PRACTICE EXAM 15: ISA CERTIFIED ARBORIST SIMULATION

QUESTIONS 1–200

Time limit: 3 hours 30 minutes. Each question has exactly one correct answer.

1. Compared to phloem, xylem is best distinguished by the fact that it:

A. Transports sugars from leaves to roots

B. Remains alive and actively respiring at maturity

C. Is located in the inner bark of the trunk

D. Consists of dead cells forming hollow water-conducting tubes

2. The key difference between vascular cambium and heartwood is that the cambium:

A. Contains extractives deposited in cell walls

B. Is living tissue actively producing new cells

C. Provides the trunk's main structural support

D. Is the oldest wood in a mature trunk

3. Sapwood differs from heartwood primarily in that sapwood:

A. Actively conducts water from roots to leaves

B. Contains deposited tannins and resins throughout

C. Is darker colored than the surrounding wood

D. Provides no function in water transport

4. Which feature best distinguishes Wall 4 from Walls 1, 2, and 3 in the CODIT model?

A. It plugs vertical xylem vessels after wounding

B. It resists inward decay across growth rings

C. It is formed by the cambium at the wound margin and is the strongest

D. It resists lateral decay spread through ray tissue

5. Compared to cytokinin, auxin is best characterized by its:

A. Production primarily in actively growing root tips

B. Production at the shoot tip and role in apical dominance

C. Role in triggering fruit ripening responses

D. Function in inducing winter bud dormancy

6. Transpiration and photosynthesis differ in their primary function, but are linked by:

A. Their identical energy requirements per cell

B. Their shared location only within root tissue

C. Their exclusive occurrence during the night

D. Their shared dependence on open stomata

7. Compared to early autumn, carbohydrate reserves in late spring are typically:

A. At their highest annual level from summer production

B. Unchanged because reserves are stable year-round

C. At their lowest annual level from refoliation demand

D. Stored exclusively within the outer bark layer

8. The key difference between primary and secondary growth is that primary growth:

A. Extends shoots and roots in length at apical meristems

B. Increases trunk and branch diameter through cambial activity

C. Produces only heartwood in mature trees

D. Occurs only during periods of dormancy

9. Respiration differs from photosynthesis in that respiration:

A. Converts carbon dioxide and water into sugars

B. Requires sunlight to proceed in plant cells

C. Occurs only in the leaves of mature trees

D. Consumes stored sugars to release energy

10. Compared to nitrogen-fixing bacteria, mycorrhizal fungi:

A. Convert atmospheric nitrogen into plant-usable forms

B. Extend the absorbing surface of tree roots into soil

C. Produce broad-spectrum antibiotics against pathogens

D. Decompose woody debris on the forest floor

11. The distinction between a sign and a symptom of tree disease is that a sign:

A. Is the tree's general response to a stressor

B. Is written in the diagnosis report by the arborist

C. Is direct evidence of the causal agent itself

D. Is reported only by the homeowner to the arborist

12. Compared to a secondary pest, a primary pest is distinguished by its ability to:

A. Attack and kill healthy vigorous trees on its own

B. Survive only in laboratory colonies year-round

C. Reproduce exclusively during drought periods

D. Feed only on dead or decaying wood tissue

13. Reduction cuts differ from heading cuts in that reduction cuts:

A. Always remove branches larger than six inches

B. Cut back to a lateral large enough to assume the terminal role

C. Leave an arbitrary stub of uniform length

D. Are performed exclusively with pole pruners

14. The key difference between opposite and alternate leaf arrangement is that opposite arrangement has:

A. Leaves borne singly at each node along a stem

B. Leaves radiating from a single whorl around the stem

C. Leaves arranged spirally along the length of twigs

D. Leaves borne in pairs directly across from each other

15. A pinnately compound leaf differs from a palmately compound leaf in that the pinnate form has:

A. Leaflets arranged along two sides of a central rachis

B. Leaflets radiating from a single attachment point

C. A single undivided blade with a toothed margin

D. Multiple leaves joined only at their petioles

16. Red oaks are distinguished from white oaks primarily by:

A. Acorns maturing within a single growing season

B. Rounded leaf lobes without any bristle tips

C. Pointed leaf lobes ending in bristles and two-season acorns

D. Smooth bark that remains unchanged throughout life

17. Bald cypress differs from eastern white pine in that bald cypress:

A. Produces large woody seed cones each year

B. Bears evergreen needles in bundles of five

C. Grows only on dry upland sites above water

D. Sheds its needles each autumn as a deciduous conifer

18. The key difference between a cultivar and a botanical variety is that a cultivar:

A. Occurs naturally in wild populations only

B. Is propagated clonally and named in single quotes

C. Is formally published in Latin scientific names

D. Replaces the species name in nomenclature

19. Loam soil is distinguished from clay soil primarily by:

A. Its balanced proportions of sand, silt, and clay

B. Its composition of nearly pure fine particles

C. Its exclusive content of coarse sand grains

D. Its total absence of any mineral particles

20. A pH of 7.8 differs from a pH of 6.2 in that the 7.8 soil is:

A. Strongly acidic below the neutral midpoint

B. At the exact neutral midpoint of the scale

C. Moderately alkaline above the neutral midpoint

D. Off the lower end of the standard scale

21. Cation exchange capacity in a sandy soil differs from CEC in a clay-rich soil primarily because the sandy soil:

A. Has higher exchange capacity from coarse particles

B. Has lower CEC due to limited clay and organic matter

C. Retains cations more strongly than clay soils

D. Contains more nitrogen-fixing bacterial communities

22. Compared to loose soil at 1.2 g/cm³, a compacted soil at 1.8 g/cm³ is best characterized by:

A. Greater pore space and improved aeration

B. Higher oxygen availability at the root surface

C. Enhanced root penetration and expansion rates

D. Severely reduced pore space that halts most root growth

23. A perc test draining in 6 hours differs from one draining in 36 hours in that the 6-hour result indicates:

A. Permanently waterlogged and saturated conditions

B. Inadequate drainage unsuitable for most trees

C. Adequate drainage acceptable for most tree species

D. The exact drainage rate of pure sand alone

24. The key distinction between a composite soil sample and a single grab sample is that the composite sample:

A. Averages variation across the sampled area

B. Requires no specialized sampling equipment

C. Takes much less time to collect on site

D. Is cheaper for the laboratory to process

25. Compared to mineral soil amendment with sand, adding organic matter to clay soil:

A. Produces faster particle-size changes

B. Genuinely improves structure and pore space over time

C. Lowers cation exchange capacity gradually

D. Is recognized as ineffective by current research

26. The key difference between a native and an invasive tree species is that the invasive:

A. Is non-native and spreads aggressively into natural areas

B. Belongs to the local ecosystem's original flora

C. Is always shorter at maturity than natives

D. Has been endangered by federal protection

27. Tree of heaven (*Ailanthus altissima*) differs from eastern redbud primarily because it:

A. Is native to many eastern North American states

B. Belongs to the legume family with showy pink flowers

C. Is widely grown as a protected understory species

D. Is a non-native invasive that escapes cultivation aggressively

28. Right Tree, Right Place is best distinguished from aesthetic species selection by its focus on:

A. The preferred fall color of the property owner

B. The current price of nursery stock available

C. Matching mature tree characteristics to site conditions

D. Only the leaf shape of the species chosen

29. The 10-20-30 rule limits diversity at three levels; which sequence correctly lists them from strictest to most permissive?

A. Family, then genus, then species of plantings

B. Species, then genus, then family of plantings

C. Genus, then species, then order of plantings

D. Family, then order, then class of plantings

30. Staking a newly planted tree differs from unstaked establishment primarily in that unstaked trees:

A. Are guaranteed to fall in the first storm

B. Cannot establish in any site conditions

C. Must be watered twice as often to survive

D. Develop greater trunk taper from natural wind flexing

31. The key difference between planting at the correct flare depth and planting too deep is that a buried flare:

A. Develops bark decay and long-term decline

B. Produces stronger structural roots immediately

C. Improves nutrient uptake at the trunk base

D. Eliminates the need for any mulch ring

32. A hole dug to 2–3 times the root ball diameter differs from a hole dug to exactly ball width in that the wider hole:

A. Increases the risk of root ball settling

B. Requires more expensive amended backfill

C. Provides loosened soil for outward root expansion

D. Prevents any contact between the ball and soil

33. The key distinction between native backfill and heavily amended backfill is that current best practice favors:

A. Peat moss and perlite in equal mixed proportions

B. Sterilized potting mix from commercial bags

C. Coarse builder's sand with added ground lime

D. The unamended native soil from the planting hole

34. A 4-inch caliper tree and a 2-inch caliper tree differ in expected establishment time by approximately:

A. No measurable difference between the two

B. Two additional growing seasons at one per caliper inch

C. Ten additional growing seasons at five per inch

D. Only one additional week of establishment

35. The key difference between proper mulch depth and mulch piled against the trunk is that proper mulch:

A. Is 2 to 4 inches deep with the trunk kept clear

B. Is 8 to 10 inches deep piled against the trunk

C. Must directly contact the root flare continuously

D. Must be made exclusively of inorganic gravel

36. Compared to planting during summer, dormant-season transplanting is preferred because:

A. The tree is actively transpiring at maximum rates

B. New leaves provide maximum photosynthetic demand

C. The tree is not actively transpiring and stress is minimized

D. Soil temperatures are highest for root growth

37. Advance root pruning before transplanting differs from immediate transplanting in that advance pruning:

A. Reduces the total weight of the future ball

B. Encourages new fibrous roots inside the future ball line

C. Eliminates the need for any supplemental watering

D. Prevents suckers from emerging at the trunk

38. Lifting a B&B tree by the trunk differs from lifting by the root ball primarily because lifting by the trunk:

A. Can separate the trunk from the ball and damage roots

B. Distributes load evenly across all ball dimensions

C. Is the standard recommended handling technique

D. Prevents any settling during later planting

39. A stub cut differs from a proper pruning cut in that a stub:

A. Removes the branch collar along with the wood

B. Is placed exactly outside the branch bark ridge

C. Preserves the cambium that would form Wall 4

D. Leaves dead wood beyond the collar that cannot compartmentalize

40. A flush cut differs from a proper pruning cut in that a flush cut:

A. Leaves a projecting stub beyond the branch collar

B. Is placed just outside the branch bark ridge

C. Removes the branch collar and eliminates Wall 4 tissue

D. Uses progressively smaller diameter cutting tools

41. The key distinction between bypass pruning blades and anvil blades is that bypass blades:

A. Cut cleanly between two blades without crushing stems

B. Press the stem against a flat anvil surface

C. Are limited to use only on dead wood

D. Apply more force than bypass blades can generate

42. A pole pruner differs from a hand pruner primarily in its suitability for:

A. Branches over six inches in diameter at height

B. Felling small trees on flat ground safely

C. Small branches out of reach without climbing

D. Cutting through all lower scaffold branches

43. The cleaning pruning objective differs from the raising objective in that cleaning:

A. Removes only lower branches for vertical clearance

B. Removes dead, dying, diseased, broken, or weak branches

C. Reduces the overall height of the canopy by one-third

D. Restores form after previous storm damage or topping

44. Structural pruning on young trees differs from pruning on mature trees in that structural work is:

A. Impossible before the tree has any scaffold branches

B. Limited to removing only deadwood and broken limbs

C. Always required by ANSI A300 every year

D. Most beneficial during the juvenile phase while cuts are small

45. Pollarding is best distinguished from topping by the fact that pollarding:

A. Is a one-time heading cut made at random heights

B. Uses the same wound dressings applied to topping cuts

C. Is a long-term system requiring repeated cuts at the same framework points

D. Applies only to conifers and evergreens

46. Lion-tailing differs from proper thinning in that lion-tailing:

A. Strips interior foliage and concentrates weight at branch ends

B. Removes evenly distributed branches throughout the canopy

C. Meets ANSI A300 requirements for mature tree care

D. Is recommended as a standard practice by current research

47. The key distinction between restoration pruning and cleaning is that restoration:

A. Removes only dead and dying branches from the crown

B. Lowers overall crown height by uniform reduction

C. Provides clearance for vehicles beneath the canopy

D. Develops acceptable structure after topping or severe damage

48. Subordination pruning differs from outright removal of a competing stem in that subordination:

A. Severs the competing stem at its base entirely

B. Reduces the growth of the competing stem without full removal

C. Applies only to dead or dying competing stems

D. Is performed only during active midsummer growth

49. The three-cut method differs from a single cut in that the three-cut sequence:

A. Requires twice as much time per branch removed

B. Allows use of a much smaller chainsaw bar

C. Prevents bark from tearing down the trunk

D. Produces a larger wound than a single cut

50. Proper cut placement differs from the time of year in its effect on wound closure because:

A. Cut placement relative to the branch collar is the single most important factor

B. Weather is the single most important factor for compartmentalization

C. Tool brand determines whether a wound closes successfully

D. Time of day alone controls the tree's wound response

51. ANSI A300 differs from ANSI Z133 in that A300:

A. Regulates the minimum tensile strength of climbing ropes

B. Specifies personal protective equipment for ground crews

C. Defines minimum approach distances to energized lines

D. Governs tree pruning and maintenance practices

52. ANSI Z133 differs from ANSI A300 in that Z133:

A. Is the core standard governing pruning technique

B. Is the core safety standard for arboricultural operations

C. Regulates nursery stock grades and quality

D. Applies only to the design of climbing helmets

53. The minimum approach distance for unqualified workers to lines below 50 kV differs from the distance for qualified line-clearance arborists in that the unqualified minimum is:

A. 10 feet, a more conservative distance

B. 3 feet, only under dry weather conditions

C. 5 feet, during all types of line work

D. Equal to the clearance used by qualified workers

54. A qualified line-clearance arborist differs from an unqualified worker by having:

A. Only a current driver's license for bucket trucks

B. Only a personal set of insulated rubber gloves

C. Specialized training in electrical hazards and line work

D. Only general landscape design experience

55. A climbing helmet differs from a standard construction hard hat in that the climbing helmet includes:

A. A wide brim for blocking direct overhead sunlight

B. A chin strap to retain the helmet during climbing

C. Reflective tape covering every external surface

D. A completely open face design for peripheral vision

56. Chainsaw-resistant leg protection differs from ordinary work pants by:

A. Activating an electromagnetic brake on the saw

B. Reflecting the moving chain away from skin

C. Producing an audible warning to the operator

D. Containing fibers that clog the chain on contact

57. Top-handle chainsaws differ from rear-handle chainsaws in their specific design purpose for:

A. Climbing arborist use up in the canopy

B. Felling full-size mature forest trees

C. Cutting residential firewood at ground level

D. Bucking large logs on flat terrain only

58. The kickback zone of a chainsaw differs from the cutting zone in that the kickback zone is:

A. The rear handle near the throttle control

B. The middle of the bar during normal cutting

C. The upper portion of the bar tip

D. The bottom edge of the bar near the powerhead

59. Two-handed chainsaw operation differs from one-handed use in that two-handed operation:

A. Is reserved only for very large felling cuts

B. Is optional based purely on operator skill level

C. Is required only for overhead cutting positions

D. Is the standard practice for nearly all chainsaw use

60. The working load limit on rigging equipment differs from the tensile strength in that WLL is:

A. Equal to the rated tensile strength directly

B. Approximately one-tenth of the rated tensile strength

C. Nine-tenths of the rated tensile strength

D. Measured only at the moment of failure

61. Shock loading in rigging differs from static loading in that shock loading:

A. Represents the steady weight of a hanging piece

B. Is the initial slow lifting force applied to a cut

C. Is a dynamic force from a falling piece suddenly caught

D. Never exceeds the static weight of the piece itself

62. A friction device used in rigging differs from a hard tie-off in that the friction device:

A. Allows controlled slip to reduce shock loading

B. Eliminates all movement of the rigging rope

C. Increases peak forces during every catch

D. Removes the need for any anchor point entirely

63. A block redirecting a rigging load differs from a simple anchor in that the block:

A. Experiences exactly half the force of the load alone

B. Experiences approximately twice the force of the load

C. Experiences no additional force when well installed

D. Supports only the weight of the rope itself

64. The hinge in a standard felling cut differs from the back cut in that the hinge:

A. Is cut completely through before the tree falls

B. Is formed only by the first notch cut from the front

C. Is cut only in hollow or decayed trunks requiring it

D. Remains intact to control fall direction

65. "Barber chair" differs from normal tree felling in that barber chair involves:

A. Vertical splitting of the trunk during the back cut

B. A resting position taken between difficult cuts

C. A decorative form left in the stump for appearance

D. A specialty chain used for softwood species

66. A planned escape route during felling differs from an improvised route in that a planned route:

A. Is always exactly straight behind the feller

B. Leads beneath the expected fall line directly

C. Is cleared before cutting begins and diagonal from the fall

D. Is selected at the final moment of the actual fall

67. Chipper operators feeding from the side differ from those standing directly behind the infeed in that side-positioning:

A. Produces chips of a finer uniform size

B. Reduces chipper engine fuel consumption

C. Allows feeding with loose clothing safely

D. Avoids struck-by hazards from flexing branches

68. A Level 1 tree risk assessment differs from a Level 2 assessment in that Level 1:

A. Uses resistograph drilling and sonic tomography

B. Is a rapid limited visual screening of many trees

C. Is a detailed single-tree inspection with a mallet

D. Includes laboratory analysis of wood core samples

69. A Level 2 risk assessment differs from a Level 3 assessment in that Level 2:

A. Requires only a drive-by visual glance

B. Uses advanced sonic imaging through the trunk

C. Is a detailed visual inspection of an individual tree

D. Applies exclusively to dead standing trees

70. A Level 3 risk assessment is best distinguished from Level 1 and Level 2 by its use of:

A. Advanced instrumentation like resistograph and tomography

B. Only handheld measuring tape and ground observation

C. Drive-by photography from a moving vehicle

D. Only a small rubber mallet for sounding

71. The likelihood of failure in TRAQ differs from the consequences of failure in that likelihood:

A. Measures the severity of damage if failure occurs

B. Describes the probability that failure will occur in the assessment period

C. Is measured only in financial terms

D. Is measured exclusively in physical tree dimensions

72. "Probable" likelihood in TRAQ differs from "possible" likelihood in that probable means failure is:

A. Impossible under any foreseeable conditions

B. Unlikely but theoretically not ruled out

C. Already occurring or clearly imminent now

D. Likely to occur during the assessment period

73. The "severe" consequence level in TRAQ differs from the "minor" level in that severe applies to:

A. Catastrophic damage, serious injury, or death

B. Light property damage easily repaired at low cost

C. Moderate damage with minor repairable injuries

D. No measurable effect on any nearby target

74. Residual risk differs from initial risk in that residual risk is:

A. The level of risk present before any mitigation

B. The maximum risk at the moment of tree failure

C. The risk that remains after mitigation is implemented

D. The total risk including all possible future events

75. A target in TRAQ differs from a tree defect in that a target is:

A. A branch identified for reduction pruning

B. An internal area of decay visible from outside

C. The part of the tree likely to fail structurally

D. A person, property, or activity that could be affected by failure

76. Target occupancy rate differs from target type in that occupancy rate:

A. Identifies the specific nature of the target

B. Describes the frequency and duration of target presence in the strike zone

C. Measures only the monetary value of the target

D. Lists the number of targets by name in the area

77. A cavity with sufficient surrounding sound wood differs from a failing hollow trunk in that the sound cavity:

A. Guarantees zero structural risk forever

B. Automatically requires complete tree removal

C. May still provide adequate structural support

D. Has already begun catastrophic collapse

78. Codominant stems with included bark differ from a strong branch union in that the codominant union has:

A. Bark trapped between stems preventing a strong attachment

B. Wood fibers continuous across the entire union

C. A healthy branch collar forming at the attachment

D. Lower risk of splitting than a single-trunk form

79. Cabling and bracing systems differ from pruning mitigation in that cable systems:

A. Eliminate all structural risk on the supported union

B. Never require any inspection or maintenance

C. Are required by ANSI A300 on every mature tree

D. Reduce but do not eliminate structural risk

80. A reduction cut on an overextended limb differs from whole-tree removal as a risk mitigation in that reduction:

A. Eliminates all future risk at the site

B. Decreases end weight while preserving the tree

C. Requires no further monitoring after cutting

D. Damages the tree more than removal itself

81. The Critical Root Zone formula differs from the dripline as a protection boundary in that the CRZ:

A. Is defined by the visible extent of foliage only

B. Always extends less far than the dripline

C. Shifts in shape as the seasons change

D. Provides a calculated radius of one foot per inch of DBH

82. The actual root system of a mature tree differs from the dripline in that the root system typically extends:

A. Only to half of the crown radius distance

B. Two to three times beyond the crown radius

C. Exactly to the edge of the visible dripline

D. Only directly beneath the central trunk

83. Raising the soil grade differs from lowering the grade in its effect on existing tree roots because raising:

A. Directly severs roots along with removed soil

B. Improves drainage to the deeper soil horizons

C. Buries roots and reduces oxygen availability

D. Preserves existing root oxygen access completely

84. Lowering the soil grade differs from raising the grade in that lowering:

A. Directly removes soil along with living roots

B. Smothers roots with a layer of added fill

C. Always improves conditions for remaining roots

D. Has no measurable effect on the tree system

85. Directional boring differs from open-cut trenching as a utility installation method in that directional boring:

A. Produces the largest possible root disturbance

B. Severs more roots than any other method

C. Costs less than conventional trenching always

D. Passes beneath the root zone without disturbing soil

86. Tree protection fencing differs from flimsy flagging tape in that protection fencing:

A. Is easily moved by any crew member on site

B. Marks only the center point of the tree

C. Is sturdy, visible, and maintained throughout construction

D. Is built only at the outer dripline of the crown

87. A pre-construction tree assessment differs from a post-construction assessment in that the pre-construction version:

A. Allows findings to influence final project decisions

B. Documents damage that has already occurred

C. Is used only for final billing of the client

D. Eliminates the need for any later monitoring

88. Hand or air excavation differs from mechanical excavation in that hand or air excavation:

A. Works more quickly than any mechanical option

B. Allows roots to be identified and preserved during work

C. Tears roots indiscriminately like a backhoe

D. Costs less per foot than mechanical trenching

89. A baseline condition report differs from a post-damage report in that the baseline:

A. Is written only after construction is complete

B. Exists to calculate insurance payouts for damage

C. Lists only healthy trees with no defects

D. Documents pre-existing conditions for later comparison

90. Delayed decline after construction differs from immediate decline in that delayed decline:

A. Typically becomes visible months to several years later

B. Appears within hours of the damaging activity

C. Happens only on the anniversary of the damage date

D. Occurs only during dormant winter periods

91. Tree reserves masking initial injury differ from healthy reserve accumulation in that injury-masking consumption:

A. Increases total reserves beyond normal summer levels

B. Occurs only during years of heavy fruit production

C. Draws down stored reserves to meet the stress demand

D. Strengthens the tree's long-term carbon balance

92. Anthracnose differs from a bacterial vascular wilt in that anthracnose is:

A. A systemic bacterial infection blocking xylem

B. A fungal disease producing leaf spots and blotches

C. A viral disease transmitted by insect vectors

D. A nutrient deficiency limited to new growth

93. Dutch elm disease differs from oak wilt in that Dutch elm disease:

A. Is caused by a fungus spread by elm bark beetles and root grafts

B. Is caused by a bacterium spread by aphids and leafhoppers

C. Affects only oaks in the white oak group

D. Spreads only through infested nursery stock sold

94. Oak wilt differs from Dutch elm disease in that oak wilt:

A. Affects only elms along urban streets

B. Is spread primarily by chewing beetles in the bark

C. Is transmitted exclusively through wind dispersal

D. Is spread by sap-feeding beetles and root grafts among oaks

95. Iron chlorosis differs from nitrogen deficiency in the pattern of leaves affected because iron deficiency first appears on:

A. Older inner leaves with uniform yellowing

B. New leaves as interveinal chlorosis with green veins

C. Stems only, not the leaves themselves

D. Bark only, never visible on any leaves

96. Nitrogen deficiency differs from iron deficiency in the pattern of yellowing because nitrogen deficiency first appears on:

A. New expanding leaves at the shoot tips

B. Only the south-facing side of the canopy

C. Older inner leaves as uniform yellowing first

D. The bark surface of the main trunk

97. Phenoxy herbicide exposure differs from drought stress in that herbicide exposure produces:

A. Cupping and twisting distortion of new growth

B. Sudden wilting identical to drought symptoms

C. Uniform yellowing of all leaves at once

D. Complete defoliation within a few hours

98. A fungal fruiting body on a trunk differs from a symptom of disease in that the fruiting body is:

A. Only a homeowner's complaint about appearance

B. The tree's physiological response to stress

C. A description in the inspection report alone

D. Direct evidence (a sign) of active decay within the tree

99. Integrated Pest Management differs from calendar-based spraying in that IPM:

A. Sprays fixed dates regardless of pest presence

B. Prohibits all use of pesticide products entirely

C. Uses monitoring, thresholds, and multiple control tactics

D. Relies exclusively on biological control agents

100. Trunk injection of a systemic insecticide differs from foliar spraying in that trunk injection:

A. Requires repeated weekly applications year-round

B. Delivers the active ingredient directly into the vascular system

C. Is prohibited on all high-value landscape trees

D. Exposes every surrounding lawn area to the chemical

101. The vascular cambium differs from apical meristems in that the cambium:

A. Produces only new flowers at each node

B. Extends shoots and roots in length at the tips

C. Adds new leaves at each growing tip

D. Produces secondary xylem and phloem for trunk thickening

102. Apical meristems differ from the vascular cambium in that apical meristems:

A. Extend shoots and roots in length at the tips

B. Thicken the trunk through radial cell division

C. Produce only heartwood in mature trees

D. Operate only during winter dormancy

103. Primary growth differs from secondary growth in that primary growth:

A. Produces all new phloem and xylem rings

B. Occurs only within the central heartwood

C. Extends the length of shoots and roots

D. Adds thickness to mature trunks and branches

104. The root epidermis differs from the root cortex in that the epidermis:

A. Is the main storage tissue for root carbohydrates

B. Is the outermost absorbing surface with root hairs

C. Surrounds the central vascular cylinder

D. Contains the active cambial layer of roots

105. A root hair differs from a fine lateral root primarily in that the root hair is:

A. A single-celled extension of an epidermal cell

B. A multicellular lateral branch with its own cambium

C. A specialized storage organ for starch

D. A reproductive structure during flowering

106. The phloem sieve tube element differs from a xylem vessel element in that the sieve tube:

A. Is a dead cell at functional maturity

B. Transports water from roots to leaves

C. Is made of lignified secondary cell walls only

D. Is a living cell conducting sugar solutions

107. A xylem tracheid differs from a xylem vessel element in that the tracheid:

A. Is a living cell with active cytoplasm

B. Is a single elongated cell without open end walls

C. Is much wider than any vessel element

D. Transports sugars downward to the roots

108. Auxin differs from gibberellin in its primary role because auxin is best known for:

A. Breaking dormancy and triggering germination

B. Inducing flowering in long-day species

C. Maintaining apical dominance in shoots

D. Causing stomatal closure during drought

109. Abscisic acid differs from auxin in that ABA primarily:

A. Maintains apical dominance throughout the year

B. Stimulates shoot elongation in spring

C. Induces cell division at growing tips

D. Triggers stomatal closure and dormancy responses

110. Transpiration differs from respiration in that transpiration is:

A. The loss of water vapor from the leaves

B. The release of stored energy from sugars

C. The uptake of oxygen by root cells

D. The production of sugars during photosynthesis

111. A tree's latent buds differ from its active buds in that latent buds:

A. Grow into new shoots immediately upon formation

B. Produce flowers but never any new leaves

C. Remain dormant as a reserve until triggered to grow

D. Die within one growing season of forming

112. Epicormic sprouts differ from normal branches in that epicormic sprouts:

A. Develop during the first year of seedling growth

B. Emerge from latent or adventitious buds after stress

C. Always form the primary scaffold of a young tree

D. Grow only from terminal shoots at branch tips

113. A girdling root differs from a normal structural root in that a girdling root:

A. Spreads outward from the trunk in a radial pattern

B. Anchors the tree against wind loads strongly

C. Provides the primary water absorption surface

D. Wraps against the trunk and compresses the vascular tissue

114. The branch bark ridge differs from the branch collar in that the bark ridge is:

A. A raised line on the upper side of the branch union

B. A swollen zone of tissue beneath the branch base

C. A layer of heartwood within the branch center

D. The phloem layer of the branch itself

115. The branch collar differs from a stub cut location in that the collar is:

A. A projection of dead wood beyond the cut site

B. The swollen zone of stem tissue at the branch base

C. The inner bark tissue of the branch alone

D. A region entirely within the branch interior

116. A branch protection zone differs from a healthy trunk wood zone in that the branch protection zone is:

A. Open and allows free decay spread to the trunk

B. Composed of living phloem conducting sugars

C. A chemically altered zone resisting decay spread from the branch into the trunk

D. The heartwood core at the very center of the stem

117. Wall 1 in CODIT differs from Wall 4 in that Wall 1:

A. Plugs xylem vessels to resist vertical decay spread

B. Forms at the cambium after wounding events

C. Is the strongest of the four CODIT walls

D. Forms only in coniferous species of trees

118. Wall 2 in CODIT differs from Wall 3 in that Wall 2:

A. Is formed at the cambium as a Wall 4 barrier

B. Plugs xylem vessels along the vertical grain

C. Blocks lateral decay through the ray tissue only

D. Resists inward decay spread across annual rings

119. Wall 3 in CODIT differs from Wall 2 in that Wall 3:

A. Plugs xylem vessels along the vertical grain

B. Blocks inward decay spread across annual rings

C. Resists lateral spread through ray tissue

D. Is formed by the cambium after injury occurs

120. Heartwood decay resistance differs from sapwood decay resistance in that heartwood:

A. Is decay-resistant because of continuous living cells

B. Has decay resistance from deposited extractives like tannins

C. Provides active defense through living immune responses

D. Has no more decay resistance than outer sapwood

121. A tree's starch reserves differ from its simple sugar pool in that starch is:

A. The immediately usable energy form in phloem

B. A short-term carbon storage in leaf cells only

C. The primary long-term storage form in parenchyma

D. A structural component of the cell wall itself

122. Living parenchyma cells differ from dead xylem vessels in that parenchyma:

A. Stores carbohydrate reserves and participates in wound response

B. Conducts all of the tree's water upward under tension

C. Forms only the heartwood cylinder at the center

D. Exists exclusively in the outer corky bark layer

123. A tree's spring flush differs from its summer growth in that the spring flush is:

A. Funded mainly by current summer photosynthesis

B. Limited to the second flush after midsummer

C. Driven primarily by photosynthesis that same day

D. Funded largely by carbohydrate reserves stored the previous year

124. A drought-stressed tree differs from a well-watered tree in that the drought-stressed tree:

A. Increases photosynthesis dramatically as a response

B. Closes stomata, reducing both transpiration and photosynthesis

C. Produces new latent buds in the canopy immediately

D. Grows a deeper taproot within a single week

125. Reaction wood differs from normal wood in that reaction wood is:

A. Found only in dead sections of old branches

B. Indistinguishable from normal wood structure

C. Produced in response to mechanical stress like wind or lean

D. Composed entirely of dead pith cells only

126. Compression wood in conifers differs from tension wood in hardwoods in that compression wood:

A. Forms on the upper side of leaning stems in hardwoods

B. Forms on the lower side of leaning conifer stems

C. Is produced only by the pith of hardwood trees

D. Is absent from all reaction-wood responses

127. A tree's response to mechanical stress differs from its response to drought in that mechanical stress:

A. Stimulates reaction wood and greater trunk taper development

B. Triggers immediate stomatal closure in all species

C. Causes uniform yellowing of older inner leaves

D. Reduces carbohydrate storage for several years

128. A sheltered staked tree differs from a naturally flexing tree in that the sheltered staked tree:

A. Develops greater trunk taper and wind resistance

B. Accumulates more reaction wood throughout the trunk

C. Produces a deeper taproot under the soil

D. Develops a thinner trunk with weaker taper

129. Natural wind flexing differs from rigid staking in that natural flexing:

A. Prevents any wind damage from ever occurring

B. Halts all cambial division during the event

C. Stimulates reaction wood and develops greater trunk taper

D. Is always harmful to a young establishing tree

130. Mycorrhizal associations differ from parasitic fungi in that mycorrhizae are:

A. Mutually beneficial for both the fungus and tree host

B. Harmful to the tree despite the tree producing resistance

C. Entirely independent of the tree's sugar production

D. Responsible for severe cankers on the main trunk

131. An ectomycorrhizal association differs from an endomycorrhizal association in that ectomycorrhizae:

A. Penetrate the cortical cells with haustoria

B. Form a sheath around the outside of root cells

C. Are limited to agricultural crops only

D. Occur only inside the heartwood column

132. Beneficial mycorrhizae differ from soil pathogens in that mycorrhizae:

A. Cause cankers and crown dieback in infected trees

B. Decompose woody roots rapidly after infection

C. Produce wilt symptoms in the host's vascular system

D. Extend the absorbing surface of the host root system

133. A mature tree's surface roots differ from its central taproot concept in that most absorbing roots are actually:

A. Concentrated in the upper 12 to 18 inches of soil

B. Located entirely below five feet of depth

C. Found only in a narrow column below the trunk

D. Present only during the juvenile phase

134. The root flare differs from the buttress root in that the flare is:

A. The deepest point of the taproot at depth

B. A seasonal swelling of the outer bark only

C. The widening at the base of the trunk where it meets the roots

D. An abnormal growth indicating internal decay

135. A container tree's circling roots differ from a normally rooted tree in that circling roots:

A. Distribute evenly in all directions outward

B. Anchor the tree with maximum strength

C. Break down naturally after the first season

D. Follow the container wall and become permanent defects

136. A balled-and-burlapped tree differs from a container tree primarily in that the B&B tree was:

A. Grown only in a commercial greenhouse environment

B. Dug from a field nursery with its root ball wrapped

C. Started from seed in a recycled plastic pot

D. Air-pruned in a fabric bag during production

137. A bare-root tree differs from a container tree in that the bare-root tree:

A. Is sold in a large rigid plastic container

B. Is shipped with a rootball of heavy soil attached

C. Is shipped without soil around the exposed roots

D. Is always a specimen over six inches in caliper

138. Soil texture differs from soil structure in that texture refers to:

A. The relative proportions of sand, silt, and clay

B. The arrangement of particles into stable aggregates

C. The depth of topsoil over the subsoil layer

D. The total dissolved salt content in the profile

139. Soil structure differs from soil texture in that structure refers to:

A. The particle size distribution of mineral grains

B. The total water-holding capacity in inches

C. The pH reading on the alkalinity scale

D. The arrangement of particles into stable aggregates

140. Field capacity differs from the permanent wilting point in that field capacity is:

A. The moisture level at which all plants wilt permanently

B. The moisture level held after free drainage has ceased

C. The maximum saturation level during heavy rainfall

D. The moisture level of an oven-dried soil sample

141. The permanent wilting point differs from field capacity in that wilting point is:

A. The moisture level at which plants cannot recover turgor

B. The moisture level at which drainage has just ceased

C. The total saturation of all soil pores at once

D. The moisture level of pure bedrock material

142. Plant-available water differs from total soil water in that plant-available water:

A. Includes water bound tightly to clay particles

B. Is the total mineral content of the soil sample

C. Lies between field capacity and the wilting point

D. Is only the water held within living roots themselves

143. A hydrophobic soil differs from a normally wetting soil in that a hydrophobic surface:

A. Absorbs water faster than any normal soil

B. Repels water and causes surface runoff

C. Holds water at far higher capacities normally

D. Releases water slowly but completely upon rain

144. Soil compaction differs from poor drainage primarily in its direct mechanism on roots because compaction:

A. Increases oxygen delivery to the deepest roots

B. Raises total pore space in the affected soil

C. Lowers bulk density in the root environment

D. Eliminates pore space needed for root gas exchange

145. A bulk density of 1.2 g/cm³ differs from 1.8 g/cm³ in that 1.2 represents:

A. Loose soil supporting healthy root expansion

B. Severe compaction halting most root growth

C. The upper limit for any root penetration

D. A reading typical only of pure clay subsoil

146. A low-CEC soil differs from a high-CEC soil in that low-CEC soils:

A. Hold nutrients more tightly against leaching

B. Contain far more clay and organic matter

C. Leach cations more readily after fertilization

D. Require no fertilization during establishment

147. Organic mulch differs from inorganic mulch in that organic mulch:

A. Never contributes any nutrients to the soil

B. Is permanently stable and never breaks down

C. Is made exclusively of plastic sheeting material

D. Decomposes over time and improves soil organic matter

148. Proper 3-inch mulch with the trunk clear differs from mulch piled 8 inches against the trunk in that the 3-inch version:

A. Suffocates roots and decays the trunk bark

B. Is within the recommended range and protects the root zone

C. Supplies the tree's complete annual nitrogen needs

D. Eliminates any need for irrigation water

149. A mulch volcano differs from a proper mulch ring in that the volcano:

A. Suffocates the root flare and decays trunk bark

B. Keeps the trunk base fully exposed to air

C. Protects the root zone from temperature extremes

D. Follows the standard 2 to 4 inch depth rule

150. Sprinkler lawn irrigation differs from deep tree watering in that sprinkler watering typically:

A. Delivers water deep into the tree's root zone

B. Produces the most drought-tolerant deep roots

C. Meets every landscape tree's complete water need

D. Wets only the upper inch or two of soil surface

151. Deep watering differs from shallow watering in that deep watering:

A. Stays only at the surface of the lawn

B. Encourages shallow surface rooting primarily

C. Encourages deeper root development and drought tolerance

D. Is prohibited by most municipal ordinances

152. A pH of 4.5 differs from a pH of 7.0 in that the 4.5 soil is:

A. Moderately alkaline above the neutral level

B. Strongly acidic well below the neutral level

C. Exactly at the neutral scale midpoint

D. Off the standard scale entirely

153. A pH of 8.5 differs from a pH of 7.0 in that the 8.5 soil is:

A. Alkaline above the neutral scale midpoint

B. Acidic below the neutral scale midpoint

C. Exactly neutral at the scale midpoint

D. Off the upper end of the standard scale

154. Soil acidification differs from alkalization in that acidification:

A. Raises pH toward the alkaline end of the scale

B. Has no effect on nutrient availability at all

C. Lowers pH toward the acidic end of the scale

D. Only occurs in laboratory experiments never in soil

155. Sulfur applied to lower pH differs from lime applied to raise pH in that sulfur:

A. Raises pH by supplying calcium carbonate

B. Acidifies the soil by producing sulfuric acid

C. Has no effect on the soil pH whatsoever

D. Only affects the soil microbial population

156. Chelated iron differs from inorganic iron sulfate in that chelated iron:

A. Is useless in alkaline soils of any type

B. Costs less than the sulfate form to apply

C. Precipitates immediately in acidic soils

D. Remains available to roots across a broader pH range

157. Container-grown nursery stock differs from field-grown B&B stock primarily in that container stock:

A. Carries a large mass of native field soil attached

B. Is always much larger than any B&B tree

C. Has roots confined within the container walls

D. Requires no root inspection at planting time

158. A certified arborist differs from an untrained tree worker in that the certified arborist has:

A. Passed an ISA exam demonstrating baseline tree care knowledge

B. Received only general landscape maintenance experience

C. Completed a standard driver's license course only

D. Worked in the field for any length of time

159. A qualified tree risk assessor (TRAQ) differs from a general arborist in that the TRAQ assessor has:

A. Only taken any arboricultural coursework briefly

B. Worked for only one tree care company before

C. Only owned specialized decay-detection tools

D. Completed formal training in the TRAQ risk framework

160. A city forester differs from a commercial arborist in that the city forester:

A. Works exclusively on private residential lots

B. Manages the urban forest as public infrastructure

C. Provides only climbing and rigging services

D. Sells nursery stock directly to consumers

161. An arboricultural specification differs from a verbal agreement in that a specification:

A. Lists only the price charged for the job

B. Details scope, objectives, standards, and deliverables in writing

C. Is less binding on the parties than a verbal deal

D. Excludes any reference to ANSI standards

162. A written estimate differs from an invoice in that the estimate:

A. Demands immediate payment for completed work

B. Is issued after all work has been finished

C. Includes only penalties for nonpayment of fees

D. Projects costs before the work is performed

163. A tree inventory record differs from a hazard tree list in that the inventory:

A. Documents all trees in the area with full data

B. Lists only trees scheduled for immediate removal

C. Excludes healthy trees from the dataset entirely

D. Contains only trees with confirmed decay inside

164. A municipal tree ordinance differs from an individual homeowner preference in that the ordinance:

A. Applies only to commercial properties in the city

B. Is enforceable only against city employees

C. Establishes legal standards for tree care and removal

D. Has no force of law in any jurisdiction at all

165. A building permit differs from a tree removal permit in that the tree removal permit:

A. Authorizes new construction on a property

B. Authorizes the removal of a protected tree

C. Grants only zoning variance approval

D. Applies only to interior remodeling work

166. A landscape architect differs from an arborist in that the landscape architect primarily:

A. Designs the overall layout and function of landscapes

B. Performs climbing and rigging in the canopy

C. Diagnoses internal tree diseases in the field

D. Operates chainsaws during removals and prunings

167. A consulting arborist differs from a production arborist in that the consulting arborist primarily:

A. Performs aerial rescue during rigging operations

B. Climbs trees to perform pruning cuts

C. Operates chainsaws during heavy removals

D. Provides assessments, reports, and expert opinions

168. An American Forest Service i-Tree analysis differs from a property appraisal in that i-Tree quantifies:

A. Only the resale value of the house and lot

B. Only the raw lumber value of each tree

C. Ecosystem services such as stormwater and air quality

D. Only the zoning category of the parcel

169. The trunk formula method of tree appraisal differs from the replacement cost method in that the trunk formula:

A. Is used when the tree is too large to replace with nursery stock

B. Applies only to small newly planted seedlings

C. Requires no consideration of species or condition

D. Uses only the dollar sales price of the timber

170. Species rating in the trunk formula method differs from condition rating in that species rating reflects:

A. The current health and structural integrity of the tree

B. The desirability and suitability of the species locally

C. Only the trunk diameter at breast height

D. Only the total age of the specimen in years

171. Condition rating in plant appraisal differs from location rating in that condition rating reflects:

A. The specific zoning category of the property

B. The distance from the nearest city boundary

C. The desirability of the species in the local region

D. The current health and structural state of the specific tree

172. Location rating in plant appraisal differs from species rating in that location rating reflects:

A. The horticultural desirability of the species overall

B. The current biological health of the specific tree

C. The contribution of the site to the tree's value

D. Only the geographic latitude of the property

173. A tree protection ordinance differs from a landscape ordinance in that the tree protection ordinance:

A. Regulates only the color of plants in a yard

B. Requires permits for removal of protected trees

C. Controls only the placement of outdoor lighting

D. Applies exclusively to agricultural croplands only

174. A canopy cover goal differs from a tree count goal in that canopy cover is expressed as:

A. The percentage of land area covered by tree canopy

B. The total number of trees per acre of land

C. The height of the average street tree in feet

D. The dollar value of the nursery stock planted

175. Tree City USA differs from Tree Campus USA in that Tree City USA applies to:

A. Only private commercial businesses that plant trees

B. Only K–12 public school districts in the state

C. Municipalities that meet forestry program standards

D. Only federally owned national parks on the map

176. Tree City USA's minimum budget requirement differs from no budget at all in that Tree City USA requires:

A. Ten dollars per capita in annual funding

B. Fifty dollars per capita in annual funding

C. One hundred dollars per capita in annual funding

D. Two dollars per capita in annual forestry funding

177. An Arbor Day observance for Tree City USA differs from a general community event in that the observance:

A. Includes a formal program and tree planting activity

B. Is held only on December 25 each year

C. Requires no public participation at all

D. Is open only to municipal staff in attendance

178. A tree board differs from a public works department in that a tree board:

A. Is responsible for paving streets and sidewalks only

B. Advises on tree policy and community forestry

C. Operates trash collection services citywide

D. Regulates water and sewer infrastructure only

179. A street tree differs from a park tree in that street trees:

A. Have no special growing condition challenges

B. Are always removed from their soil environment

C. Grow in a constrained public right-of-way setting

D. Are all planted exclusively in private backyards

180. Urban tree canopy differs from forest canopy in that urban canopy:

A. Exists under natural undisturbed conditions

B. Has unlimited rooting volume at every site

C. Is buffered from pests by full species diversity

D. Grows in a built environment with many stressors

181. The urban heat island effect differs from general climate warming in that the heat island effect is:

A. A global change in atmospheric composition

B. Localized elevated temperature in built-up areas

C. A seasonal cycle of natural temperature shifts

D. A feature only of agricultural lowland regions

182. Evapotranspiration cooling from trees differs from mechanical air conditioning in that evapotranspiration:

A. Uses electricity from the utility grid

B. Produces greenhouse gas emissions continuously

C. Is a natural cooling process from plant water loss

D. Requires refrigerant chemicals to function

183. The stormwater interception benefit of a tree differs from a concrete gutter in that the tree:

A. Slows, absorbs, and reduces runoff volume

B. Channels water instantly to the street drain

C. Has no effect on the surface runoff pattern

D. Adds pollutants directly to the water supply

184. The carbon sequestration benefit of a tree differs from carbon emission in that sequestration:

A. Releases carbon dioxide into the atmosphere

B. Burns fossil fuels in an industrial process

C. Has no measurable effect on the carbon cycle

D. Stores carbon in woody biomass and soil

185. Air quality improvement from trees differs from smokestack filtration in that trees:

A. Are a source of industrial pollutant emissions

B. Emit only sulfur dioxide into the atmosphere

C. Remove particulates and absorb gaseous pollutants

D. Concentrate pollutants at ground level only

186. The energy savings benefit of a shade tree differs from simple insulation in that the shade tree:

A. Reduces cooling loads by blocking direct sunlight

B. Provides no effect on building energy demands

C. Always increases winter heating bills significantly

D. Requires no maintenance of any kind over time

187. A tree's psychosocial benefit to residents differs from its ecosystem service benefit in that the psychosocial benefit:

A. Is only a measurable monetary value on a spreadsheet

B. Includes reduced stress and improved mental health

C. Is limited to cooling and stormwater capture

D. Applies only to residents of rural farms

188. A documented ecosystem service value differs from an anecdotal benefit statement in that the documented value:

A. Is based on personal preference or opinion alone

B. Is only a subjective aesthetic judgment

C. Cannot be measured using any real tool

D. Is quantified through tools like the i-Tree suite

189. The 10-20-30 diversity rule differs from a monoculture planting in that diversity:

A. Requires all identical species for uniformity

B. Bans any repetition of the same species ever

C. Protects against catastrophic single-pest losses

D. Has never been applied in any urban forest

190. A mass planting of a single species differs from a diverse planting in that mass planting:

A. Creates vulnerability to pest-driven canopy loss

B. Is the most resilient to invasive insect arrivals

C. Is encouraged under the 10-20-30 rule explicitly

D. Has no practical difference from diverse plantings

191. ANSI Z60.1 differs from ANSI A300 and ANSI Z133 in that Z60.1:

A. Regulates pruning practices for mature trees

B. Defines arboricultural safety requirements

C. Governs head protection specifications only

D. Specifies quality standards for nursery stock

192. ANSI Z89.1 differs from ANSI Z133 in that Z89.1:

A. Governs tree pruning cut placement directly

B. Defines standards for industrial head protection

C. Regulates nursery stock quality grades and sizes

D. Specifies the minimum CRZ radius for construction

193. A climbing helmet rated under ANSI Z89.1 differs from a bicycle helmet in that the climbing helmet:

A. Is rated for impact from overhead falling objects

B. Is rated only for forward-facing road impacts

C. Is not rated for any impact at all

D. Is rated only for use on children's heads

194. Personal fall arrest differs from personal fall restraint in that fall arrest:

A. Prevents the worker from reaching any fall edge

B. Anchors the worker at a fixed stationary point

C. Catches the worker after a fall has begun

D. Eliminates any need for personal protective gear

195. A climbing rope for work positioning differs from a life safety rope for fall arrest in that the work-positioning rope:

A. Is rated only for recreational rock climbing

B. Supports a worker in position during pruning

C. Provides no load-bearing function during climbing

D. Is identical in every way to a fall arrest rope

196. A friction hitch differs from a mechanical ascender in that the friction hitch:

A. Contains metal cam jaws gripping the rope

B. Requires electric power to operate correctly

C. Can only descend a rope and never ascend

D. Uses cordage friction to grip and release the host rope

197. A mechanical descender differs from a friction hitch in that the mechanical descender:

A. Uses a metal device to control rope slip during descent

B. Is tied only from a length of accessory cord

C. Provides no friction during the descent process

D. Is prohibited under current safety standards

198. An open-gate snap versus a locking carabiner differs in that the locking carabiner:

A. Has no gate of any kind on its frame

B. Opens more easily than any open-gate version

C. Requires intentional action to open the gate securely

D. Is used only for decorative purposes on harnesses

199. A wire-core flipline differs from a rope flipline in that the wire-core version:

A. Is made only of soft textile fiber with no metal

B. Resists cuts from a chainsaw better than pure rope

C. Is prohibited under ANSI Z133 for any use

D. Stretches more than any rope material available

200. A personal first aid kit differs from a worksite kit in that the worksite kit:

A. Contains only adhesive bandages for minor cuts

B. Is carried only by the designated safety officer

C. Is stored permanently in a vehicle off site

D. Is stocked for crew-level hazards including chainsaw injuries

PRACTICE EXAM 15 — ANSWER KEY AND EXPLANATIONS

1. D — Xylem consists of dead cells forming hollow water-conducting tubes at functional maturity, while phloem is alive and conducts sugars. This structural difference allows xylem to move water under tension without any metabolic energy input. The division of labor between these two vascular tissues is fundamental to tree physiology.

2. B — The vascular cambium is living tissue actively dividing to produce new xylem and phloem, while heartwood is dead tissue with deposited extractives. The cambium is the most metabolically active layer of a mature trunk. Heartwood provides structural support but cannot grow or respond.

3. A — Sapwood actively conducts water from roots to leaves, while heartwood is dead and no longer functional in water transport. Sapwood is the outer functional xylem; heartwood is the inner dead core with decay-resistant extractives. This distinction explains why sapwood loss is more critical than heartwood loss.

4. C — Wall 4 is formed by the cambium at the wound margin and is the strongest of the four CODIT walls. It resists outward spread of decay into new wood produced after the injury. Preserving the branch collar during pruning is essential because it contains this critical cambium.

5. B — Auxin is produced at the shoot tip and is responsible for apical dominance, traveling downward to suppress lateral bud growth. Cytokinin is produced in root tips and promotes cell division. This hormonal mechanism is the biological basis for many pruning responses.

6. D — Both transpiration and photosynthesis depend on open stomata — CO_2 enters through the same openings that allow water vapor to exit. This linkage means closing stomata during drought halts both processes simultaneously. The trade-off is the central constraint on tree function under stress.

7. C — Reserves reach their lowest annual level in late spring after refoliation has consumed stored sugars but before new leaves have repaid the investment through photosynthesis. Reserves rebuild through summer and peak in early autumn. This is why spring defoliation is so devastating.

8. A — Primary growth extends shoots and roots in length at apical meristems, while secondary growth thickens trunks and branches through cambial activity. These two types of growth operate simultaneously but in different locations. Together they produce the overall tree form.

9. D — Respiration consumes stored sugars to release energy for cellular function, while photosynthesis produces sugars from carbon dioxide and water using light energy. The two

processes are opposite sides of the carbon cycle in the tree. Respiration occurs continuously in every living cell.

10. B — Mycorrhizal fungi extend the absorbing surface of tree roots through hyphae reaching into the soil, while nitrogen-fixing bacteria convert atmospheric nitrogen into plant-usable forms. Mycorrhizae access water and mineral nutrients from a much larger soil volume than roots alone could reach.

11. C — A sign is direct evidence of the causal agent itself — fungal fruiting bodies, visible insects, or confirmed pathogens. A symptom is the tree's response such as wilting or yellowing. Signs are more reliable than symptoms because they point directly to a cause.

12. A — A primary pest can attack and kill healthy, vigorous trees on its own without requiring the host to be stressed first. Secondary pests attack only weakened trees. Emerald ash borer is the classic example of a primary pest devastating healthy populations.

13. B — A reduction cut removes a branch back to a lateral large enough (typically at least one-third the diameter of the removed portion) to assume the terminal role. Heading cuts, by contrast, leave arbitrary stubs without regard to laterals. The difference determines how the wound responds.

14. D — Opposite leaf arrangement has leaves borne in pairs directly across from each other at each node. Alternate arrangement has leaves borne singly at alternating positions. This single feature narrows identification dramatically — the MAD Horse genera are the main opposite broadleaf trees.

15. A — A pinnately compound leaf has leaflets arranged along two sides of a central rachis, like the feathers of a bird. A palmately compound leaf has leaflets radiating from a single attachment point. Ash, hickory, and walnut are pinnate; horse chestnut is palmate.

16. C — Red oaks have pointed leaf lobes ending in bristles and produce acorns that mature over two growing seasons. White oaks have rounded lobes without bristles and acorns maturing in a single season. These differences are the primary field distinction between the two groups.

17. D — Bald cypress (*Taxodium distichum*) sheds its needles each autumn as a deciduous conifer. Eastern white pine is evergreen and retains its needles year-round. Bald cypress belongs to a small group of deciduous conifers including larch and dawn redwood.

18. B — A cultivar is propagated clonally and its name is written in single quotation marks — not italicized. A botanical variety occurs naturally in wild populations and is recognized in formal Latin nomenclature. The difference affects propagation method and naming conventions.

19. A — Loam has balanced proportions of sand, silt, and clay, producing good drainage and water retention. Clay soil is dominated by very fine particles, producing poor drainage and structural problems. Loam is the ideal texture for most tree species.

20. C — A pH of 7.8 is moderately alkaline, above the neutral value of 7.0. A pH of 6.2 is slightly acidic, below neutral. Each whole number represents a tenfold change in hydrogen ion concentration.

21. B — Sandy soil has lower CEC because CEC depends on clay content and organic matter — both of which are minimal in sand. Clay-rich soils hold cations more effectively because clay particles have negatively charged surfaces. Building organic matter is the only practical way to raise CEC in sandy soils.

22. D — A bulk density of 1.8 g/cm³ represents severe compaction that halts most root growth. Below 1.3 indicates good structure; above 1.7 progressively halts roots. Compaction reduces the pore space that holds air for root respiration.

23. C — A 6-hour drainage time indicates adequate drainage acceptable for most tree species. A 36-hour drainage time indicates inadequate drainage unsuitable for most trees. Water persisting more than 12 to 24 hours signals a drainage problem.

24. A — A composite sample averages variation across the area being tested, producing a representative result. A single grab sample may not reflect overall conditions. Proper sampling is the most important step in soil testing — more important than the analysis itself.

25. B — Adding organic matter genuinely improves clay soil structure and pore space over time, while sand tends to make clay soils worse. Organic matter improves aggregation and creates stable pores for water and air. Texture itself cannot be meaningfully changed.

26. A — An invasive species is non-native and spreads aggressively into natural areas, displacing native vegetation. A native species is part of the local ecosystem's original flora. Tree of heaven and Norway maple are examples of invasive non-natives in eastern North America.

27. D — Tree of heaven (*Ailanthus altissima*) is a non-native invasive that escapes cultivation aggressively, while eastern redbud is a native understory species. Tree of heaven colonizes disturbed sites and is also the preferred host of the spotted lanternfly. Native status and invasive status are distinct classifications.

28. C — Right Tree, Right Place focuses on matching mature tree characteristics — size, form, soil and water needs, tolerance — to the conditions of the planting site. Ignoring mature dimensions is the most common species selection error. Aesthetics alone cannot drive a durable planting.

29. B — The 10-20-30 rule limits plantings to no more than 10% of any species, 20% of any genus, and 30% of any family. Species is the strictest level and family the most permissive. The hierarchy protects against threats at each taxonomic level.

30. D — Unstaked trees develop greater trunk taper from natural wind flexing, which stimulates reaction wood and basal thickening. Staking should only be used when necessary and removed within one growing season. Rigid staking produces weaker trunks over time.

31. A — A buried flare develops bark decay and long-term decline because the tissue below the flare is not adapted to underground conditions. The buried flare also encourages girdling root formation. Finding and preserving the true flare is essential at planting.

32. C — A wide planting hole provides loosened soil for outward root expansion during establishment. A hole dug just to ball width offers no expansion zone for new roots. Width matters more than depth in establishing a new tree.

33. D — Current best practice is to backfill with the unamended native soil excavated from the planting hole. Research has shown that heavily amended backfill can produce pot-bound conditions in the ground. Soil improvement is better delivered through surface mulching.

34. B — A 4-inch caliper tree requires approximately two additional growing seasons compared to a 2-inch caliper tree, based on the one-year-per-caliper-inch rule. Larger trees take longer to rebuild lost root systems. This is a widely used rule of thumb.

35. A — Proper mulch is 2 to 4 inches deep with the trunk kept clear. Mulch piled against the trunk causes bark decay and encourages girdling roots. The correct shape is a flat ring, not a volcano against the base.

36. C — Dormant-season transplanting is preferred because the tree is not actively transpiring, so stress from root loss is minimized. Summer transplanting carries much higher risk because the tree is in full metabolic demand. Timing is one of the most important transplant variables.

37. B — Advance root pruning encourages new fibrous roots to form inside the future ball line before the move. These fibrous roots are harvested with the ball and dramatically improve transplant survival. The technique is essential for large specimen trees.

38. A — Lifting a B&B tree by the trunk can separate the trunk from the ball and destroy the root connection. A B&B tree must always be lifted by supporting the root ball from underneath. This is one of the most basic handling rules.

39. D — A stub cut leaves dead wood projecting beyond the branch collar that the tree cannot compartmentalize. The dead stub becomes an entry point for fungal colonization that eventually reaches the collar and then the trunk. Stubs are serious pruning errors.

40. C — A flush cut removes the branch collar along with the branch, eliminating the cambium that would have formed Wall 4. The result is a wound that cannot be effectively compartmentalized and provides a direct pathway for decay. Flush cuts are serious pruning errors.

41. A — Bypass blades cut with a scissor-like action between two curved blades, producing clean cuts on living wood without crushing tissue. Anvil blades press the stem against a flat surface and tend to crush, limiting them to dead material. Tool selection matters for wound response.

42. C — A pole pruner is most appropriate for small-diameter branches out of reach from the ground that do not warrant climbing. Larger branches require more controlled methods. Pole pruners extend reach but do not substitute for proper positioning on larger work.

43. B — The cleaning objective is defined as selective removal of dead, dying, diseased, broken, and weakly attached branches. The raising objective removes lower branches for vertical clearance. Cleaning is the most common routine pruning objective under ANSI A300.

44. D — Structural pruning during the juvenile phase produces the greatest benefit because small cuts now correct defects that would otherwise require much larger, more damaging cuts decades later. The architectural framework is still being established. Waiting until maturity is far less effective.

45. C — Pollarding is a long-term system requiring repeated cuts at the same framework points on a schedule, usually annually or biennially. Topping is a one-time destructive heading cut with no ongoing commitment. Pollarding must be maintained once begun.

46. A — Lion-tailing strips interior foliage and concentrates weight at the branch ends, creating weaker branches than properly distributed thinning. The pattern removes interior foliage that cushions wind loads. It is explicitly discouraged under current standards.

47. D — Restoration develops an acceptable crown structure from sprouts that have emerged after topping, vandalism, or severe storm damage. Cleaning removes dead and dying branches from an otherwise intact structure. Restoration is a long-term process requiring multiple visits over years.

48. B — Subordination reduces the growth of a competing stem in favor of a dominant leader, gradually shifting dominance without the wound of outright removal. It is used to correct codominant stems in young trees. The technique is gentler than removal.

49. C — The three-cut method prevents bark from tearing down the trunk below the cut when a heavy branch falls. A single cut from above causes the falling weight to rip bark downward. The undercut severs this bark pathway in advance.

50. A — Cut placement relative to the branch collar is the single most important factor in whether a pruning wound closes successfully. Correct placement preserves the cambium that forms Wall 4; incorrect placement eliminates it. Tool brand and timing matter far less.

51. D — ANSI A300 governs tree pruning and maintenance practices in the United States. ANSI Z133 addresses worker safety. These two standards complement each other and together define accepted professional practice.

52. B — ANSI Z133 is the core safety standard for arboricultural operations in the United States. ANSI A300 addresses pruning practices. Z133 covers electrical hazards, PPE, climbing, rigging, and aerial rescue requirements.

53. A — The minimum approach distance for unqualified workers to energized lines below 50 kV is 10 feet under ANSI Z133. Qualified line-clearance arborists may work closer with specialized training and equipment. The 10-foot figure is the most commonly cited MAD.

54. C — A qualified line-clearance arborist has completed specialized training in electrical hazards, safe work procedures near energized lines, use of insulated tools, and emergency response to electrical contact. This training cannot be acquired informally.

55. B — A climbing helmet must have a chin strap to retain the helmet during active climbing, rigging, and inverted positions. Traditional construction hard hats without chin straps can fall off during dynamic movement. The chin strap is the key distinguishing feature.

56. D — Chainsaw-resistant leg protection contains cut-resistant fibers (ballistic nylon or aramid) that clog the chain of a running saw on contact, stopping the chain before it reaches the leg. The protection dramatically reduces injury severity in accidental contact.

57. A — Top-handle chainsaws are designed specifically for climbing arborist use up in the canopy, where compact size and potential one-handed operation are required. They should not be used by untrained workers or for ground-based work.

58. C — The kickback zone is the upper portion of the bar tip. Contact between this area and any object can trigger a violent upward and backward reaction. Awareness of tip position throughout every cut is a foundational safety skill.

59. D — Two-handed operation is the standard practice for nearly all chainsaw use and is required except in specific climbing situations using top-handle saws. The standard grip provides maximum control and reduces injury risk.

60. B — Working load limit is commonly calculated as approximately one-tenth of the tensile strength of rigging equipment. A rope with 14,000 pounds tensile strength has a WLL of about 1,400 pounds. This margin protects against shock loading and wear.

61. C — Shock loading is the dynamic force generated when a falling piece is suddenly caught by the rigging rope. Peak forces can be many times the static weight of the piece depending on fall distance and system elasticity. Static loading is the steady hanging weight.

62. A — A friction device such as a Port-a-Wrap allows controlled slip that distributes the energy of the catch over time rather than stopping the load instantly. The result is a dramatically lower peak force compared to a hard tie-off. Friction devices are essential for heavy rigging.

63. B — A block redirecting a rigging load experiences approximately twice the force of the load itself, because the block holds both the lifting side and holding side of the rope simultaneously. This doubling is a routine source of anchor failure when overlooked.

64. D — The hinge is the strip of wood between the notch and the back cut that remains intact to control fall direction as the tree commits to falling. Cutting through the hinge eliminates directional control. Hinge width should be approximately 10% of trunk diameter.

65. A — Barber chair is a vertical splitting of the trunk upward along the grain during the back cut, caused by cutting the hinge too thin or making the back cut too slowly. It can propel trunk sections backward at high speed and is a serious felling hazard.

66. C — A planned escape route is cleared before cutting begins and leads away from the tree at about 45 degrees from the fall line on the opposite side. The route should never lead directly beneath the fall or straight back. Planning prevents serious injury.

67. D — Chipper operators feeding from the side avoid struck-by hazards from branches that flex, kick back, or whip during feeding. Standing directly behind the infeed is a recurring cause of serious injury. Side positioning is the fundamental safe feeding practice.

68. B — A Level 1 assessment is a rapid limited visual screening used for large tree populations along streets, through parks, or across properties. Its purpose is to identify obvious hazards requiring further evaluation. It is the simplest and fastest level.

69. C — A Level 2 assessment is a detailed visual inspection of an individual tree, typically performed while walking around it from multiple angles using basic tools such as a mallet and probe. It is the standard level for trees of concern.

70. A — Level 3 assessment techniques include resistograph drilling, sonic tomography, static load testing, and other advanced instrumentation. These tools are reserved for high-value trees or situations where Level 2 has left significant uncertainty.

71. B — Likelihood of failure describes the probability that failure will occur during the assessment period. Consequences of failure describe the severity of damage if failure actually happens. Both dimensions must be combined to produce an overall risk rating.

72. D — A probable likelihood of failure in TRAQ means failure is likely to occur during the assessment time frame under normal conditions. Possible means failure is not expected but cannot be ruled out. The four levels are improbable, possible, probable, and imminent.

73. A — The severe consequence level in TRAQ applies to catastrophic property damage, serious injury, or death. Minor consequences involve minor damage or injury. The level of consequence depends on the target and the nature of the potential failure.

74. C — Residual risk is the risk that remains after mitigation measures have been implemented. Initial risk is the level before mitigation. No mitigation eliminates risk entirely — clients must understand they are choosing acceptable risk levels.

75. D — A target is any person, property, or activity that could be affected by a failing tree or tree part. Targets include pedestrians, vehicles, buildings, utility lines, and outdoor activities. Without targets, even high failure likelihood does not produce high risk.

76. B — Target occupancy rate describes the frequency and duration of target presence within the potential strike zone. Higher occupancy contributes to higher overall risk because failures are more likely to coincide with target presence.

77. C — A cavity with sufficient surrounding sound wood may still provide adequate structural support for the tree. A common guideline holds that at least one-third of the diameter should remain as sound wood around the perimeter. Cavities alone do not guarantee removal.

78. A — Included bark between codominant stems prevents formation of a strong structural union by trapping bark tissue that should have knit together as solid wood. The attachment becomes progressively weaker as the stems grow, and catastrophic splitting can occur.

79. D — Cabling and bracing provide supplemental support that reduces but does not eliminate structural risk. The installations require ongoing inspection and maintenance. They are appropriate when defects cannot be addressed by pruning alone.

80. B — Reduction pruning decreases end weight on an overextended limb while preserving the tree, addressing the identified defect without removing the specimen. It is a standard mitigation for moderate risk from specific branch defects over targets.

81. D — The CRZ formula provides a calculated radius of one foot per inch of trunk diameter at breast height. It is the standard reference in ISA Best Management Practices and produces a defensible protection boundary. The dripline shifts with canopy shape and is a poorer boundary.

82. B — The actual root system of a mature tree typically extends two to three times the crown radius, well beyond the visible dripline. Using the dripline as the protection boundary leaves most absorbing roots exposed to damage.

83. C — Raising the grade buries existing roots and root flares under added soil, producing gradual decline as buried tissues lose access to oxygen. Symptoms develop over months or years as reserves are exhausted. Even a few inches of added fill can be damaging.

84. A — Lowering the grade removes soil along with any roots growing in it, producing immediate direct loss of functional root tissue. Even a few inches of grade cut can remove a large share of absorbing roots concentrated near the surface.

85. D — Directional boring passes a utility beneath the root zone without disturbing the soil at root depth. Open-cut trenching through the CRZ is the most damaging installation option. Higher equipment cost typically favors boring when tree value is significant.

86. C — Tree protection fencing should be sturdy, visible (brightly colored, at least four feet tall), clearly marked with signage, and maintained throughout construction. Flimsy flagging is routinely moved or ignored, providing no actual protection.

87. A — Pre-construction tree assessment should occur before final design so findings can influence project decisions. Assessment after drawings are complete is reduced to documentation of what has already been decided. Timing is critical for effective protection.

88. B — Hand or air excavation allows workers to identify and preserve roots individually rather than severing them blindly. These techniques trade labor cost for root preservation and are appropriate when roots must be crossed or exposed.

89. D — A baseline condition report documents pre-existing tree conditions for later comparison. It protects all parties when damage is alleged after construction, allowing actual damage to be distinguished from pre-existing conditions. Without a baseline, disputes cannot be resolved.

90. A — Delayed decline following construction damage typically becomes visible months to several years after the triggering event. Trees mobilize reserves to mask initial injury, and when reserves are exhausted, decline begins. Monitoring should continue for at least three to five growing seasons.

91. C — Injury-masking reserve consumption draws down stored carbohydrates to meet the stress demand, gradually exhausting reserves even though the tree appears healthy. When reserves are exhausted, decline becomes visible. This explains the delayed nature of construction damage.

92. B — Anthracnose is a fungal disease producing leaf spots and blotches, often followed by premature leaf drop. Most anthracnose infections are cosmetic rather than life-threatening. Bacterial vascular wilts are systemic and often lethal — a fundamentally different disease type.

93. A — Dutch elm disease is caused by a fungus (*Ophiostoma*) and spread by elm bark beetles carrying fungal spores and through root grafts between adjacent elms. This dual pathway is why the disease caused the near-total loss of American elm as a street tree.

94. D — Oak wilt is spread by sap-feeding beetles attracted to fresh wounds and by root grafts among oaks. The beetle-vector pathway makes warm-season pruning of oaks risky in affected regions. It affects all oaks, though the red oak group is most susceptible.

95. B — Iron is an immobile nutrient, and deficiency appears first on new leaves as interveinal chlorosis with green veins. The tree cannot translocate iron from older foliage to new growth. In landscape settings, this is almost always a pH-related availability problem.

96. C — Nitrogen is a mobile macronutrient that the tree translocates from older leaves to support new growth when supply is inadequate. Deficiencies therefore appear first on older inner leaves as uniform yellowing. All mobile-nutrient deficiencies follow this pattern.

97. A — Phenoxy herbicide exposure produces cupping and twisting distortion of new growth because these chemicals mimic plant growth hormones. The pattern is often most severe on the side nearest the application source. Drought produces wilting, not hormonal distortion.

98. D — A fungal fruiting body is direct evidence (a sign) of the causal agent itself, indicating active decay already established within the tree. Symptoms are the tree's responses such as wilting or yellowing. Signs are more reliable diagnostic evidence than symptoms.

99. C — IPM is a decision-making framework that uses monitoring, action thresholds, and multiple control tactics. It is not a specific product, a prohibition on pesticides, or a biological-only approach. The least toxic effective option is preferred when chemical control is warranted.

100. B — Trunk injection delivers the active ingredient directly into the vascular system, bypassing the soil and foliage. It is most appropriate for high-value trees threatened by borers, where foliar sprays would be impractical or ineffective. Injection provides rapid systemic distribution with low environmental exposure.

101. D — The vascular cambium produces secondary xylem and phloem for trunk thickening through radial cell division. Apical meristems produce primary growth at the tips, extending shoots and roots in length. These two growth processes operate in different locations simultaneously.

102. A — Apical meristems extend shoots and roots in length at the tips, producing primary growth. The vascular cambium adds thickness through secondary growth. Together, these two meristematic systems produce the tree's overall form.

103. C — Primary growth extends the length of shoots and roots at the apical meristems. Secondary growth thickens stems and roots through cambial activity. The distinction is fundamental to understanding how trees develop.

104. B — The root epidermis is the outermost absorbing surface with root hairs that dramatically increase absorbing surface area. The root cortex is the storage layer inside the epidermis. Root hairs are single-celled extensions from epidermal cells.

105. A — A root hair is a single-celled extension of an epidermal cell that dramatically increases the absorbing surface area of young roots. A lateral root is a multicellular branch with its own vascular tissue. Root hairs are short-lived and are continuously replaced.

106. D — Phloem sieve tube elements are living cells conducting sugar solutions from sources to sinks. Xylem vessel elements are dead at maturity and conduct water. This fundamental difference in cell status reflects the different energy requirements of the two transport systems.

107. B — A tracheid is a single elongated cell without open end walls — water passes between tracheids through pit pairs. Vessel elements have perforated end walls that connect to form continuous tubes. Conifers rely on tracheids; hardwoods have both.

108. C — Auxin is best known for maintaining apical dominance in shoots by suppressing lateral bud growth. Gibberellin primarily promotes stem elongation and seed germination. Removing the leader interrupts auxin flow and releases lateral buds to grow.

109. D — Abscisic acid (ABA) triggers stomatal closure during water stress and induces dormancy responses in buds and seeds. Auxin promotes growth and apical dominance. The two hormones often work in opposite directions on tree physiology.

110. A — Transpiration is the loss of water vapor from the leaves through open stomata, driving the cohesion-tension mechanism that pulls water upward. Respiration is the release of stored energy from sugars in living cells. The two processes are distinct but both depend on living tissue.

111. C — Latent buds remain dormant as a reserve under the bark until triggered to grow by injury, severe pruning, or other stress. Active buds grow into shoots during the normal growing season. Latent buds are the source of epicormic sprouts following topping.

112. B — Epicormic sprouts emerge from latent or adventitious buds after stress events such as topping, severe defoliation, or canopy damage. They are weakly attached and produce the poor structure seen after topping. Normal scaffold branches form from active buds.

113. D — A girdling root wraps against the trunk and compresses the vascular tissue, eventually restricting water and sugar transport. It can develop from circling roots left uncorrected at planting or from planting too deep. Girdling roots are a long-term decline factor.

114. A — The branch bark ridge is a raised line of bark on the upper surface of a branch union, marking the dividing line between stem and branch tissue. It is the reference point for correct pruning cut placement. Proper cuts are made just outside the ridge.

115. B — The branch collar is the swollen zone of stem tissue at the branch base that contains the cambium forming Wall 4. Preserving the collar during pruning is essential for proper compartmentalization. Flush cuts damage the collar; stubs leave wood beyond it.

116. C — The branch protection zone is a chemically altered zone at the base of branches that resists decay spread from the branch into the trunk. This is part of the tree's natural defense system. Flush cuts destroy this zone along with the branch collar.

117. A — Wall 1 plugs xylem vessels with tyloses and resins to resist vertical spread of decay upward and downward. It is the weakest of the four CODIT walls. Wall 4 is formed later by the cambium and is the strongest.

118. D — Wall 2 resists inward decay spread across annual growth rings, produced by denser wood at the end of each growing season. Wall 3 resists lateral spread through ray tissue. Walls 1, 2, and 3 all exist in wood present before the wound.

119. C — Wall 3 resists lateral decay spread through the ray tissue that runs radially through the wood. Wall 2 resists inward spread across growth rings. Together, Walls 1, 2, and 3 contain decay within the wood present at the time of wounding.

120. B — Heartwood decay resistance comes from extractives like tannins and resins deposited in the dead cell walls during the heartwood formation process. Sapwood is actively living and relies on cellular defenses rather than chemical deposits. Heartwood provides passive decay resistance.

121. C — Starch is the primary long-term carbohydrate storage form in living parenchyma cells throughout the sapwood, inner bark, and roots. Simple sugars are the short-term usable energy form. Starch reserves fluctuate seasonally and fuel recovery from stress.

122. A — Living parenchyma cells store carbohydrate reserves and participate in wound response, including the formation of tyloses and the compartmentalization process. Dead xylem vessels conduct water but cannot store reserves or respond to injury.

123. D — Spring flush is funded largely by carbohydrate reserves stored the previous year, because new leaves cannot photosynthesize until they are fully expanded. This is why reserves reach their lowest point in late spring. Spring defoliation during this window is particularly devastating.

124. B — A drought-stressed tree closes stomata to conserve water, which simultaneously reduces transpiration and photosynthesis because CO_2 can no longer enter the leaves. The trade-off between water conservation and carbon gain is the central constraint under drought.

125. C — Reaction wood is produced by the cambium in response to mechanical stress like wind flexing or lean. It contributes to greater trunk taper and structural adaptation. Rigidly staked trees lose this stimulus and develop weaker trunks.

126. B — Compression wood forms on the lower side of leaning conifer stems, pushing the stem upright. Tension wood forms on the upper side of leaning hardwoods, pulling the stem upright. These are the two forms of reaction wood in conifers and hardwoods respectively.

127. A — Mechanical stress stimulates the cambium to produce reaction wood and develop greater trunk taper at the base, where bending forces are greatest. Drought triggers stomatal closure. These responses address different types of stress through different mechanisms.

128. D — A sheltered, rigidly staked tree develops a thinner trunk with weaker taper because it lacks the wind-flexing stimulus that normally produces reaction wood. Naturally flexing trees develop stronger structure through mechanical stress. This is why prolonged staking is harmful.

129. C — Natural wind flexing stimulates the cambium to produce reaction wood and develop greater trunk taper. Rigid staking removes this stimulus and produces weaker trees. Natural flexing is essential to proper trunk development in young trees.

130. A — Mycorrhizal associations are mutually beneficial for both partners — the tree supplies sugars, and the fungus supplies water and mineral nutrients accessed through its extensive hyphal network. Parasitic fungi harm the host without providing benefit.

131. B — Ectomycorrhizae form a sheath around the outside of root cells and grow between cortical cells but do not penetrate them. Endomycorrhizae (arbuscular mycorrhizae) penetrate cortical cell walls with specialized structures. Both types benefit the tree.

132. D — Beneficial mycorrhizae extend the absorbing surface of the host root system through their hyphal network, reaching water and nutrients from a much larger soil volume. Soil pathogens damage the tree. The two groups of fungi have opposite effects on tree health.

133. A — Most absorbing roots of a mature tree are concentrated in the upper 12 to 18 inches of soil, where oxygen, water, and nutrients are most available. The central taproot concept is largely inaccurate for mature trees. Surface soil is where root activity concentrates.

134. C — The root flare is the widening at the base of the trunk where it meets the root system. A buttress root is a large structural root providing basal support. Finding and preserving the root flare at planting is essential.

135. D — Container circling roots follow the container wall during nursery production and become permanent defects if not corrected at planting. They can girdle the trunk years later. Circling roots must be cut or straightened before placing the tree in the hole.

136. B — A balled-and-burlapped tree is dug from a field nursery with its root ball wrapped in burlap and often secured with a wire basket. Container trees are grown in plastic pots. The production method affects handling and establishment characteristics.

137. C — A bare-root tree is shipped without soil around the exposed roots, which must be kept moist and planted quickly. Container and B&B trees include soil. Bare-root shipping is common for deciduous species during dormancy.

138. A — Soil texture refers to the relative proportions of sand, silt, and clay particles in a soil. Structure refers to how those particles are arranged into aggregates. Texture is essentially permanent; structure can be improved over time through organic matter.

139. D — Soil structure refers to the arrangement of particles into stable aggregates that create pore space for water, air, and roots. Texture refers to particle size proportions. Structure is improved through organic matter additions; texture cannot be meaningfully changed.

140. B — Field capacity is the moisture level held in soil after free drainage has ceased under gravity. It represents the maximum plant-available water. The permanent wilting point is the lower limit of plant-available water.

141. A — The permanent wilting point is the moisture level at which plants cannot recover turgor even when moved to saturated conditions. It defines the lower limit of plant-available water. Plants wilt and die below this level.

142. C — Plant-available water lies between field capacity (upper limit) and the permanent wilting point (lower limit). This range represents water that roots can actually extract for growth. The rest of the soil water is either bound too tightly or drains away.

143. B — A hydrophobic soil repels water and causes surface runoff rather than infiltration. This can develop in soils with heavy organic residues or after severe drought. Wetting agents can sometimes restore normal infiltration.

144. D — Compaction eliminates the pore space needed for root gas exchange — particularly the large pores that hold air. Roots that cannot respire cannot absorb water or nutrients. This is the primary mechanism by which compaction kills urban trees.

145. A — A bulk density of 1.2 g/cm³ represents loose soil supporting healthy root expansion. Above 1.7 indicates severe compaction. Good soil structure combined with adequate organic matter produces bulk densities in the 1.0 to 1.4 range.

146. C — Low-CEC soils (sandy, low in organic matter) leach cations more readily after fertilization because they have fewer negatively charged sites to hold them. High-CEC soils retain nutrients better. Building organic matter raises CEC over time.

147. D — Organic mulch decomposes over time and contributes to soil organic matter, improving structure, CEC, and microbial activity. Inorganic mulches like gravel do not decompose. Organic mulch is preferred for landscape tree plantings.

148. B — A 3-inch mulch layer with the trunk kept clear is within the recommended 2 to 4 inch range and protects the root zone without causing bark decay. Mulch piled 8 inches against the trunk suffocates roots and damages the bark. Placement matters as much as depth.

149. A — A mulch volcano piles mulch against the trunk, suffocating the root flare and decaying the trunk bark. It also encourages girdling root formation. The correct shape is a flat ring with the trunk base exposed.

150. D — Sprinkler lawn irrigation typically wets only the upper inch or two of soil surface, which is inadequate for deep tree root systems. Trees benefit from slow, deep watering that reaches the main absorbing root zone. Frequency is less important than depth.

151. C — Deep watering encourages deeper root development and drought tolerance because roots grow toward available moisture. Shallow watering trains roots to stay at the surface, making trees more vulnerable to drought. Depth matters more than frequency.

152. B — A pH of 4.5 is strongly acidic, well below the neutral value of 7.0. At this level, aluminum and manganese toxicity become concerns for many tree species. Each whole number represents a tenfold change in hydrogen ion concentration.

153. A — A pH of 8.5 is alkaline, above the neutral midpoint of 7.0. At this level, iron, manganese, and phosphorus availability drops. Pin oaks and other acid-loving species develop interveinal chlorosis in such soils.

154. C — Soil acidification lowers pH toward the acidic end of the scale, often accomplished by adding elemental sulfur or acid-forming fertilizers. Alkalization raises pH through lime additions. Direction of pH change determines which amendment to use.

155. B — Elemental sulfur acidifies soil through microbial oxidation that produces sulfuric acid, lowering pH over time. Lime raises pH by neutralizing acidity. The two amendments have opposite effects and must be chosen based on soil needs.

156. D — Chelated iron remains chemically available to roots across a broader pH range than inorganic iron sulfate. In alkaline soils, inorganic iron rapidly precipitates and becomes unavailable. Chelated forms are more effective for treating iron chlorosis in high-pH soils.

157. C — Container-grown nursery stock has roots confined within the container walls during production, which can produce circling root defects. B&B stock is grown in open field soil. Container trees require careful root inspection and correction at planting.

158. A — A certified arborist has passed an ISA exam demonstrating baseline knowledge of tree biology, care practices, safety, and related topics. Certification is a professional credential that distinguishes trained practitioners from untrained workers.

159. D — A Tree Risk Assessment Qualification (TRAQ) requires completing formal training in the TRAQ risk assessment framework developed by ISA. This qualification is specific to tree risk assessment and is separate from general Certified Arborist status.

160. B — A city forester manages the urban forest as public infrastructure, overseeing street trees, park trees, inventories, ordinances, and public policy. A commercial arborist performs contract work on private properties. The two roles serve different but complementary functions.

161. B — An arboricultural specification details scope, objectives, standards, and deliverables in writing, providing a clear framework for the work. Verbal agreements leave expectations ambiguous. Written specifications protect both arborist and client.

162. D — A written estimate projects costs before the work is performed, allowing the client to make an informed decision. An invoice is issued after the work is complete and demands payment. The two documents serve different stages of the contract process.

163. A — A tree inventory documents all trees in the area with full data on species, size, condition, location, and management needs. A hazard tree list contains only trees requiring attention. Inventories support long-term management planning.

164. C — A municipal tree ordinance establishes legal standards for tree care and removal within the jurisdiction. It is enforceable under local law and applies to all property owners within the municipality. Ordinances distinguish municipal regulation from personal preference.

165. B — A tree removal permit authorizes the removal of a protected tree under local ordinance. Building permits authorize construction activities. The two permit types are separate and serve different regulatory purposes.

166. A — A landscape architect designs the overall layout and function of landscapes, including site planning, grading, plant selection, and use. An arborist specializes in individual tree care and health. The two professions collaborate on planting projects.

167. D — A consulting arborist provides assessments, reports, and expert opinions rather than performing production work. Production arborists climb, prune, rig, and remove trees. Consulting work requires strong diagnostic, communication, and writing skills.

168. C — The i-Tree suite quantifies ecosystem services such as stormwater interception, air quality improvement, carbon sequestration, and energy savings provided by urban tree populations. Property appraisals measure real estate value, which is a different metric.

169. A — The trunk formula method is used when a tree is too large to be practically replaced by nursery stock. It calculates value from trunk cross-sectional area adjusted by species, condition, and location ratings. Replacement cost applies to smaller trees.

170. B — Species rating in the trunk formula method reflects the desirability and suitability of the species in the local area. High-quality species well adapted to the location receive higher ratings; invasive or poorly suited species receive lower ones.

171. D — Condition rating reflects the current health and structural state of the specific tree being appraised. It includes canopy density, structure, defects, and overall vigor. Species and location ratings address other dimensions of value.

172. C — Location rating reflects the contribution of the site to the tree's value, including factors such as placement, functional value, and site desirability. A magnificent specimen in a poor location has less value than the same tree in a prominent location.

173. B — A tree protection ordinance typically requires permits for removal of protected trees, with penalties for unauthorized removal. Landscape ordinances address broader plant placement and maintenance. Tree protection ordinances specifically target mature tree preservation.

174. A — Canopy cover goals are typically expressed as the percentage of land area covered by tree canopy, measured through aerial imagery analysis. Tree counts measure individual trees. Canopy percentage is a more direct measure of urban forest functional value.

175. C — Tree City USA applies to municipalities that meet community forestry program standards, including a tree board, tree care ordinance, community forestry program meeting $2 per capita, and Arbor Day observance. Tree Campus USA applies to colleges and universities.

176. D — Tree City USA requires a minimum community forestry budget of two dollars per capita annually. This is the baseline funding threshold along with the other program requirements. The per-capita formula scales the requirement to community size.

177. A — Tree City USA Arbor Day observances include a formal program and tree planting activity, along with a proclamation issued by the community. This is one of the four standards for the recognition program. The observance demonstrates community commitment.

178. B — A tree board advises on tree policy and community forestry, typically including citizens and city staff. Public works departments handle physical infrastructure like streets and utilities. Tree boards provide dedicated oversight of urban forest management.

179. C — Street trees grow in a constrained public right-of-way setting with limited rooting volume, compacted soils, utility conflicts, and vehicle impacts. Park trees have more favorable growing conditions. Street trees are among the most challenging urban forest environments.

180. D — Urban tree canopy grows in a built environment with many stressors including compaction, pollution, heat, limited soil volume, and mechanical damage. Forest canopy grows under more natural conditions. Urban trees require active management to thrive.

181. B — The urban heat island effect is localized elevated temperature in built-up areas due to heat absorption by pavement and buildings and loss of vegetation. It is distinct from global climate change, though both are related to urban environments. Trees mitigate the heat island effect.

182. C — Evapotranspiration cooling is a natural process of water loss from tree leaves that cools the surrounding air through the phase change from liquid to vapor. Mechanical air conditioning uses refrigerants and electricity. Trees provide free, sustainable cooling.

183. A — Trees slow, absorb, and reduce runoff volume by intercepting rainfall on leaves and bark, increasing infiltration, and storing water in wood and soil. Concrete gutters channel water directly to storm drains. Trees provide substantial stormwater benefits that can be quantified.

184. D — Carbon sequestration stores carbon in woody biomass and soil organic matter as trees grow, removing carbon dioxide from the atmosphere. Carbon emission releases carbon into the atmosphere. Trees are a key natural carbon sink in the global carbon cycle.

185. C — Trees improve air quality by removing particulates on leaf surfaces and absorbing gaseous pollutants such as ozone, nitrogen dioxide, and sulfur dioxide through stomata. Smokestack filtration traps pollutants at the source. Trees provide distributed air quality benefits.

186. A — A shade tree reduces cooling loads by blocking direct sunlight on buildings during summer. Strategically placed shade trees can cut summer cooling bills by 20–30% in many climates. Deciduous species also allow winter sun to reach the building after leaf drop.

187. B — The psychosocial benefit of urban trees includes reduced stress, improved mental health, faster recovery from illness, and increased social connection. These benefits are documented in multiple studies and distinct from measurable ecosystem services like stormwater or cooling.

188. D — A documented ecosystem service value is quantified through tools like the i-Tree suite, producing dollar values for stormwater, cooling, air quality, and carbon. Anecdotal statements are opinions without measurement. Documented values support data-driven decision-making.

189. C — The 10-20-30 diversity rule protects urban forests against catastrophic pest-driven losses when species-, genus-, or family-specific pests arrive. Monocultures are devastated by single-pest events. Dutch elm disease and emerald ash borer illustrate why diversity matters.

190. A — Mass planting of a single species creates vulnerability to pest-driven canopy loss when a targeted pest arrives. The elm-lined streets devastated by Dutch elm disease illustrate this risk. Diversity is the primary insurance against such losses.

191. D — ANSI Z60.1 specifies quality standards for nursery stock, including root ball sizes, caliper measurements, and plant grading criteria. ANSI A300 addresses pruning, and Z133 addresses safety. Each standard covers a different aspect of professional tree care.

192. B — ANSI Z89.1 defines standards for industrial head protection, including impact ratings, electrical classifications, and construction specifications. It governs hard hats used in construction and tree care. ANSI Z133 incorporates Z89.1 requirements for arboricultural helmets.

193. A — A climbing helmet rated under ANSI Z89.1 is rated for impact from overhead falling objects, which is essential for tree work where branches, tools, and debris may fall. Bicycle helmets are rated only for forward impacts. The distinction matters for worker safety.

194. C — Personal fall arrest catches a worker after a fall has begun, absorbing energy through a harness and lanyard system. Fall restraint prevents the worker from reaching the fall edge in the first place. Arrest systems allow work at height; restraint systems prevent falls entirely.

195. B — A work-positioning rope supports a worker in position during tasks such as pruning, using the rope as the primary means of support. A life safety rope for fall arrest catches the worker after a fall begins. Both types have specific rating requirements.

196. A — A friction hitch uses cordage friction to grip and release the host rope, providing controlled ascent and descent. Mechanical ascenders use metal cam jaws. Friction hitches are the traditional climbing method and remain widely used for their simplicity and adjustability.

197. A — A mechanical descender uses a metal device to control rope slip during descent, providing consistent friction and smooth control. Friction hitches are tied from cordage. Mechanical descenders are often preferred for long descents and controlled rigging work.

198. C — A locking carabiner requires intentional action (screw gate, twist lock, or triple-action mechanism) to open the gate, preventing accidental opening under load. Open-gate snaps open more easily and are not used in life-safety applications. Locking carabiners are required for critical connections.

199. B — A wire-core flipline resists cuts from a chainsaw better than a pure rope flipline, providing an additional safety margin when working near the saw. Rope fliplines can be cut easily by an uncontrolled chain. The wire-core design is a common safety upgrade.

200. D — A worksite first aid kit is stocked for crew-level hazards including chainsaw injuries, severe lacerations, and bleeding control. Personal kits contain minimal supplies. Worksite kits must be appropriate for the specific hazards of tree care operations.