for the limited root system

B. Heavy fertilization at planting

C. Deep planting for stability

D. Immediate pruning of all branches

31. Soil compaction most severely affects tree roots by reducing what?

A. Nutrient availability

B. Oxygen availability and root penetration

C. Soil temperature

D. Soil pH

32. The final cut in the three-cut pruning method should be positioned where?

A. Flush with the trunk

B. Leaving a 2-inch stub

C. Just outside the branch collar

D. Through the branch bark ridge

33. What type of mycorrhizal association is most common in temperate hardwood forest trees like oaks and beeches?

A. Arbuscular mycorrhizae

B. Endomycorrhizae

C. Parasitic fungi

D. Ectomycorrhizae

34. What is the typical growth response following severe topping of a tree?

A. Rapid production of many weakly attached epicormic sprouts

B. Improved branch structure

C. Enhanced wound closure

D. Reduced maintenance needs

35. The 10-20-30 diversity rule sets what limit for family representation in urban forests?

A. 10 percent

B. 30 percent

C. 20 percent

D. 40 percent

36. What type of tree assessment involves detailed evaluation of individual trees including use of specialized diagnostic tools?

A. Limited visual assessment

B. Sample inventory

C. Advanced assessment

D. Windshield survey

37. Chlorosis appearing on older leaves while young leaves remain green indicates deficiency of what type of nutrient?

A. Mobile nutrients (nitrogen, magnesium, potassium)

B. Immobile nutrients only

C. All micronutrients

D. Calcium exclusively

38. What is the minimum approach distance from electrical conductors for unqualified workers at voltages below 50 kV?

A. 5 feet

B. 15 feet

C. 25 feet

D. 10 feet

39. Stem-girdling roots most commonly develop from what cause?

A. Natural root growth patterns

B. Container production defects or deep planting

C. Excessive fertilization

D. Overwatering

40. A tree with structural defects but no target in the potential failure zone has what risk classification?

A. High risk requiring immediate action

B. Extreme risk

C. Low or no risk (no target = no risk)

D. Moderate risk

41. Phloem tissue is located in what position relative to the vascular cambium?

A. To the outside (toward the bark)

B. To the inside (toward the center)

C. Mixed within the xylem

D. Only in roots

42. How long does tree establishment typically take for a transplanted tree?

A. 2-4 weeks

B. One growing season

C. 6 months

D. 1-3 years depending on tree size

43. Severing roots on one side of a tree will cause decline symptoms to appear where in the crown?

A. Uniformly throughout

B. On the corresponding side

C. On the opposite side

D. At the top only

44. Phytophthora root rot thrives under what soil conditions?

A. Dry, well-drained soils

B. Neutral pH soils

C. Wet, poorly drained soils

D. Sandy soils

45. In the trunk formula method of tree appraisal, what does multiplying basic value by condition rating account for?

A. Reductions in value due to health problems or structural defects

B. Species characteristics only

C. Location factors only

D. Age of the tree

46. A Level 1 limited visual assessment is most appropriate for what situation?

A. Post-failure investigation

B. Evaluating a single high-value tree

C. Detailed decay mapping

D. Screening large populations to identify trees needing further evaluation

47. Job briefings before tree work should be repeated when what occurs?

A. Every hour regardless of conditions

B. When conditions change significantly

C. Only at the start of each day

D. Never during ongoing work

48. What anatomical structure enables trees to close wounds effectively?

A. Heartwood regeneration

B. Pith expansion

C. Cambium producing callus tissue at wound margins

D. Bark splitting and repair

49. Radial trenching in the root zone can help remediate what soil problem?

A. Compaction

B. Excessive drainage

C. High pH

D. Nutrient toxicity

50. What is the primary goal of urban forest management diversity standards?

A. Reducing maintenance costs

B. Aesthetic uniformity

C. Simplified inventory

D. Resilience against catastrophic pest/disease losses

51. What is the correct procedure for removing guy wires from established trees?

A. Cut wires and leave hardware in trunk

B. Remove completely including hardware before it becomes embedded

C. Leave permanently for ongoing support

D. Tighten annually

52. Crown cleaning specifically targets removal of what types of branches?

A. Lower branches only

B. Branches to reduce size

C. Dead, dying, diseased, broken, and weakly attached branches

D. All interior branches

53. Prolonged stomatal closure during drought leads to what physiological consequence?

A. Depleted carbohydrate reserves from reduced photosynthesis

B. Increased photosynthesis

C. Enhanced root growth

D. Improved disease resistance

54. Conservation biological control involves what approach?

A. Importing new natural enemy species

B. Applying microbial pesticides

C. Using pheromone traps

D. Protecting and enhancing existing natural enemy populations

55. The branch collar is located at what position on a branch?

A. At the tip of the branch

B. At the base where the branch attaches to the trunk

C. Along the middle of the branch

D. At branch intersections only

56. For voltages above 50 kV, the minimum approach distance increases by how much for each 10 kV increment?

A. 2 inches

B. 6 inches

C. 4 inches

D. 8 inches

57. What distinguishes a thinning cut from a heading cut?

A. Thinning cuts remove branches at their point of origin

B. Thinning cuts leave stubs

C. Heading cuts are always preferable

D. They are identical techniques

58. Tissue (foliar) analysis is particularly useful when what situation exists?

A. Soil tests are unavailable

B. Trees are newly planted

C. Root systems are healthy

D. Soil tests show adequate nutrients but trees show deficiency symptoms

59. What climbing technique uses two separate climbing systems for primary and secondary attachment?

A. Single rope technique

B. Doubled rope technique (DRT/MRS)

C. Modified rope technique

D. Secured footlock

60. What is the primary emphasis of plant health care programs?

A. Reactive pest treatment

B. Calendar-based applications

C. Prevention and maintaining plant vigor

D. Removing affected plants

61. Why are wounds on scaffold branches less structurally critical than basal trunk wounds?

A. They affect a smaller portion of the tree's structural load path

B. They are more visible

C. They never develop decay

D. They close faster

62. Earlywood (springwood) cells differ from latewood (summerwood) cells in what way?

A. Earlywood cells are always dead

B. Latewood cells are larger

C. There is no difference

D. Earlywood cells are larger with thinner walls

63. Training young trees through structural pruning primarily aims to achieve what goal?

A. Increase flower production

B. Develop strong architecture with well-spaced scaffold branches

C. Reduce tree height permanently

D. Remove all lower branches

64. Bacterial wetwood (slime flux) is characterized by what symptom?

A. White powdery growth

B. Leaf spots

C. Foul-smelling liquid oozing from wounds or cracks

D. Gall formation

65. What is the primary function of tree risk assessment?

A. Identify trees with potential to fail and cause harm for informed management decisions

B. Determine tree age

C. Calculate tree value

D. Plan pruning schedules

66. Certified arborist credentials require what for maintenance?

A. No requirements after initial certification

B. One-time exam only

C. Annual fee only

D. Continuing education units (CEUs) and recertification

67. What is the purpose of the feed control bar on a wood chipper?

A. Adjust chip size

B. Stop or reverse feed mechanism if contacted

C. Direct discharge direction

D. Increase feed speed

68. The target in tree risk assessment refers to what?

A. The tree being evaluated

B. The assessment method used

C. What could be harmed if the tree fails

D. The defect identified

69. Proper rigging technique requires consideration of what factors?

A. Load weight, rope and equipment ratings, anchor strength, and dynamic forces

B. Tree species only

C. Time of day

D. Weather forecast only

70. What is the effect of removing more than 25% of live crown from a mature tree?

A. Improved tree structure

B. Enhanced wound closure

C. Better pest resistance

D. Stress response including reduced energy reserves and possible epicormic sprouting

71. Soil pH affects nutrient availability in what way?

A. pH has no effect on nutrients

B. Certain nutrients become unavailable at high or low pH

C. All nutrients are equally available at any pH

D. Only nitrogen is affected by pH

72. What is the proper treatment for a flush cut that has damaged the trunk?

A. Apply wound dressing immediately

B. Cut away the damaged tissue

C. Allow the tree to respond naturally; no treatment improves outcomes

D. Paint with fungicide

73. Ectomycorrhizal fungi benefit trees primarily by enhancing uptake of what?

A. Water and mineral nutrients, especially phosphorus

B. Carbohydrates

C. Oxygen

D. Carbon dioxide

74. What determines whether a tree is a "hazard tree" under risk assessment terminology?

A. Tree species alone

B. Tree age only

C. Location in a park

D. Presence of both significant defects AND a target that could be harmed

75. Trees should not be climbed for assessment when what condition exists?

A. Moderate wind

B. Evidence of severe structural compromise or imminent failure

C. Previous pruning

D. Presence of lichen

76. What rigging scenario creates the highest dynamic forces?

A. Controlled lowering

B. Pieces hung in rope without dropping

C. Free-falling pieces stopped suddenly (shock loading)

D. Slow descent

77. What is the most effective long-term strategy for managing emerald ash borer in urban forests?

A. Species diversity including phased removal and replacement of ash

B. Treating all ash trees indefinitely

C. Ignoring the pest

D. Removing all ash immediately

78. The working load limit (WLL) of rigging equipment is typically what fraction of its breaking strength?

A. One-half

B. Three-quarters

C. Equal to breaking strength

D. One-fifth or less for adequate safety margin

79. What symptom distinguishes bacterial leaf scorch from drought-induced leaf scorch?

A. Uniform leaf browning

B. A yellow or reddish halo between dead and green tissue

C. Wilting recovery overnight

D. Symptoms appear in spring

80. Crown raising provides what benefit?

A. Reduced crown density

B. Improved branch structure

C. Vertical clearance beneath the crown

D. Decreased overall height

81. What is the function of the tree protection zone (TPZ) during construction?

A. Protect trunk only from physical impact

B. Mark trees for removal

C. Indicate property boundaries

D. Identify where equipment, storage, and excavation are prohibited

82. Anthracnose diseases are favored by what weather conditions?

A. Hot, dry weather

B. Cold, dry winter conditions

C. Warm, windy conditions

D. Cool, wet spring weather

83. Root pruning before transplanting is performed to accomplish what?

A. Reduce tree size

B. Stimulate fibrous root growth within the future root ball

C. Remove diseased roots

D. Improve fall color

84. What information does a soil test provide that is useful for tree care?

A. Tree age

B. Root distribution

C. pH, nutrient levels, and organic matter content

D. Photosynthesis rate

85. Lightning protection systems for trees should include what components?

A. Air terminals, conductor, and ground rods

B. Cables only

C. Ground rods only

D. Air terminals only

86. What condition indicates a climbing line should be retired?

A. Minor surface fuzz

B. Slight color fading

C. Normal flexibility

D. Core damage, significant sheath wear, or contamination

87. Proper mulch application provides what benefits?

A. Should contact trunk for moisture

B. Conserves moisture, moderates temperature, and improves soil

C. Should be piled as deeply as possible

D. Eliminates need for watering

88. What type of root system do most landscape trees develop?

A. Deep taproot system

B. Roots only under the canopy

C. Shallow, spreading lateral root system

D. Roots only near the trunk

89. Pre-climb inspection should identify what hazards?

A. Structural defects, dead branches, electrical conductors, wildlife, and overall condition

B. Tree species only

C. Soil type

D. Property boundaries

90. The "10-20-30 rule" in urban forestry establishes limits at what taxonomic levels?

A. Only species level

B. Only genus level

C. Only family level

D. Species, genus, and family levels

91. What causes the characteristic "flagging" symptom in oak wilt affected red oaks?

A. Wind damage

B. Rapid wilting and browning of leaves on individual branches

C. Frost injury

D. Nutrient deficiency

92. Cabling systems should be inspected at what minimum interval?

A. Every 5 years

B. Every 10 years

C. Annually and after major storms

D. Monthly

93. What is the primary purpose of establishing a critical root zone (CRZ)?

A. Define the root protection area during construction

B. Calculate fertilizer rates

C. Determine watering schedules

D. Establish property boundaries

94. Girdling by stem-girdling roots causes tree decline by doing what?

A. Introducing disease

B. Causing nutrient toxicity

C. Increasing water uptake

D. Restricting water and nutrient flow through the trunk

95. What distinguishes pollarding from topping?

A. They are identical practices

B. Pollarding is a planned, ongoing maintenance system initiated on young trees

C. Topping is always acceptable

D. Pollarding is only done once

96. The load in rigging operations should never exceed what value?

A. The tree's total weight

B. Twice the rope strength

C. The working load limit of the weakest component in the system

D. Any specified limit

97. What symptom pattern is characteristic of vascular wilt diseases?

A. Vascular streaking in the sapwood and wilting

B. Leaf spots

C. Powdery growth on leaves

D. Root galls

98. Urban tree inventories support management by providing what?

A. Legal property surveys

B. Aesthetic ratings only

C. Construction permits

D. Data for planning, budgeting, maintenance scheduling, and risk management

99. What is the proper response if a tree begins to move unexpectedly during felling?

A. Continue cutting to finish quickly

B. Immediately retreat along planned escape route

C. Stand directly behind the tree

D. Attempt to push the tree

100. Trees respond to wounding primarily through what process?

A. Regenerating lost tissue

B. Healing wounds completely

C. Compartmentalization—walling off damaged tissue

D. Shedding affected parts

PRACTICE TEST 11: ANSWER KEY WITH EXPLANATIONS

1. **D. Cork cambium (phellogen)** - The cork cambium, also called phellogen, is the lateral meristem responsible for producing cork cells (phellem) that form the outer protective bark. It produces cork cells toward the outside and phelloderm toward the inside. Cork cells are dead at maturity with cell walls impregnated with suberin, a waxy waterproof substance. The cork cambium, cork, and phelloderm together constitute the periderm, which replaces the epidermis as stems and roots increase in diameter through secondary growth.

2. **B. Leg protection designed to reduce chain saw injury** - ANSI Z133 requires workers operating chain saws during felling to wear leg protection (chaps or pants) specifically designed to reduce the severity of chain saw injuries. These protective garments contain layers of cut-resistant material that, when contacted by a moving chain, pull out and jam the saw mechanism. Leg injuries from chain saws can be devastating, involving major arteries; proper protective equipment significantly reduces injury severity. This requirement applies to felling and other high-risk chain saw operations.

3. **C. Sand** - Sandy soils have large particle sizes (0.05-2.0 mm) that create large pore spaces. Water drains rapidly through these pores, giving sandy soils excellent drainage but poor water-holding capacity. The limited particle surface area also means low cation exchange capacity (CEC), so sandy soils hold few nutrients. Trees in sandy soils often require more frequent irrigation and may need supplemental fertilization. However, the excellent aeration of sandy soils benefits root respiration and reduces risk of waterlogging.

4. **A. Excurrent** - Excurrent growth form describes trees that maintain a single dominant central leader extending to the apex, creating a pyramidal or conical crown shape. This form is typical of many conifers (pines, spruces, firs) and some hardwoods like sweetgum and tulip poplar. Apical dominance—where auxin from the terminal bud suppresses lateral branch growth—maintains this form. Understanding growth habits helps predict structural development and guides pruning decisions for young trees.

5. **D. To prevent bark tearing on the trunk** - The three-cut method prevents bark tearing (stripping) that occurs when heavy branches fall before the cut is complete. The first cut (undercut) is made on the bottom of the branch, partway through; the second cut removes most of the branch from the top, slightly farther from the trunk, allowing it to fall without tearing bark; the third cut removes the remaining stub just outside the branch collar. This technique protects trunk tissue that would be damaged by bark stripping.

6. **B. Reduce the height and/or spread of the tree** - Crown reduction is a pruning operation that reduces the overall size of the crown—its height, spread, or both. According to ANSI A300, reduction must be accomplished using reduction cuts to lateral branches at least one-third the diameter of the removed branch. These laterals can assume the terminal role, maintaining natural form while achieving smaller size. Crown reduction differs from topping, which uses heading cuts and creates serious problems.

7. **A. The percentage of soil volume occupied by pore spaces** - Soil porosity is the proportion of soil volume consisting of pore spaces (voids) between solid particles. These pores contain air and water essential for root function. Ideal soil has approximately 50% solid particles and 50% pore space, with pores roughly evenly divided between air-filled and water-filled. Compaction reduces porosity by collapsing pore spaces, directly limiting oxygen availability and root penetration.

8. **C. Wall 3** - In the CODIT (Compartmentalization of Decay in Trees) model, Wall 3 consists of ray parenchyma cells that limit the lateral (tangential) spread of decay around the trunk's circumference. Rays extend radially from the trunk center outward; they create compartments like slices of a pie, limiting decay spread from one "slice" to another. Wall 3 is generally more effective than Walls 1 and 2, though Wall 4 (the barrier zone of new growth) is typically strongest.

9. **B. Armillaria root rot** - White mycelial fans found beneath the bark of declining trees are diagnostic of Armillaria species (honey fungus), aggressive root rot pathogens. These fans grow between bark and wood, appearing as white, fan-shaped sheets with a characteristic mushroom odor. Other Armillaria signs include black rhizomorphs ("shoestrings") in soil and honey-colored mushroom clusters at tree bases in autumn. Armillaria can kill healthy trees and spreads through root contact and rhizomorphs.

10. **D. 4 inches of live, sound wood** - Both primary and secondary (backup) tie-in points should meet the same minimum standard: 4 inches of live, sound wood at the attachment point with secure connection to the parent stem. Secondary tie-in points provide backup if the primary fails; if the secondary were weaker, it would not provide adequate protection. Both anchor points should be tested before committing weight and should be free of decay, cracks, and structural defects.

11. **A. Cohesion (attraction between water molecules)** - The cohesion-tension theory explains that water molecules in xylem are held together by cohesion—hydrogen bonds that attract water molecules to each other, creating continuous columns. These columns are pulled upward by tension created by transpiration from leaves. Adhesion (attraction to vessel walls) also helps maintain these columns. This passive mechanism can lift water over 300 feet without the tree expending energy.

12. **C. Bark decay, rodent damage, and girdling root development** - Mulch piled against tree trunks ("volcano mulching") causes multiple serious problems: constant moisture against bark promotes decay that can progress into wood; the warm, moist environment attracts rodents (voles, mice) that gnaw bark, potentially girdling the tree; and roots growing into the mulch layer may develop as

stem-girdling roots. Proper mulching maintains a 3-6 inch gap between mulch and trunk with 2-4 inches depth.

13. **B. Along a central rachis (axis)** - Pinnately compound leaves have multiple leaflets arranged along a central axis called the rachis, resembling a feather pattern. Examples include ash, walnut, hickory, and black locust. This differs from palmately compound leaves, where leaflets radiate from a single point at the petiole tip (like buckeye). Distinguishing compound leaf types and identifying individual leaflets versus simple leaves is essential for accurate tree identification.

14. **D. Juglans (walnut); walnut twig beetle** - Thousand cankers disease affects walnut trees (Juglans species), particularly black walnut. It involves a complex of the walnut twig beetle (Pityophthorus juglandis) and the fungus Geosmithia morbida. Beetles bore into branches and twigs, introducing the fungus, which creates small cankers. Thousands of these cankers coalesce, girdling branches and eventually the trunk. The disease has spread from the western United States eastward into native black walnut range.

15. **A. Select a different anchor point** - If a tie-in point shows any sign of weakness during load testing—movement, sounds, cracking, or visual changes—it must be abandoned immediately. Never proceed with a questionable anchor point, regardless of how minor the weakness appears. Select a different anchor and test it before committing weight. The consequences of tie-in point failure during climbing can be catastrophic; no anchor is worth the risk if it shows any sign of compromise.

16. **C. Shock absorption allowing some movement before engaging** - Dynamic cabling systems (such as Cobra and similar products) use materials that stretch, allowing limbs to move naturally before the cable engages. This contrasts with standard steel cables that are installed with specific tension and engage immediately when movement begins. Dynamic systems may be more appropriate for maintaining natural movement patterns while still providing support to reduce likelihood of failure during severe loading.

17. **D. Lateral roots** - The pericycle is a layer of cells inside the root, between the endodermis and vascular tissue, that retains the ability to divide (meristematic capability). When lateral root formation is initiated, pericycle cells begin dividing to form a new root primordium that grows outward through the cortex and epidermis. This internal origin explains why lateral roots emerge from within the parent root rather than from surface tissues.

18. **B. Ethylene** - Ethylene is a gaseous plant hormone that promotes fruit ripening, flower senescence, and leaf abscission (dropping). It is produced in response to various stresses including wounding, flooding, and senescence. Ethylene triggers the formation of the abscission zone at leaf bases, leading to leaf fall. In fruit ripening, ethylene promotes color changes, softening, and flavor development. One ripe fruit can stimulate ripening of others through ethylene release.

19. **A. Tree age and growth rate** - An increment borer extracts a thin cylindrical core of wood from the trunk, allowing examination of annual growth rings without seriously damaging the tree.

Counting rings provides tree age (at core height); measuring ring widths reveals growth rate patterns over time. Narrow rings indicate stress years (drought, defoliation, competition); wide rings indicate favorable conditions. Core samples can also reveal injury history and decay presence.

20. **C. Tunneling into wood or bark tissue** - Boring insects (beetles, moths, wasps) have larvae that tunnel into wood, bark, or cambium tissue. These tunnels (galleries) disrupt vascular function and structural integrity. Some borers vector diseases (bark beetles carry Dutch elm disease; emerald ash borer destroys ash cambium). Boring insect damage often becomes visible as decline, dieback, or bark abnormalities. Exit holes indicate adult emergence; frass (sawdust-like material) indicates active tunneling.

21. **D. Healthy and vigorously growing** - Compartmentalization effectiveness depends heavily on tree health and vigor at the time of wounding. Vigorous trees have more resources to invest in chemical barriers and can produce callus tissue more rapidly. Wall 4 (barrier zone) strength particularly depends on growth rate—faster-growing trees produce stronger barriers. Stressed trees lack energy for effective compartmentalization, explaining why wounds on declining trees often lead to extensive decay.

22. **B. Wilting and dieback often on one side of the tree first** - Verticillium wilt, caused by soil-borne fungi (Verticillium dahliae and V. albo-atrum), characteristically affects one side or portion of the crown before spreading, creating asymmetric symptoms. This pattern results from the pathogen entering through roots and colonizing xylem vessels on one side of the trunk. Olive or brown vascular streaking visible when branches are cut confirms diagnosis. Many tree species are susceptible, including maple, ash, and catalpa.

23. **A. Likelihood of failure, likelihood of impact, and consequences** - Tree risk assessment integrates three factors: likelihood of failure (probability the tree or part will fail, based on defects, loading, and species characteristics); likelihood of impact (probability that failure will strike the target, based on target location and occupancy); and consequences (severity of harm if impact occurs, based on target type and failure size). All three components must be evaluated to determine overall risk rating.

24. **C. Gas exchange** - Lenticels are specialized porous areas in bark that allow gas exchange between living cells and the external atmosphere. They appear as raised dots, lines, or corky areas on bark surfaces. As bark develops and the epidermis is replaced by cork, lenticels provide the pathway for oxygen to reach living cells and carbon dioxide to escape. Some species have very prominent lenticels (cherries, birches) that aid identification.

25. **D. Decline syndrome from chronic stress** - Progressive symptoms developing over multiple years—crown thinning, small leaves, early fall color, twig dieback, reduced growth—characterize tree decline. Decline typically results from accumulated chronic stresses: soil compaction, restricted rooting space, grade changes, repeated drought, root damage, or pollution. Unlike acute

problems with rapid onset, decline develops gradually and is often difficult to reverse once advanced. Early intervention to reduce stress offers the best prognosis.

26. **A. Efficient light capture for photosynthesis** - The palisade mesophyll consists of columnar, tightly packed cells oriented perpendicular to the leaf surface, optimizing light capture for photosynthesis. These cells contain abundant chloroplasts and are typically located just beneath the upper epidermis where light intensity is greatest. The palisade layer's organization maximizes the amount of chlorophyll exposed to incoming light, making it the primary site of photosynthetic activity in most leaves.

27. **B. 1-5 years or more** - Construction damage to tree roots often does not become visible in the crown for 1-5 years or longer. Trees have stored resources that temporarily mask the effects of root loss, and the crown may appear healthy initially. As stored reserves deplete and remaining roots cannot meet the crown's needs, decline symptoms gradually appear. This delayed response means construction damage often isn't connected to tree decline years later, complicating diagnosis and responsibility determination.

28. **C. Youngest leaves** - Iron is an immobile nutrient—it cannot be translocated from older tissue to support new growth. When iron is deficient, developing leaves cannot obtain it from existing plant reserves, so deficiency symptoms appear on the youngest leaves first. Classic iron deficiency symptoms include interveinal chlorosis (yellowing between veins while veins remain green) on new growth. Deficiency often results from high soil pH making iron chemically unavailable rather than actual absence.

29. **D. Weak barriers allowing extensive decay spread** - Tree species vary significantly in compartmentalization ability. Poor compartmentalizers (willows, poplars, birches) form weak chemical and physical barriers that allow decay to spread extensively from wounds. This means wounds on these species are more likely to result in significant internal decay. Understanding species-specific compartmentalization ability helps arborists predict wound response and guides pruning decisions—smaller cuts are especially important on poor compartmentalizers.

30. **A. Maintaining adequate moisture for the limited root system** - Transplanting removes 90-95% of a tree's root system while the crown remains largely intact, creating severe imbalance between water demand (transpiration from existing foliage) and water supply (greatly reduced root capacity). The most critical factor for transplant success is maintaining adequate moisture in the root ball until new roots grow into surrounding soil and restore balance. Proper watering during establishment (1-3 years depending on tree size) is essential.

31. **B. Oxygen availability and root penetration** - Soil compaction collapses pore spaces, severely reducing oxygen availability for root respiration. Roots require oxygen to function; without it, they cannot absorb water and nutrients, and cells begin dying. Compaction also physically impedes root penetration, limiting the soil volume roots can explore. Compacted soil reduces water infiltration,

creating both drought stress (water runs off) and potential waterlogging in depressions. Compaction is easier to prevent than remediate.

32. **C. Just outside the branch collar** - The final cut in the three-cut method should be positioned just outside the branch collar, the swollen area at the branch base containing specialized tissue for compartmentalization and wound closure. This position preserves the collar's function while removing all branch tissue. Flush cuts damage trunk tissue and remove compartmentalization capability; stub cuts cannot close properly and invite decay entry. Proper cut placement is fundamental to good pruning practice.

33. **D. Ectomycorrhizae** - Ectomycorrhizal associations are most common in temperate forest trees including oaks, beeches, birches, pines, and willows. These fungi form a visible sheath (mantle) around root tips and grow between root cortex cells (forming the Hartig net) without penetrating cell walls. The fungal network dramatically extends the tree's absorptive surface area, enhancing water and mineral uptake (especially phosphorus). The tree provides carbohydrates to the fungus in return.

34. **A. Rapid production of many weakly attached epicormic sprouts** - Topping removes the dominant terminal buds that normally suppress dormant buds through apical dominance. Released from suppression, numerous dormant buds rapidly produce epicormic sprouts. These sprouts originate from near the bark surface (rather than from deep within branch tissue), creating inherently weak attachments. Multiple sprouts compete for dominance, often developing included bark. Topped trees become increasingly hazardous as sprouts grow larger.

35. **B. 30 percent** - The 10-20-30 diversity guideline establishes limits at three taxonomic levels: no single species should exceed 10% of the urban forest, no single genus should exceed 20%, and no single family should exceed 30%. This multi-level approach provides comprehensive protection against threats at various taxonomic levels—from species-specific problems to genus-level threats (like emerald ash borer affecting all Fraxinus species) to potential family-level vulnerabilities.

36. **C. Advanced assessment** - Advanced assessment (Level 3 in the ANSI A300 framework) involves detailed evaluation of individual trees using specialized diagnostic tools such as resistance drills, sonic tomographs, aerial inspection, or root crown excavation. This level is appropriate when visual assessment cannot determine conditions affecting management decisions—particularly when internal decay is suspected. Advanced assessment provides quantitative data to inform decisions about high-value trees or those with suspected but invisible defects.

37. **A. Mobile nutrients (nitrogen, magnesium, potassium)** - Mobile nutrients can be translocated from older tissue to support new growth. When these nutrients are deficient, the plant moves existing supplies from older leaves to developing leaves, causing deficiency symptoms to appear on older leaves first. Nitrogen deficiency causes general yellowing of older leaves; magnesium causes interveinal chlorosis on older leaves. Understanding nutrient mobility is essential for diagnosing deficiencies based on symptom location.

38. **D. 10 feet** - ANSI Z133 specifies that unqualified workers must maintain a minimum approach distance of 10 feet from electrical conductors at voltages below 50 kV. This distance applies to all body parts, tools, equipment, and materials being handled. Above 50 kV, the distance increases by 4 inches for each additional 10 kV. Only qualified line-clearance arborists with specific training may work within reduced distances from energized conductors.

39. **B. Container production defects or deep planting** - Stem-girdling roots most commonly develop from circling roots in containers that continue circling after planting, or from trees planted too deeply (which encourages adventitious roots that may grow tangentially). These roots gradually enlarge and compress the trunk or major roots, restricting water and nutrient flow. Girdling may take years or decades to cause visible decline, making it a hidden cause of tree problems that becomes apparent only upon root collar examination.

40. **C. Low or no risk (no target = no risk)** - Tree risk requires both a potential for failure AND a target that could be harmed if failure occurs. Without a target in the potential failure zone, there is no risk regardless of the tree's condition. A severely defective tree in a remote location with no people, property, or activities has no risk rating. Risk assessment resources should focus on trees where failure would actually cause harm, not simply on trees with structural defects.

41. **A. To the outside (toward the bark)** - The vascular cambium produces xylem (wood) toward the inside of the tree and phloem toward the outside (toward the bark). Phloem tissue conducts sugars produced by photosynthesis from leaves to other parts of the tree. Because phloem is located just inside the bark, girdling damage that removes bark also removes phloem, cutting off sugar supply to roots and eventually killing the tree. New phloem is produced annually as the tree grows.

42. **D. 1-3 years depending on tree size** - Tree establishment—the time required for roots to grow into surrounding soil and restore water supply balance—typically takes 1-3 years depending on tree size at transplanting. A general guideline is approximately one year per inch of trunk diameter. During establishment, trees require supplemental irrigation because the limited root system cannot meet the crown's water demands. After establishment, trees can typically survive on natural rainfall in most climates.

43. **B. On the corresponding side** - Root damage on one side of a tree affects the crown portion supplied by those roots. This root-crown correspondence results from vascular connections between specific root sectors and specific crown sections. Decline symptoms—wilting, scorch, reduced growth, dieback—appear on the side of the crown corresponding to the damaged roots while other portions remain healthier. This asymmetric pattern helps diagnose root problems not visible above ground.

44. **C. Wet, poorly drained soils** - Phytophthora species are oomycetes (water molds) that thrive in saturated soil conditions. Their swimming spores require water to disperse and infect roots. Poorly drained sites, overwatering, and flooding events create ideal conditions for Phytophthora root rot.

Symptoms include crown decline, root decay, and sometimes bleeding cankers on the trunk base. Species selection for drainage-appropriate trees and improving drainage help prevent this disease.

45. **A. Reductions in value due to health problems or structural defects** - The condition rating in the trunk formula method evaluates tree health (crown density, vigor, decline symptoms) and structural integrity (decay, cracks, weak attachments). Trees in excellent condition receive 100%; significant problems reduce the rating proportionally. A tree with 50% condition rating is worth only half what an identical healthy tree would be worth. This factor substantially impacts final appraised value.

46. **D. Screening large populations to identify trees needing further evaluation** - Level 1 limited visual assessment is a "walk-by" or "drive-by" survey appropriate for efficiently screening many trees to identify those with obvious defects requiring detailed inspection. It cannot provide detailed risk ratings for individual trees but can quickly categorize trees as "apparently low risk" or "needs further assessment." This approach efficiently allocates limited assessment resources where they're most needed.

47. **B. When conditions change significantly** - Job briefings should be repeated whenever conditions change significantly from those discussed in the initial briefing. Changes might include weather shifts, discovery of unexpected hazards, equipment problems, personnel changes, or revised work plans. A single morning briefing is insufficient if conditions change during the day. Effective communication about changed conditions prevents incidents resulting from outdated understanding.

48. **C. Cambium producing callus tissue at wound margins** - Trees close wounds through callus (woundwood) production by the vascular cambium at wound margins. Cambial cells around the wound edges divide, producing new tissue that gradually rolls over the wound surface from edges inward. The rate of closure depends on wound size and tree vigor—vigorous trees with rapid annual growth close wounds faster. Proper pruning that preserves the branch collar optimizes callus production.

49. **A. Compaction** - Radial trenching involves cutting narrow trenches radiating outward from the trunk through the root zone, loosening compacted soil and often filling trenches with amended soil or organic matter. This creates channels for air and water infiltration and pathways for root growth through otherwise impenetrable soil. Combined with surface organic matter application, radial trenching can gradually improve compacted root zones, though prevention remains preferable to remediation.

50. **D. Resilience against catastrophic pest/disease losses** - Urban forest diversity standards exist primarily to prevent devastating losses when species-specific threats arrive. The loss of American chestnut, American elm, and ash to pests and diseases demonstrates how monocultures are vulnerable. Diversity ensures no single pest or disease can eliminate more than a limited portion

of the urban forest, maintaining overall canopy cover and community benefits even during pest outbreaks.

51. **B. Remove completely including hardware before it becomes embedded** - Guy wires and staking should be removed completely after root establishment (typically 1-2 growing seasons), including all hardware, straps, and ties. Left in place, these materials can girdle expanding trunks, become embedded in bark creating wounds, and prevent proper trunk development. Trees need wind movement to develop trunk strength; permanent support prevents this response. Remove support systems on schedule to prevent damage.

52. **C. Dead, dying, diseased, broken, and weakly attached branches** - Crown cleaning specifically targets removal of dead, dying, diseased, crowded, weakly attached, broken, and crossing branches. This pruning type improves tree health by removing potential infection sources, enhances safety by removing branches likely to fail, and improves appearance by removing visually objectionable elements. Crown cleaning is appropriate for mature trees requiring maintenance and often combined with other pruning types.

53. **A. Depleted carbohydrate reserves from reduced photosynthesis** - When stomata close to conserve water during drought, carbon dioxide cannot enter leaves for photosynthesis. With photosynthesis reduced or stopped, the tree cannot produce carbohydrates to maintain functions and must draw on stored reserves. Prolonged stomatal closure depletes these reserves, reducing growth, weakening defenses against pests and pathogens, and potentially causing decline that persists even after drought ends. This explains why drought effects often extend beyond the drought period.

54. **D. Protecting and enhancing existing natural enemy populations** - Conservation biological control involves protecting, enhancing, and maintaining existing populations of natural enemies (predators, parasitoids, pathogens) already present in the environment. Techniques include providing habitat, avoiding broad-spectrum pesticides that kill beneficial insects, and planting vegetation that supports natural enemies. This approach is typically more sustainable than importing new species and forms the foundation of ecologically sound pest management.

55. **B. At the base where the branch attaches to the trunk** - The branch collar is a swollen ring of tissue at the base of a branch where it attaches to the parent stem. The collar contains overlapping trunk and branch tissue with specialized cells for compartmentalization and wound closure. Pruning cuts should be made just outside the collar to preserve its function. The collar is often more visible on the underside of horizontal branches and may be subtle or pronounced depending on species.

56. **C. 4 inches** - For voltages above 50 kV, the minimum approach distance increases by 4 inches for each additional 10 kV increment. For example, at 100 kV (50 kV above the threshold), the distance increases by 20 inches (4 inches × 5 increments of 10 kV), making the total minimum distance 10

feet plus 20 inches, or approximately 11 feet 8 inches. These distances protect against electrical arcing, which can occur over greater distances at higher voltages.

57. **A. Thinning cuts remove branches at their point of origin** - Thinning cuts remove branches entirely at their point of origin—either at the trunk or at a parent branch. This removes branches without stimulating excessive regrowth because it doesn't disrupt apical dominance at the cut point. Heading cuts, in contrast, remove branches at random points between nodes, releasing dormant buds below the cut and stimulating multiple sprouts. Thinning cuts are preferred for most pruning operations.

58. **D. Soil tests show adequate nutrients but trees show deficiency symptoms** - Tissue (foliar) analysis is particularly valuable when soil tests indicate adequate nutrient levels but trees display deficiency symptoms. This situation suggests nutrients are present but unavailable (often due to pH problems) or that root dysfunction prevents uptake. Tissue analysis reveals what nutrients the tree has actually absorbed, identifying whether the problem is soil chemistry, root health, or other factors.

59. **B. Doubled rope technique (DRT/MRS)** - The doubled rope technique (DRT), also called moving rope system (MRS), uses a single rope passed over a branch and attached to the climber at both ends, creating two attachment points. As the climber moves, the rope moves through the attachment point above. This contrasts with single rope technique (SRT) or stationary rope technique (SRT) where the rope is fixed at one point. Both primary and secondary attachment provide redundant safety.

60. **C. Prevention and maintaining plant vigor** - Plant health care programs emphasize proactive health maintenance over reactive pest treatment. Healthy, vigorous plants naturally resist and tolerate pest pressure better than stressed plants. PHC integrates proper cultural practices (appropriate watering, mulching, soil management), regular monitoring, accurate diagnosis, and intervention only when monitoring indicates action thresholds are exceeded. This approach typically reduces pesticide use while improving long-term plant outcomes.

61. **A. They affect a smaller portion of the tree's structural load path** - Wounds on scaffold branches affect only the branch and portions above it, which represent a smaller fraction of the tree's total structural system. Basal trunk wounds affect the entire structural foundation where all above-ground loads transfer to the root system. The same-sized wound at the trunk base compromises a greater percentage of the tree's load-bearing capacity than the same wound on an upper branch.

62. **D. Earlywood cells are larger with thinner walls** - Earlywood (springwood) is produced early in the growing season when conditions favor rapid growth. These cells are larger in diameter with thinner walls, optimizing water transport capacity. Latewood (summerwood) is produced later when conditions are less favorable; these cells are smaller with thicker walls, providing more

structural strength. The alternation between earlywood and latewood creates the visible annual rings used to determine tree age.

63. **B. Develop strong architecture with well-spaced scaffold branches** - Structural pruning of young trees aims to develop strong, durable architecture: a single dominant leader (in excurrent species), well-spaced scaffold branches with wide attachment angles, elimination of included bark, and removal of competing leaders before they become problematic. Early intervention requires only small cuts that close quickly; waiting until defects are serious requires large cuts with greater stress and decay potential.

64. **C. Foul-smelling liquid oozing from wounds or cracks** - Bacterial wetwood (slime flux) causes internal fermentation by bacteria, creating gas pressure that forces foul-smelling liquid to ooze from wounds, cracks, or branch stubs. The liquid is often dark and may kill grass beneath the tree or stain bark. While unsightly and often concerning to tree owners, wetwood rarely causes serious harm to otherwise healthy trees. There is no effective treatment; maintaining overall tree health is the best approach.

65. **A. Identify trees with potential to fail and cause harm for informed management decisions** - Tree risk assessment is a systematic process to identify trees with structural defects or health conditions that could lead to failure, and to evaluate whether such failure would cause harm. The assessment informs management decisions—whether to accept, mitigate, or remove the risk. Assessment is not about eliminating all risk (impossible) but about making informed decisions that balance safety, tree value, and management resources.

66. **D. Continuing education units (CEUs) and recertification** - ISA Certified Arborist credentials require ongoing continuing education to maintain certification. Credential holders must earn a specified number of continuing education units (CEUs) during each three-year certification period and pay recertification fees. This requirement ensures certified arborists stay current with evolving knowledge, techniques, and standards. Failure to meet requirements results in loss of certification.

67. **B. Stop or reverse feed mechanism if contacted** - The feed control bar is a critical safety device positioned across the chipper feed opening that stops or reverses the feed mechanism when pushed. If entanglement begins, pushing this bar may halt feed before the operator is pulled further into the machine. This device must be tested before each use and never disabled. Despite this safety feature, proper operating procedures (appropriate positioning, no loose clothing, feed butt-end first) remain essential.

68. **C. What could be harmed if the tree fails** - In tree risk assessment terminology, the target is anything of value that could be harmed if the tree or portion fails. Targets include people, vehicles, structures, utilities, and other property. Without a target in the potential failure zone, there is no risk regardless of tree condition. Target assessment considers type (people vs. property), occupancy rate (how often the target is present), and vulnerability (ability to withstand impact).

69. **A. Load weight, rope and equipment ratings, anchor strength, and dynamic forces** - Safe rigging requires understanding multiple factors: the weight of pieces being removed; the strength ratings of all components (ropes, blocks, slings, carabiners); anchor point capacity; and dynamic forces generated when falling pieces are stopped. Dynamic forces can multiply static weights by 2-10 times depending on fall distance. The system is only as strong as its weakest component; all elements must be rated for anticipated loads.

70. **D. Stress response including reduced energy reserves and possible epicormic sprouting** - Removing excessive live crown (more than 25% from mature trees) causes severe stress. The tree loses photosynthetic capacity and stored energy contained in removed branches. It often responds with vigorous epicormic sprouting—weakly attached water sprouts from dormant buds. Depleted energy reserves reduce ability to close wounds, defend against pests, and maintain functions. Over-pruning predisposes trees to decline.

71. **B. Certain nutrients become unavailable at high or low pH** - Soil pH significantly affects nutrient availability. Iron, manganese, zinc, and copper become progressively less available as pH increases above 7 (alkaline conditions), causing deficiencies even when these elements are present in soil. Phosphorus availability decreases at both high and low pH extremes. Nitrogen, potassium, and sulfur availability generally decreases in acidic conditions. Understanding pH effects guides fertilization and soil amendment decisions.

72. **C. Allow the tree to respond naturally; no treatment improves outcomes** - Once a flush cut has been made, no treatment improves outcomes. Wound dressings do not accelerate healing or prevent decay; cutting additional tissue only enlarges the wound. The tree's compartmentalization response is already compromised by removal of the branch collar. The best approach is to allow the tree to respond naturally and maintain overall tree health to optimize whatever wound response is possible.

73. **A. Water and mineral nutrients, especially phosphorus** - Ectomycorrhizal fungi dramatically enhance tree water and mineral nutrient uptake, particularly phosphorus, which is relatively immobile in soil. The fungal hyphal network extends far beyond root surfaces, exploring a much greater soil volume than roots alone could reach. In return for these benefits, trees provide carbohydrates to the fungus—typically 10-20% of photosynthetic production. This mutualistic relationship is essential for many forest tree species.

74. **D. Presence of both significant defects AND a target that could be harmed** - A hazard tree is defined by two essential components: structural defects creating likelihood of failure AND targets in the potential failure zone that could be harmed. Without both components, there is no hazard. A defective tree with no targets has no risk; a sound tree over a playground has no hazard designation. This definition focuses management attention where failure would actually cause harm.

75. **B. Evidence of severe structural compromise or imminent failure** - Trees showing evidence of severe structural problems (extensive basal decay, horizontal trunk cracks, recent lean with root

plate movement, active structural failure) should not be climbed until alternative assessment determines whether they can support climbing loads. Climbing adds dynamic forces that could trigger failure in compromised trees. Alternative access (aerial lift) or ground-based assessment may be necessary.

76. **C. Free-falling pieces stopped suddenly (shock loading)** - Shock loading—when falling pieces are stopped suddenly—creates the highest dynamic forces in rigging. A piece falling even a short distance before being stopped can generate forces 2-10 times its static weight. These forces can exceed equipment ratings, causing system failure. Proper rigging minimizes shock loading through controlled lowering; pieces should not drop before engagement when possible. Understanding dynamic forces is essential for safe rigging.

77. **A. Species diversity including phased removal and replacement of ash** - Long-term emerald ash borer management requires accepting that most ash will eventually be lost and planning accordingly. Strategies include: diversifying species composition (don't replace ash with ash); phased removal to spread costs and maintain canopy; selective treatment of high-value trees; and planting diverse replacement species. Treating all ash indefinitely is not economically sustainable, and ignoring the problem leaves communities vulnerable to sudden canopy loss.

78. **D. One-fifth or less for adequate safety margin** - Working load limit (WLL) is typically set at one-fifth (5:1 safety factor) or less of equipment breaking strength for life safety applications. This provides margin for dynamic forces, material degradation, connection efficiency losses, and unknown factors. For example, a rope with 5,400 pounds breaking strength would have a WLL of approximately 1,080 pounds. Never approach breaking strength in normal operations; dynamic forces can easily multiply static loads.

79. **B. A yellow or reddish halo between dead and green tissue** - Bacterial leaf scorch caused by Xylella fastidiosa produces characteristic marginal leaf scorch with a yellow or reddish border (halo) between dead brown tissue at the margin and green tissue toward the midvein. This halo distinguishes it from drought scorch, which typically lacks this distinct color transition. Bacterial leaf scorch symptoms progress over years, typically worsening annually, while drought scorch resolves when moisture returns.

80. **C. Vertical clearance beneath the crown** - Crown raising removes lower branches to increase vertical clearance beneath the tree canopy for pedestrians, vehicles, views, buildings, or other uses. It is commonly needed along streets, over parking areas, and adjacent to structures. Crown raising should be accomplished gradually on young trees through training rather than removing large lower limbs from mature trees, which creates significant wounds and removes substantial photosynthetic capacity.

81. **A. Protect trunk only from physical impact** - This answer is incorrect. The tree protection zone (TPZ) functions to protect the entire root zone—not just the trunk—from damage during construction. The TPZ should be fenced to prohibit equipment operation, material storage,

excavation, grade changes, and other activities that could damage roots through compaction, severing, or altered drainage. Protection limited to the trunk provides inadequate root protection.

82. **D. Cool, wet spring weather** - Anthracnose diseases are favored by cool (50-68°F), wet conditions, particularly in spring when new leaves are developing and most susceptible. Rainfall spreads fungal spores and provides moisture for infection. Dry, warm weather suppresses disease development. In favorable years, anthracnose can cause significant defoliation on susceptible species (sycamore, oak, maple, ash, dogwood), though healthy trees typically survive and refoliate.

83. **B. Stimulate fibrous root growth within the future root ball** - Root pruning before transplanting severs roots at the anticipated root ball boundary, stimulating production of fibrous, absorbing roots within the area that will be transplanted. This increases the ratio of functional roots to crown, improving survival and establishment. Root pruning is typically done 6-12 months before moving large trees, allowing new root growth to develop before the stress of transplanting.

84. **C. pH, nutrient levels, and organic matter content** - Soil testing provides valuable information for tree care including soil pH (affects nutrient availability), levels of macronutrients (nitrogen, phosphorus, potassium) and sometimes micronutrients, organic matter content (affects structure and nutrient retention), and sometimes texture and cation exchange capacity. Results guide fertilization decisions and soil amendments. Soil testing should be performed before making nutrient applications to avoid unnecessary or harmful fertilization.

85. **A. Air terminals, conductor, and ground rods** - A complete lightning protection system for trees includes three essential components: air terminals (copper points at the tree's highest points to receive lightning strikes), conductors (copper cables running down the trunk to carry current), and ground rods (copper rods driven deep into moist soil to dissipate current safely). The system provides a low-resistance path for lightning current, protecting the tree from explosive damage. Systems should be installed according to ANSI A300 Part 4.

86. **D. Core damage, significant sheath wear, or contamination** - Climbing lines must be retired immediately when they show core damage (felt as lumps, soft spots, or inconsistency), significant sheath wear exposing the core, contamination with chemicals or substances that could weaken fibers, heat damage, or evidence of shock loading. Minor surface fuzz from normal use is expected. Rope inspection before each use is mandatory; damaged ropes can fail catastrophically without warning. When in doubt, retire the rope.

87. **B. Conserves moisture, moderates temperature, and improves soil** - Properly applied mulch provides multiple benefits: conserves soil moisture by reducing evaporation; moderates soil temperature (cooler in summer, warmer in winter); suppresses weed competition; improves soil structure and fertility as it decomposes; and protects soil from compaction. Proper application means 2-4 inch depth in a wide area around the tree with 3-6 inch gap at the trunk—not piled against bark.

88. **C. Shallow, spreading lateral root system** - Most landscape trees develop relatively shallow, spreading root systems with the majority of absorbing roots in the top 12-18 inches of soil where oxygen, water, and nutrients are most available. Roots typically extend 2-3 times beyond the crown spread. Deep taproots are uncommon in mature trees of most species. Understanding root distribution informs protection strategies, irrigation practices, and planting design.

89. **A. Structural defects, dead branches, electrical conductors, wildlife, and overall condition** - Pre-climb inspection systematically identifies hazards that could endanger the climber: structural defects (cracks, decay, weak attachments); dead branches in the climbing path; electrical conductors; wildlife (particularly stinging insects); and overall tree condition (evidence of root problems, lean, previous failures). This assessment determines whether climbing is safe and identifies conditions requiring precautions or alternative access methods.

90. **D. Species, genus, and family levels** - The 10-20-30 rule establishes diversity limits at three taxonomic levels: no single species should exceed 10%, no single genus should exceed 20%, and no single family should exceed 30% of the urban forest. This multi-level approach provides comprehensive protection against threats at various taxonomic levels—species-specific diseases, genus-level pests like emerald ash borer, and potential family-level vulnerabilities.

91. **B. Rapid wilting and browning of leaves on individual branches** - "Flagging" in oak wilt describes the rapid wilting and browning of leaves on individual branches before the entire crown is affected, creating flag-like patches of dead foliage. In red oaks, this occurs rapidly—often the entire tree dies within weeks to months. The vascular plugging and toxins produced by Bretziella fagacearum cause the distinctive rapid symptom development that distinguishes oak wilt from other oak decline conditions.

92. **C. Annually and after major storms** - Cable and brace support systems require regular inspection to ensure continued proper function. Annual inspection at minimum, plus inspection after major storms (wind, ice, heavy snow), verifies hardware condition, cable tension (for static cables), tree growth around components, and whether the system remains appropriate for current tree conditions. Neglected systems may fail to provide intended support or may damage trees as they grow.

93. **A. Define the root protection area during construction** - The critical root zone (CRZ) establishes the minimum area requiring protection to maintain tree survival during construction. Standard calculation (1 foot radius per inch DBH, or 1 foot per inch of trunk diameter) encompasses most roots critical for tree survival. The CRZ should be fenced before construction to prohibit equipment, storage, excavation, and grade changes. Effective protection requires this zone to remain undisturbed throughout construction.

94. **D. Restricting water and nutrient flow through the trunk** - Stem-girdling roots gradually enlarge and compress the trunk or major roots, physically restricting the vascular tissue that transports water upward and sugars downward. As girdling progresses over years or decades, the

tree shows increasing decline symptoms: crown thinning, reduced growth, dieback. Complete girdling eventually kills the tree. Early detection through root collar examination allows corrective root removal before serious damage occurs.

95. **B. Pollarding is a planned, ongoing maintenance system initiated on young trees** - Pollarding is a traditional European practice of repeatedly removing all new growth back to permanent scaffold branches (pollard heads) on a regular cycle (annually to every few years). When properly initiated on young trees and maintained consistently, it creates distinctive forms and manages tree size. Topping, in contrast, is a one-time indiscriminate cutting of mature trees without plans for ongoing management, creating serious structural and health problems.

96. **C. The working load limit of the weakest component in the system** - A rigging system is only as strong as its weakest component. Every element—ropes, slings, carabiners, blocks, anchors—must be rated for anticipated loads, and the load must never exceed the working load limit of the weakest component. Dynamic forces can multiply static weights significantly; proper rigging technique minimizes shock loading. Understanding all component ratings and calculating anticipated forces is essential for safe rigging.

97. **A. Vascular streaking in the sapwood and wilting** - Vascular wilt diseases (Dutch elm disease, oak wilt, Verticillium wilt) share characteristic symptoms: wilting of foliage (often sectional initially) and brown or olive streaking visible in the sapwood when branches are cut. This streaking results from the tree's vascular plugging response (tyloses) and fungal colonization of xylem vessels. Finding vascular discoloration in a wilting tree strongly suggests vascular wilt disease.

98. **D. Data for planning, budgeting, maintenance scheduling, and risk management** - Tree inventories provide essential data for urban forest management: species composition for diversity planning; size distribution for predicting future needs; condition information for prioritizing maintenance; location data for work scheduling; and risk assessment data for safety management. Inventories support budgeting, long-term planning, and documentation of urban forest value. Complete inventories enable individual tree management; sample inventories support population-level planning.

99. **B. Immediately retreat along planned escape route** - If a tree begins moving unexpectedly during felling, the faller should immediately retreat along the pre-planned escape route (typically 45 degrees behind and away from the intended fall direction). Never stand directly behind a falling tree (butt kickback risk) or attempt to continue cutting. The escape route should be cleared before felling begins. Quick, decisive retreat is essential—falling trees are unpredictable and delays can be fatal.

100. **C. Compartmentalization—walling off damaged tissue** - Trees do not heal wounds by regenerating lost tissue. Instead, they respond through compartmentalization—chemically and physically walling off damaged tissue to limit decay spread while producing new tissue (callus) that grows over the wound surface. Understanding that trees compartmentalize rather than heal

fundamentally changes how we approach tree care. Pruning cuts that optimize compartmentalization produce better long-term outcomes than techniques based on "healing" misconceptions.