PRACTICE EXAM 16: CTS-I SIMULATION (FINAL EXAM)

QUESTIONS 1–125

Domain A — Conducting Pre-Installation Activities

1. A CTS-I installer receives a project with 16 conference rooms requiring identical AV installations. Planning efficiency is best achieved through:

A. Installing each room sequentially without coordinated planning

B. Duplicating the installation approach room-by-room

C. Scheduling installations based solely on client preference

D. Establishing standardized procedures, materials staging, and coordinated scheduling across all rooms

2. A pre-installation review identifies that the wiring schedule specifies 400 cables but drawings show only 350 cable pathways marked. The most professional response is:

A. Request design team clarification on the 50-cable discrepancy before proceeding

B. Install 350 cables and document the deviation

C. Install 400 cables without specific pathways

D. Reduce cable count to match available pathways

3. A 1.25-inch EMT conduit has internal cross-sectional area of 1.496 square inches. At 40% fill with 12 cables of equal size, the maximum individual cable cross-sectional area is approximately:

A. 0.0625 square inches

B. 0.0450 square inches

C. 0.0499 square inches

D. 0.0550 square inches

4. An installation manager calculates that 85 baseline labor hours need productivity adjustments of 15% (occupied building), 10% (restricted access), and 20% (coordination complexity). Applied multiplicatively, total hours equal approximately:

A. 120 hours

B. 129 hours

C. 135 hours

D. 145 hours

5. A pre-installation walkthrough identifies that the proposed ceiling projector mount point is 2 inches away from a structural beam. The most appropriate response is:

A. Use adhesive mounting to avoid the beam

B. Install the projector mount off-center from the beam

C. Drill through the beam to maintain specified mounting location

D. Coordinate with structural engineer to verify proximity acceptable or relocate

6. The acronym DISCAS in AV standards refers to:

A. Display Image Size for 2D Content specified by AVIXA V202.01

B. Distributed Speaker Coverage Area Standard

C. Digital Signal Classification and Scheduling

D. Design Specification for Installation Compliance Assessment

7. A pre-installation site survey identifies that electrical circuits planned for AV equipment are 120V but the specified equipment includes 208V items. The primary concern is:

A. Equipment voltage must match available circuit voltage

B. Higher voltages generate more heat

C. Voltage mismatches prevent equipment operation and may cause damage

D. Circuit costs vary with voltage

8. NEC fill limits for two cables in a conduit restrict cumulative cable cross-sectional area to:

A. 40% of conduit internal area

B. 31% of conduit internal area

C. 53% of conduit internal area

D. 25% of conduit internal area

9. A pre-installation site survey identifies 14 acoustic panels on conference room walls. The primary consideration for microphone placement is:

A. Panels don't affect microphone performance

B. Panel locations determine microphone mounting points

C. Panels require different microphone types

D. Acoustic treatment affects microphone pickup characteristics and optimal placement

10. A pre-installation review of a specified 500-pound rack identifies that the installation room floor lacks structural capacity documentation. The appropriate response is:

A. Verify floor capacity through structural engineering review before installation

B. Install with weight distribution across multiple points

C. Use adhesive mounting to reduce point load

D. Accept the condition and proceed

11. A 0.25-inch diameter cable has cross-sectional area of approximately:

A. 0.0314 square inches

B. 0.0491 square inches

C. 0.0615 square inches

D. 0.0738 square inches

12. A pre-installation meeting with the client typically covers which of these critical areas?

A. Equipment selection and procurement

B. Only installation schedule

C. Schedule, access, scope, safety, communication, and key personnel

D. Only cost and billing arrangements

13. A pre-installation review shows that specified fiber cables exceed the installer's current inventory by 2,000 feet. The most appropriate response is:

A. Procure additional fiber with adequate lead time before installation begins

B. Use available quantity and obtain remainder during installation

C. Substitute copper cable for fiber sections

D. Reduce fiber specifications

14. A drawing scale of 1/8" = 1'-0" shows a ceiling plan 24 inches long on paper. The actual dimension is:

A. 128 feet

B. 160 feet

C. 184 feet

D. 192 feet

15. A pre-installation walkthrough identifies that specified Power over Ethernet devices require 30 watts each, but the installed network switch provides only IEEE 802.3af PoE (12.95 watts at device). The appropriate response is:

A. Reduce device scope to fit PoE capacity

B. Coordinate with IT to upgrade switch to PoE+ or PoE++ supporting higher wattage

C. Use external power supplies for PoE devices

D. Accept the limitation and operate at reduced performance

16. The acronym EDID in digital video context stands for:

A. Extended Digital Interface Data

B. Embedded Digital Information Descriptor

C. Extended Display Identification Data

D. Encrypted Digital Interface Descriptor

17. A pre-installation site survey identifies that the equipment room connects to the main HVAC system supply duct. The primary concern is:

A. Cold air from HVAC may cause condensation on equipment

B. HVAC air provides adequate ventilation

C. HVAC air temperature is always ideal

D. HVAC connection is irrelevant to AV equipment

18. A pre-installation review identifies 45 wall-mounted displays in a retail installation. Structural blocking requirements best addressed by:

A. The installer during mounting

B. The drywall contractor during wall finishing

C. The electrical contractor during rough-in

D. Coordination with general contractor during framing

19. A pre-installation labor calculation of 200 hours with 18% productivity decrease due to difficult site conditions requires:

A. 218 hours

B. 244 hours

C. 260 hours

D. 300 hours

20. The acronym HDBaseT in AV transmission stands for:

A. High-Definition Basic Transmission

B. Home Digital Broadcasting Technology

C. High-Definition signal transmission over standard Category-rated copper cable

D. Hybrid Digital Broadcast Transmission

21. A pre-installation review identifies that the client has specified professional-grade audio equipment operating in their existing building electrical environment. The most critical electrical coordination issue is:

A. Ensuring dedicated AV circuits with appropriate grounding

B. Coordinating fiber optic pathways

C. Installing network infrastructure

D. Specifying HVAC requirements

22. A pre-installation walkthrough identifies that wireless microphone channel assignments must avoid local TV broadcasts. The appropriate response is:

A. Accept interference as unavoidable

B. Use wired microphones throughout

C. Operate at reduced power

D. Coordinate FCC-compliant frequency selection with regional spectrum considerations

23. The acronym NFPA in AV installation context refers to:

A. National Fabric Protection Agency

B. Northwest Fire Protection Association

C. National Fire Protection Association publishing NFPA 70 (NEC)

D. National Federation of Public Administrators

24. A pre-installation review identifies that specified display mount requires 4 studs for attachment, but existing construction provides studs on 24-inch centers rather than the typical 16-inch centers. The appropriate response is:

A. Install into drywall between studs using anchors

B. Coordinate with structural for blocking to accommodate 4-stud mounting pattern

C. Use adhesive mounting to bypass stud requirement

D. Reduce display mounting to 2 studs

25. A pre-installation walkthrough identifies that the AV installation must coordinate with a separately-contracted security system installer. The appropriate coordination approach is:

A. Inter-vendor coordination through project manager or general contractor

B. Direct coordination between vendors without supervisors

C. Completely independent work

D. Coordination only at final commissioning

26. The 4:1 safety factor for non-overhead mounting applied to a 180-pound display requires mount/wall capacity of:

A. 540 pounds

B. 720 pounds

C. 900 pounds

D. 1,080 pounds

27. A pre-installation review identifies that cable pathway specifications require 24-inch separation between AV and line-voltage electrical cables. The primary reason for separation is:

A. Code requires specific separation regardless of application

B. Aesthetic considerations

C. Simpler installation

D. Preventing electromagnetic coupling that degrades AV signal quality

28. A pre-installation meeting agenda topic "key personnel" typically addresses:

A. Identifying installer representatives, client contacts, and general contractor personnel for project communication

B. Training requirements for new personnel

C. Personnel insurance coverage

D. Worker compensation rates

Domain B — Conducting Site Rough-In/First-Fix

29. A cable pulled through 60 feet of conduit with 4 bends (3 at 90° and 1 at 45°) has cumulative bend angle of:

A. 225 degrees

B. 270 degrees

C. 315 degrees

D. 360 degrees

30. A 1/2-inch A307 threaded rod has tensile failure capacity of 10,000 pounds. Working load at 5:1 overhead safety factor is:

A. 2,000 pounds

B. 2,500 pounds

C. 4,000 pounds

D. 5,000 pounds

31. OSHA fall protection anchor points must have capacity of 5,000 pounds per attached worker. For 3 workers simultaneously attached, the total required capacity is:

A. 5,000 pounds

B. 10,000 pounds

C. 12,500 pounds

D. 15,000 pounds

32. A cable with minimum bend radius of 4× diameter for installation applied to a 0.50-inch cable requires minimum bend radius of:

A. 1.0 inch

B. 2.0 inches

C. 3.0 inches

D. 4.0 inches

33. An installer working on scaffolding at 18 feet above ground requires fall protection through:

A. No fall protection required at this height

B. Spotter on the ground

C. Guardrails on all open sides of the scaffold platform

D. Safety net below work area

34. An extension ladder placed at the 4-to-1 rule with base 6 feet from the structure supports working height of:

A. 24 feet

B. 30 feet

C. 36 feet

D. 18 feet

35. A worker on a scissor lift with full-perimeter guardrails is generally:

A. Required to wear personal fall arrest at all heights

B. Required to have spotter on ground

C. Required to wear personal fall arrest only above 20 feet

D. Provided sufficient passive fall protection by the guardrails

36. Concrete masonry walls require which fastener type for AV equipment mounting?

A. Wood lag bolts

B. Plastic expansion anchors

C. Concrete-rated wedge or sleeve anchors

D. Sheet metal screws

37. A cable approaching manufacturer maximum pulling tension indicates:

A. Normal pulling conditions

B. Approaching damage threshold — stop and investigate

C. Adequate lubrication applied

D. Faster pull speed needed

38. Asbestos discovery during deinstallation requires:

A. Continuing with N95 dust masks

B. Notifying only the client

C. Capping cable ends and continuing

D. Immediate work stoppage and contacting qualified abatement personnel

39. OSHA construction silica standard for concrete cutting requires:

A. Water suppression, local exhaust ventilation, or respiratory protection

B. Standard N95 dust masks

C. Outdoor cutting only

D. Carbide blade replacement

40. A J-hook supporting cable in plenum space must be:

A. Made of any available metal

B. Color-coded for identification

C. Plenum-rated and attached to structural members

D. Spaced at 12-foot intervals

41. Structural blocking for a 200-pound wall-mounted display is best installed by:

A. The installer after drywall

B. The general contractor or framing trade during construction, spanning multiple studs

C. The drywall contractor during finishing

D. The electrical contractor during rough-in

42. NEC cumulative bend angle limit between pull points is:

A. 180 degrees

B. 270 degrees

C. 450 degrees

D. 360 degrees

Domain C — Installing Audiovisual Systems

43. A standardized rack unit (RU) equals:

A. 1.75 inches

B. 1.5 inches

C. 2.0 inches

D. 1.625 inches

44. The standard rack mounting width is:

A. 17 inches

B. 18 inches

C. 19 inches

D. 21 inches

45. A 32U rack-mount device occupies vertical mounting height of:

A. 50 inches

B. 52 inches

C. 54 inches

D. 56 inches

46. The 80% rule applied to a 25-ampere circuit limits continuous loads to:

A. 20 amperes

B. 22 amperes

C. 18 amperes

D. 25 amperes

47. A 250-watt heat load converts to approximately:

A. 700 BTU/hour

B. 853 BTU/hour

C. 950 BTU/hour

D. 1,100 BTU/hour

48. The XLR connector AES convention assigns Pin 2 to:

A. Ground/shield

B. Cold/negative signal

C. Phantom power return

D. Hot/positive signal

49. Phantom power for condenser microphones is standardized at:

A. 48 volts DC

B. 24 volts DC

C. 12 volts DC

D. 36 volts DC

50. A balanced audio cable uses:

A. One conductor plus shield

B. Three conductors plus shield

C. Two conductors plus shield

D. Four conductors plus shield

51. A 6 dB increase in audio voltage represents a voltage ratio of:

A. 2:1

B. 3:1

C. 4:1

D. 1.5:1

52. The decibel formula for voltage ratios uses multiplier:

A. 10

B. 15

C. 20

D. 25

53. A 70V amplifier rated at 600 watts should drive maximum tap load of approximately:

A. 600 watts

B. 540 watts

C. 400 watts

D. 480 watts

54. The transformer at each loudspeaker on a 70V system:

A. Provides phantom power

B. Steps down the high-voltage line to the loudspeaker's voltage

C. Converts AC to DC

D. Boosts signal for long runs

55. Cat6A cable supports maximum frequency of:

A. 500 MHz

B. 250 MHz

C. 350 MHz

D. 100 MHz

56. The maximum permissible untwist at Cat6A termination is:

A. 0.75 inches

B. 0.25 inches

C. 0.5 inches

D. 1.0 inches

57. 75-ohm coaxial cable is typically used for:

A. RS-232 serial control

B. Speaker-level audio

C. Communications RF including two-way radio

D. Video signal transport including SDI and CATV

58. The maximum HDBaseT 4K60 copper cable distance is:

A. 50 meters

B. 100 meters (328 feet)

C. 75 meters

D. 200 meters

59. EDID information flows between source and display through:

A. A separate management network

B. RS-232 serial connection

C. The DDC channel embedded within the HDMI or DisplayPort cable

D. Manual configuration

60. HDCP 2.2 is required for:

A. 4K UHD content from compatible sources

B. 1080p content from any source

C. Standard-definition video

D. Audio content over Dante networks

61. OM3 multimode fiber supports 10 Gbps Ethernet to:

A. 100 meters

B. 200 meters

C. 400 meters

D. 300 meters

62. APC fiber connectors are color-coded:

A. Blue

B. Green

C. Beige

D. Yellow

63. Dante typical latency at standard settings is:

A. 50 to 100 milliseconds

B. 10 to 20 milliseconds

C. 0.25 to 1 millisecond

D. 5 to 10 milliseconds

64. SDVoE distributes uncompressed 4K60 video over minimum network of:

A. 10 Gbps Ethernet

B. 1 Gbps Ethernet

C. 100 Mbps Ethernet

D. Wireless 802.11ac

65. IEEE 802.3at provides power at powered device of:

A. 12.95 watts

B. 25.5 watts

C. 51 watts

D. 71 watts

66. A /24 subnet provides usable hosts of:

A. 128

B. 256

C. 126

D. 254

67. RFC 1918 private IPv4 ranges include:

A. 10.0.0.0/8, 172.16.0.0/12, and 192.168.0.0/16

B. Only 192.168.0.0/16

C. Only 10.0.0.0/8

D. Only 172.16.0.0/12

68. RS-232 typical baud rates range between:

A. 1200 and 4800 bps

B. 4800 and 9600 bps

C. 9600 and 115200 bps

D. 250000 and 500000 bps

69. RS-232 configuration requires matching:

A. IP address, subnet mask, gateway

B. Baud rate, data bits, parity, stop bits

C. MAC address and VLAN

D. Frequency, modulation, encryption

70. IR control is generally:

A. Bidirectional with status feedback

B. Effective at 500 feet

C. Compatible with all equipment

D. Unidirectional with no status feedback

71. A control processor with no IP response should first:

A. Reboot the processor

B. Replace the network cable

C. Verify network connectivity using ping

D. Update device firmware

72. An 8-ohm loudspeaker with 5% cable resistance limit allows maximum cable resistance of:

A. 0.40 ohms

B. 0.20 ohms

C. 0.50 ohms

D. 0.10 ohms

73. Three 8-ohm loudspeakers in parallel present combined impedance of:

A. 4 ohms

B. 2.67 ohms

C. 8 ohms

D. 24 ohms

74. Digital signals degrading over distance exhibit:

A. Gradual quality degradation

B. Increasing color saturation

C. Audible noise

D. Full quality until catastrophic failure at the digital cliff

75. A waveform monitor displays:

A. Video signal amplitude over time

B. Video chrominance

C. Audio levels

D. Network bandwidth

76. A vectorscope displays:

A. Video signal amplitude

B. Audio frequency

C. Video chrominance on a polar plot

D. Network packet loss

77. A projector with throw ratio 2.4:1 at 36 feet produces image width of:

A. 10 feet

B. 15 feet

C. 18 feet

D. 20 feet

78. The target white point for video calibration is:

A. 6500K (D65)

B. 5500K

C. 7500K

D. 9300K

79. The target gamma for standard video is:

A. 1.8

B. 2.0

C. 2.4

D. 2.2

80. AVIXA DISCAS basic decision-making content maximum viewing distance:

A. 4 times image height

B. 6 times image height

C. 8 times image height

D. 12 times image height

81. AVIXA DISCAS analytical decision-making content maximum viewing distance:

A. 8 times image height

B. 4 times image height

C. 12 times image height

D. 6 times image height

82. A measurement microphone has:

A. Flat response with omnidirectional pattern

B. Cardioid pattern

C. Hypercardioid pattern

D. Ribbon transducer

83. AES67 primarily provides:

A. Audio encryption

B. Power delivery

C. Frequency analysis

D. Open interoperability between manufacturers' networked audio

84. A polarity tester confirms:

A. Amplifier output voltage

B. Audio signal level

C. All loudspeakers move in the same direction on the same signal

D. Cable shielding

85. Cable certification for Cat6A tests:

A. Length and continuity only

B. Insertion loss, return loss, NEXT, ANEXT, propagation delay, and other parameters

C. Voltage drop only

D. Visual inspection only

86. 1080p60 at 8-bit color requires approximately:

A. 3.0 Gbps

B. 9.0 Gbps

C. 6.0 Gbps

D. 4.5 Gbps

87. 4K60 at 10-bit color with HDR requires approximately:

A. 24 Gbps

B. 12 Gbps

C. 18 Gbps

D. 36 Gbps

88. A 70V system with 8 loudspeakers at 12.5-watt taps has total tap load of:

A. 80 watts

B. 90 watts

C. 100 watts

D. 110 watts

Domain D — Perform Systems Close-Out

89. ANSI/AVIXA 10:2013 structures verification into levels representing:

A. Primary, Secondary, Tertiary

B. A-Level, B-Level, C-Level representing essential, specialized, and unique items

C. Level 1, Level 2, Level 3

D. Critical, Important, Optional

90. A non-functional system audio output is classified as:

A. A cosmetic deficiency

B. A pre-existing condition

C. A user training issue

D. A substantive deficiency affecting system function

91. Substantial completion is the milestone at which:

A. The system is ready for its intended use and warranty typically begins

B. All punch list items are resolved

C. The installer's contract begins

D. Final retention is released

92. A 12-month warranty typically begins at:

A. Contract signing

B. Equipment delivery

C. Substantial completion when the client takes beneficial use

D. First day of installation

93. As-built documentation records:

A. Original design intent

B. The installed system's actual configuration for future reference

C. Contract scope

D. Change order history

94. A typical end-user training session features:

A. Extended technical sessions

B. Lecture-style presentation

C. Self-paced video training

D. Brief focused sessions on essential operations with hands-on practice

95. A quick reference guide should include:

A. Essential functions with screenshots and simple instructions

B. Complete signal flow diagrams

C. Detailed technical specifications

D. Manufacturer service information

96. A service agreement typically provides:

A. Complete upgrades at no additional cost

B. Free equipment replacement

C. Defined response times, scheduled preventive maintenance, and priority service

D. Manufacturer warranty extension

97. A typical preventive maintenance schedule recommends:

A. Monthly visits

B. Annual visits with more frequent visits for high-use environments

C. Visits only when problems occur

D. Quarterly visits universally

98. Signed sign-off documentation creates:

A. Warranty registration

B. Tax documentation

C. Next-phase trigger

D. A formal written record of client acceptance

99. A substantial completion walk-through involves:

A. The installer, client representative, and sometimes the general contractor

B. Only the lead installer

C. Only the design engineer

D. Only client accounting

100. A certificate of substantial completion documents:

A. Original equipment costs

B. That the system is ready for use even though minor work may remain

C. Serial numbers

D. Service life expectations

101. A client representative signing completion documents typically holds:

A. Limited informal authority

B. Date verification authority only

C. Authority to modify contract terms

D. Formal signing authority for the client organization

102. Project closeout deliverables typically include:

A. As-built drawings, equipment manuals, warranty documentation, and verification reports

B. Only equipment manuals

C. Only as-built drawings

D. Only warranty cards

Domain E — Conducting Ongoing Project Responsibilities

103. Daily progress reports primarily:

A. Calculate weekly invoices

B. Document activities, labor, materials, and issues for the project record

C. Document equipment serial numbers

D. Track individual installer productivity

104. An RFI is used to:

A. Document materials consumed

B. Request labor resources

C. Submit invoices

D. Obtain clarification from the design team on field-discovered issues

105. Substituting equivalent accessories is typically:

A. A major change requiring change order

B. A code violation

C. A minor adaptation within installer authority requiring documentation

D. A breach of contract

106. Trade coordination is managed through:

A. The general contractor's superintendent and coordination meetings

B. Direct trade communication without supervisors

C. The architect

D. The client's facilities director

107. A change order is required when:

A. Materials consumed faster than estimated

B. Work scope expands beyond original contract specifications

C. Work occurs during evening hours

D. Equipment fails during installation

108. "Clean as you go" means:

A. Weekly cleanup sweeps

B. Specialized cleaning contractors handle everything

C. Cleanup deferred to close-out

D. Cable scraps, packaging, and debris managed continuously

109. Construction debris is typically disposed of through:

A. The general contractor's construction waste management system

B. The AV firm's own dumpster

C. Client's regular building trash

D. Personal disposal

110. A delay caused by another trade should be reported through:

A. Direct confrontation

B. Social media

C. The project manager who can coordinate response

D. Formal grievance

111. OSHA silica controls include:

A. Standard N95 dust masks

B. Water suppression, local exhaust ventilation, or respiratory protection

C. Outdoor cutting only

D. Carbide blade replacement

112. BIM coordination drawings support:

A. Marketing presentations

B. Building permits

C. Insurance documentation

D. Conflict identification between MEP, fire protection, and technology systems

113. Discovering an unexpected condition affecting original design requires:

A. Reporting through appropriate channels for engineering review

B. Unreported installation modification

C. Waiting for design team discovery

D. Documentation only for as-builts

114. A delay should be reported to the project manager:

A. Only after missed milestone

B. At next meeting only

C. As soon as potential delay is identified, even if impact is uncertain

D. Only when cause is confirmed

115. A scope change during installation should:

A. Be implemented immediately

B. Be routed through the project manager for change order processing

C. Be ignored if small

D. Be assigned without documentation

116. Work beyond original scope without change order approval typically results in:

A. Premium reimbursement

B. Automatic invoice addition

C. Default client acceptance

D. Labor and materials consumed without compensation

117. Documentation of field engineering decisions supports:

A. Both as-built records and traceability of decisions under installer authority

B. Sales discussions

C. Manufacturer communication

D. Performance reviews

118. The installer's firestopping responsibility is:

A. Defer to general contractor

B. Apply silicone caulk as temporary measure

C. Either perform firestopping correctly or coordinate with the firestop contractor

D. Use same material regardless of wall rating

119. Discovering asbestos-containing material requires:

A. Continuing with PPE

B. Stopping work immediately and contacting qualified abatement personnel

C. Capping cable ends

D. Notifying only the client

120. Root-cause analysis after service incidents:

A. Determines crew responsibility

B. Documents for legal proceedings

C. Calculates warranty coverage

D. Understands why the failure occurred so it does not recur

121. A typical AV installation service life is approximately:

A. 7 to 10 years

B. 2 to 3 years

C. 15 to 20 years

D. 25 to 30 years

122. End-of-life indicators include:

A. Increased user satisfaction

B. Decreased preventive maintenance

C. Increasing service frequency, declining reliability, parts unavailability

D. Reduced electricity consumption

123. Decommissioned equipment with configuration data should be:

A. Returned to manufacturer

B. Factory-reset or data-wiped before leaving the client's site

C. Donated without modification

D. Stored in client's facility

124. RoHS primarily addresses:

A. Restricted materials in electronic equipment requiring responsible handling

B. Workplace safety

C. Building codes

D. Warranty terms

125. The installer-installation relationship typically extends:

A. Only through client handover

B. Through manufacturer warranty only

C. Until next management election

D. Through the entire service life via maintenance and service

PRACTICE EXAM 16: ANSWER KEY WITH FULL ANSWER EXPLANATIONS

Questions 1–125

Domain A — Conducting Pre-Installation Activities

1. D — Establishing standardized procedures, materials staging, and coordinated scheduling across all rooms. Multi-room installations achieve efficiency through standardization that eliminates redundant decision-making across identical rooms, coordinated materials staging that minimizes movement, and scheduling that optimizes crew time across the project. Sequential room-by-room installation without standardization wastes time repeatedly deciding the same questions; duplicating approaches without coordination misses optimization opportunities; client-preference scheduling rarely produces efficient sequences. Professional installers plan identical multi-room installations systematically to achieve the economies of scale these projects offer.

2. A — Request design team clarification on the 50-cable discrepancy before proceeding. Significant discrepancies between project documents indicate coordination issues that must be resolved by the design team before installation begins. Installing fewer cables than specified may leave the installation incomplete; installing without specific pathways creates code and coordination violations; reducing cable counts unilaterally bypasses design authority. Formal design team resolution ensures that the installation matches design intent and that installer liability is clear.

3. C — 0.0499 square inches. The 40% fill of 1.496 square inches equals 0.598 square inches maximum cable area; divided by 12 cables yields 0.0499 square inches per cable maximum. This calculation determines the maximum individual cable cross-sectional area that allows all 12 cables to fit within NEC fill limits. Exceeding this value for any cable in the bundle violates NEC requirements.

4. B — 129 hours. Applied multiplicatively: 85 × 1.15 × 1.10 × 1.20 = 85 × 1.518 ≈ 129 hours. Productivity factors compound when multiple conditions affect the work, making multiplicative application essential for accurate estimation. Additive factors (which would produce 85 × 1.45 = 123 hours) understate compounded conditions that together affect installation efficiency more than their individual effects suggest.

5. D — Coordinate with structural engineer to verify proximity acceptable or relocate. Mounting near structural elements requires engineering verification because structural members have specific

load requirements and nearby mounting may be affected by structural considerations. Adhesive mounting is inadequate for substantial equipment; off-center mounting may not address structural concerns; drilling through structural beams without authorization violates structural integrity. Professional practice coordinates with structural engineering when mounting locations raise structural questions.

6. A — Display Image Size for 2D Content specified by AVIXA V202.01. DISCAS (Display Image Size for 2D Content) is the AVIXA standard specifying recommended image size relative to viewing distance and content type. The standard distinguishes between basic decision-making content (requiring general readability) and analytical decision-making content (requiring fine detail discrimination). Understanding DISCAS is fundamental to AV room design and display sizing.

7. C — Voltage mismatches prevent equipment operation and may cause damage. Operating AV equipment on incorrect voltage either prevents operation (when voltage is insufficient) or damages equipment (when voltage is excessive). Voltage matching between available electrical infrastructure and equipment requirements is a fundamental electrical coordination requirement. Heat generation, circuit costs, and other factors are secondary to the primary voltage matching issue.

8. B — 31% of conduit internal area. NEC fill limits for two cables in a conduit restrict cumulative cross-sectional area to 31% of conduit internal area. This is more restrictive than the 40% limit for three or more cables because of geometric considerations — two cables can jam against each other in specific conditions that the 31% limit prevents. Understanding these specific percentages for different cable counts is essential for accurate fill calculations.

9. D — Acoustic treatment affects microphone pickup characteristics and optimal placement. Acoustic panels absorb sound, changing room acoustics and affecting microphone pickup quality. Microphone placement considerations include acoustic treatment locations, reflection patterns, and direct sound paths — panels fundamentally alter these relationships. Coordinating microphone placement with acoustic treatment produces better audio quality than ignoring treatment or simply avoiding panel locations.

10. A — Verify floor capacity through structural engineering review before installation. Substantial equipment loads on undocumented floor structure require engineering verification before installation. A 500-pound rack concentrated on small leveling feet creates significant point loads that may exceed some floor structures, particularly older buildings or areas with reduced structural capacity. Weight distribution alone may not address the underlying capacity question; adhesive mounting doesn't apply to floor-mounted racks.

11. B — 0.0491 square inches. Cross-sectional area = $\pi \times (d/2)^2 = \pi \times (0.125)^2 = \pi \times 0.0156 \approx 0.0491$ square inches. This formula applies uniformly to all circular cables and is fundamental to NEC fill

calculations. Accurate computation requires using the diameter divided by 2, then squaring, then multiplying by π.

12. C — Schedule, access, scope, safety, communication, and key personnel. Comprehensive pre-installation meetings establish shared understanding across all critical dimensions before installation begins. Limiting meetings to single topics like equipment selection, schedule, or billing leaves other areas unaddressed, creating gaps that produce conflicts during installation. Professional practice uses the comprehensive approach to align all stakeholders.

13. A — Procure additional fiber with adequate lead time before installation begins. Fiber optic cable may have significant lead times, particularly for specialized fiber types. Procuring the full required quantity before installation begins ensures continuity during work; obtaining remainder during installation creates schedule delays when the quantity arrives late; substituting copper bypasses design requirements; reducing specifications compromises the installation. Professional procurement plans for complete installation needs.

14. D — 192 feet. At 1/8" = 1'-0" scale, 24 inches × 8 feet per inch = 192 feet. Scale conversion at 1/8" scale means each 1/8" on paper represents 1 foot of reality, so 24 inches contains 24 × 8 = 192 eighth-inch segments representing 192 feet.

15. B — Coordinate with IT to upgrade switch to PoE+ or PoE++ supporting higher wattage. Power-class mismatches between PoE devices and PoE sources are network infrastructure issues requiring IT coordination. Basic PoE (802.3af) provides 12.95W at device; PoE+ (802.3at) provides 25.5W; PoE++ (802.3bt) provides up to 71W. Devices requiring 30W exceed basic PoE capability but are supported by PoE+. Reducing device scope abandons design; external power supplies complicate the installation; accepting limitations compromises performance.

16. C — Extended Display Identification Data. EDID is a data structure that displays use to communicate their capabilities to source devices. The information includes supported resolutions, refresh rates, color depths, and other display parameters. EDID exchange allows source devices to automatically configure output to match display capabilities, enabling plug-and-play compatibility between connected devices.

17. A — Cold air from HVAC may cause condensation on equipment. Main HVAC system supply delivers cold air that can cause condensation on AV equipment when cold air contacts warm equipment surfaces, particularly in high-humidity environments. Condensation damages electronics and reduces reliability. While HVAC provides ventilation, the type and location of HVAC connection affects equipment differently — dedicated AV HVAC is typically preferred over connection to general building HVAC.

18. D — Coordination with general contractor during framing. Wall-mounted display blocking must be installed during framing before drywall closes the walls, making this a construction-phase activity coordinated with the general contractor. Installing blocking after drywall is inadequate;

drywall contractors and electrical contractors don't have scope for structural work. Early coordination during framing ensures blocking is in place when AV mounting begins.

19. B — 244 hours. 200 × 1.22 (adjusting for 18% productivity decrease) = 244 hours. A 18% productivity decrease means the same work requires 18% more time, calculated as 1 ÷ 0.82 = 1.22. Simple percentage addition (200 × 1.18 = 236) would be incorrect — productivity decrease is multiplicative against completion rate rather than additive.

20. C — High-Definition signal transmission over standard Category-rated copper cable. HDBaseT is an AV transmission protocol that carries HD and 4K video, audio, Ethernet, and control over Cat6/6A copper cabling to 100 meters. This long-distance capability over standard cabling distinguishes HDBaseT from HDMI, which is practically limited to much shorter distances.

21. A — Ensuring dedicated AV circuits with appropriate grounding. Professional audio equipment requires clean power with appropriate grounding to maintain audio signal quality without hum, noise, or ground loops. Dedicated circuits isolate AV equipment from electrical noise generated by other building loads; proper grounding provides the ground reference essential for balanced audio and equipment safety. Fiber optics, network infrastructure, and HVAC are secondary to the fundamental electrical requirements.

22. D — Coordinate FCC-compliant frequency selection with regional spectrum considerations. Wireless microphone frequencies must comply with FCC regulations that vary by region and change as spectrum is reallocated. Local TV broadcast coordination requires knowing current regional assignments. Accepting interference, operating at reduced power, or switching to wired microphones all either compromise the design, create legal exposure, or bypass the specific challenge.

23. C — National Fire Protection Association publishing NFPA 70 (NEC). NFPA is the National Fire Protection Association, which publishes NFPA 70 (the National Electrical Code) along with many other fire and life-safety standards that affect AV installation work. NFPA codes are relevant to AV installers particularly for cable ratings, firestop requirements, and fire alarm interface coordination.

24. B — Coordinate with structural for blocking to accommodate 4-stud mounting pattern. Display mounts requiring 4-stud attachment need blocking that spans the 4 studs (requiring longer blocking material at 24-inch stud spacing vs. typical 16-inch). Coordinating with structural engineering or the framing trade ensures appropriate blocking is installed during construction. Drywall anchors, adhesive mounting, and reduced-stud mounting all compromise mounting security for this display.

25. A — Inter-vendor coordination through project manager or general contractor. Multiple vendors on a project require coordinated interaction through appropriate authority to manage schedule, access, scope boundaries, and potential conflicts. Direct vendor-to-vendor coordination without supervision lacks structure and authority; independent work creates conflicts; coordinating only at commissioning misses issues that emerge throughout installation.

26. B — 720 pounds. 180 × 4 = 720 pounds minimum capacity. The 4:1 safety factor for non-overhead mounting accounts for dynamic loading, fatigue, material variability, and installation imperfections. This calculation is straightforward multiplication but fundamental to determining mount specifications for specific equipment loads.

27. D — Preventing electromagnetic coupling that degrades AV signal quality. Separation between low-voltage AV cables and line-voltage electrical cables prevents electromagnetic interference that can couple onto AV signals, producing noise, hum, and signal degradation. The 24-inch separation (typical) is based on coupling physics — closer parallel runs increase coupling proportional to length and inverse to distance. Code requirements exist partly to protect AV signal integrity, not just for physical safety.

28. A — Identifying installer representatives, client contacts, and general contractor personnel for project communication. The "key personnel" agenda topic at pre-installation meetings identifies specific individuals who will handle communication, authorization, and decisions during the project. Knowing key personnel prevents communication failures and ensures decisions reach authorized parties. Training, insurance, and compensation are separate HR topics, not project coordination concerns.

Domain B — Conducting Site Rough-In/First-Fix

29. C — 315 degrees. 3 × 90° + 1 × 45° = 270° + 45° = 315°. This cumulative bend angle is below the NEC 360-degree limit between pull points, allowing continued pulling without intermediate pull boxes. Accurate cumulative angle calculation is essential for determining NEC compliance and planning pull point spacing.

30. A — 2,000 pounds. 10,000 ÷ 5 = 2,000 pounds working load. The 5:1 overhead safety factor is higher than the 4:1 non-overhead factor because overhead loads above occupied spaces have greater failure consequences — if mounting fails, the load falls into occupied space below, creating life-safety hazards.

31. D — 15,000 pounds. 5,000 pounds × 3 workers = 15,000 pounds minimum anchor capacity. OSHA fall arrest anchor point capacity requirements multiply by the number of workers simultaneously attached because each worker could potentially experience a fall event requiring the full 5,000-pound capacity.

32. B — 2.0 inches. 4 × 0.50 = 2.0 inches minimum bend radius during installation. Cable manufacturer specifications require minimum 4× cable diameter bend radius during installation and 8× in final position. Respecting this limit prevents permanent internal geometry damage that would degrade cable performance.

33. C — Guardrails on all open sides of the scaffold platform. OSHA construction fall protection at heights of 6 feet or greater requires recognized methods, and guardrails on all open sides of scaffold platforms provide passive fall protection that doesn't depend on worker action. At 18 feet, fall

protection is definitely required; spotters and safety nets are not typically appropriate standalone solutions.

34. A — 24 feet. 6 feet × 4 = 24 feet working height at the 4-to-1 rule. The rule means base distance × 4 = working height supported, producing approximately 75-degree ladder angle. This calculation is essential for ladder positioning planning.

35. D — Provided sufficient passive fall protection by the guardrails. Scissor lifts equipped with full-perimeter guardrails permit operators to work without additional personal fall arrest because the guardrails provide complete perimeter protection. Boom lifts require additional personal fall arrest due to whipping motion, but scissor lifts have more stable vertical-only motion that guardrails alone adequately address.

36. C — Concrete-rated wedge or sleeve anchors. Concrete masonry requires anchors specifically engineered for concrete engagement. Wood lag bolts lack the mechanical engagement needed for masonry; plastic expansion anchors lack adequate capacity; sheet metal screws cannot develop sufficient holding in concrete. Concrete-rated wedge or sleeve anchors installed per manufacturer specifications provide the reliable mounting required.

37. B — Approaching damage threshold — stop and investigate. High pulling tension indicates the cable is near or at manufacturer-specified damage thresholds, creating risk of invisible internal damage that degrades cable performance permanently. Professional practice stops the pull to identify and address the cause — increased bend angles, inadequate lubrication, conduit obstructions — rather than continuing pulls that may damage cables.

38. D — Immediate work stoppage and contacting qualified abatement personnel. Asbestos exposure causes diseases emerging 20-50 years after exposure, making qualified abatement personnel with specialized training and equipment essential for any disturbance. N95 dust masks alone provide inadequate protection; client notification without stopping work continues exposure; capping cable ends doesn't address the fundamental handling requirement.

39. A — Water suppression, local exhaust ventilation, or respiratory protection. OSHA silica standard (29 CFR 1926.1153) requires specific engineering and administrative controls matched to exposure level. Standard N95 masks are insufficient for silica exposure; outdoor cutting may not eliminate exposure in ventilated spaces; carbide blade replacement doesn't reduce silica generation. The specific OSHA-mandated controls provide appropriate protection.

40. C — Plenum-rated and attached to structural members. Plenum installations require fire-retardant materials throughout, including cable supports, and attachment must be to structural members designed to support the loads. This combination addresses both fire safety (plenum-rated materials limit smoke and flame spread) and mechanical support (structural attachment provides reliable load support).

41. B — The general contractor or framing trade during construction, spanning multiple studs. A 200-pound display requires substantial structural support distributed across multiple studs through properly installed blocking. The blocking must be installed during framing before drywall closes the walls. This is construction-phase work handled by the general contractor or framing trade with proper coordination.

42. D — 360 degrees. NEC Chapter 9 limits cumulative bend angle between pull points to 360 degrees, equivalent to four 90-degree bends. Exceeding this limit dramatically increases pulling tension and damages cables; the code limit requires intermediate pull boxes for longer runs with more bends. This is an absolute code requirement.

Domain C — Installing Audiovisual Systems

43. A — 1.75 inches. The standardized rack unit (RU) equals 1.75 inches of vertical mounting height, the modular dimension that allows equipment from any manufacturer to mount into compatible racks. This standard developed from telephone equipment conventions and has become the global convention for professional AV, broadcast, data, and telecommunications equipment.

44. C — 19 inches. The 19-inch width measured between front mounting flanges is the global standard for professional AV, broadcast, data, and telecommunications equipment racks. This standardization allows compatible equipment from any manufacturer to mount into any compatible rack, supporting the modular equipment ecosystem.

45. D — 56 inches. 32 RU × 1.75 = 56 inches vertical mounting space. Multiplying rack units by 1.75 gives the precise vertical space requirement for any equipment, supporting accurate rack space planning.

46. A — 20 amperes. 25 × 0.80 = 20 amperes. The 80% rule limits continuous loads to 80% of circuit rating to provide headroom against thermal accumulation that causes breaker trips. This calculation applies to any circuit size.

47. B — 853 BTU/hour. 250 × 3.412 = 853 BTU/hour. The factor 3.412 converts watts to BTU/hour for HVAC sizing calculations. AV equipment heat dissipation must be removed by the building cooling system, and BTU/hour is the standard HVAC capacity unit.

48. D — Hot/positive signal. The XLR convention assigns Pin 1 to ground/shield, Pin 2 to hot/positive signal, and Pin 3 to cold/negative signal per the AES standard. This pin assignment is universally adopted in professional audio and ensures XLR cables function consistently across equipment.

49. A — 48 volts DC. Phantom power for condenser microphones is standardized at 48 volts DC, delivered through balanced audio cables without affecting the audio signal. This specific voltage has been the professional standard for decades and is required for most modern condenser microphones.

50. C — Two conductors plus shield. Balanced audio uses two signal conductors (hot and cold) carrying the signal as a voltage difference, plus a shield/ground conductor providing common-mode noise rejection. This three-wire configuration enables the common-mode rejection that distinguishes balanced from unbalanced audio operation.

51. A — 2:1. A 6 dB voltage increase represents a voltage ratio of 2:1, meaning voltage has doubled. The voltage formula uses $20 \times \log(V1/V2)$, so $20 \log(2) = 20 \times 0.301 \approx 6.02$ dB. This relationship (6 dB = 2× voltage = 4× power) is fundamental to decibel calculations.

52. C — 20. The decibel formula for voltage ratios uses the multiplier 20 ($20 \times \log V1/V2$), while the power ratios use 10. The voltage formula uses 20 because power scales with voltage squared, doubling the multiplier. Using the wrong multiplier produces incorrect dB values.

53. D — 480 watts. $600 \div 1.25 = 480$ watts. Professional practice sizes amplifiers at 125% of total tap load, meaning a 600-watt amplifier drives maximum tap load of 480 watts. This provides 80% utilization and operating headroom for reliable performance.

54. B — Steps down the high-voltage line to the loudspeaker's voltage. The transformer at each loudspeaker on a 70V distributed audio system steps the 70-volt line down to the loudspeaker's required voltage, with a tap selector determining the power. This high-voltage transmission system efficiently delivers audio over long distances using smaller cable gauges.

55. A — 500 MHz. Cat6A cable supports maximum frequency of 500 MHz, twice Cat6's 250 MHz capability. This higher bandwidth supports 10GBase-T Ethernet, 4K60 HDBaseT, and other modern high-bandwidth AV protocols.

56. C — 0.5 inches. Cat6A cable specifications permit maximum 0.5 inches of untwist at termination to preserve cable twist geometry and maintain high-frequency performance. Excess untwist degrades crosstalk rejection and causes certification test failures.

57. D — Video signal transport including SDI and CATV. 75-ohm coaxial cable is the standard for video applications including composite video, SDI broadcast video, CATV, and other baseband and broadband video signals. The 50-ohm version is used for RF communications applications where that impedance optimizes power transfer to antennas.

58. B — 100 meters (328 feet). HDBaseT specifications support 4K60 video transmission over Cat6A cable to 100 meters, matching general Ethernet physical layer distance limits. This enables centralized equipment with remote displays, distinguishing HDBaseT from standard HDMI's shorter reach.

59. C — The DDC channel embedded within the HDMI or DisplayPort cable. EDID information exchange uses the Display Data Channel running on dedicated pins within the HDMI or DisplayPort cable. This embedded channel enables automatic EDID exchange for plug-and-play operation between source and display.

60. A — 4K UHD content from compatible sources. HDCP 2.2 and later versions are required for 4K content because the original HDCP 1.x standard was not designed for 4K bandwidth. Every device in the signal path must support the required HDCP version for protected content to display — a single incompatible device breaks the entire chain.

61. D — 300 meters. OM3 multimode fiber supports 10 Gbps Ethernet to 300 meters, substantially exceeding copper Ethernet's 100-meter limit. OM4 extends this to 400 meters, providing even longer reach for high-bandwidth applications.

62. B — Green. APC (Angled Physical Contact) fiber connectors are color-coded green to distinguish them from blue PC and beige UPC connectors. This color coding prevents accidental mating of incompatible connector types, which would cause signal loss and potential damage.

63. C — 0.25 to 1 millisecond. Dante audio networking operates with extremely low latency at standard settings, typically 0.25 to 1 millisecond depending on specific configuration. This low latency is essential for professional audio applications where perceptible delay would degrade user experience.

64. A — 10 Gbps Ethernet. SDVoE distributes uncompressed 4K60 video requiring 10 Gbps Ethernet infrastructure to carry the video bandwidth plus protocol overhead. Uncompressed 4K60 consumes approximately 12 Gbps, and 10 Gbps infrastructure provides the practical capacity when accounting for compression and overhead.

65. B — 25.5 watts. IEEE 802.3at (PoE+) provides 25.5 watts at the powered device, with 30 watts at the power source equipment. The difference accounts for cable losses during transmission — longer cables lose more power and deliver less at the device end.

66. D — 254. A /24 subnet provides 256 total addresses (2^8 host bits) minus 2 reserved for network identifier and broadcast = 254 usable host addresses. This is the standard subnet size for many local network deployments.

67. A — 10.0.0.0/8, 172.16.0.0/12, and 192.168.0.0/16. RFC 1918 defines three private IPv4 address ranges reserved for internal networks that are not routable on the public internet. All three ranges are used in commercial installations, with choice depending on the client's existing addressing schemes.

68. C — 9600 and 115200 bps. RS-232 serial communication operates at typical baud rates between 9600 and 115200 bits per second, with 9600 being the most common default. Higher rates support greater throughput but require shorter cable lengths.

69. B — Baud rate, data bits, parity, stop bits. RS-232 communication requires matching these four serial parameters between the controller and the controlled device. Mismatched configurations prevent communication regardless of physical connection quality. The four parameters together define the serial protocol that must be identical on both ends.

70. D — Unidirectional with no status feedback. IR control transmits commands from controller to device but receives no feedback, making it limited compared to bidirectional protocols. This fundamental limitation means IR-controlled systems cannot verify command reception or device status, creating challenges in modern feedback-dependent control systems.

71. C — Verify network connectivity using ping. Ping testing is the most efficient first diagnostic step because it quickly identifies whether the device is reachable on the network. This eliminates the most common cause of communication failures before pursuing more invasive troubleshooting like reboots, cable replacement, or firmware updates.

72. A — 0.40 ohms. 5% of 8 ohms equals 0.40 ohms maximum cable resistance. Maintaining this limit preserves power transfer efficiency (less power lost in cable resistance) and prevents the amplifier from seeing reduced effective impedance that could trigger protection circuits.

73. B — 2.67 ohms. Three 8-ohm loudspeakers in parallel combine as $8 \div 3 \approx 2.67$ ohms. Parallel impedance is always lower than any individual element; the general formula $1/R(\text{total}) = \Sigma(1/R(n))$ simplifies for equal impedances to $R \div N$. Dropping below amplifier minimum specification damages the amplifier.

74. D — Full quality until catastrophic failure at the digital cliff. Digital signals tolerate signal-to-noise ratio degradation without quality loss up to the point where the receiver cannot distinguish binary ones from zeros, then fail completely. This binary success/failure characteristic fundamentally distinguishes digital from analog signal behavior.

75. A — Video signal amplitude over time. A waveform monitor displays video signal voltage as a waveform on a time-axis display, useful for verifying signal levels, sync timing, and amplitude characteristics. Modern software waveform monitors integrate with capture hardware in professional video verification workflows.

76. C — Video chrominance on a polar plot. A vectorscope displays video chrominance (color information) as a polar plot showing color hue (angle) and saturation (radius from center). This display format is essential for color verification across video sources and confirms color accuracy in video systems.

77. B — 15 feet. Image width = distance ÷ throw ratio = 36 ÷ 2.4 = 15 feet. The throw ratio formula relates projector distance to image size. This calculation is fundamental to projector positioning planning.

78. A — 6500K (D65). The D65 white point at 6500 Kelvin is the international standard for video content calibration, matching the color temperature under which video content is created. Calibrating to D65 produces accurate white reproduction without color tint.

79. D — 2.2. Standard video content is encoded for gamma 2.2, matching human visual perception and content creation standards. Display calibration adjusts gamma to this standard so midtones appear correctly bright, preserving the intended image appearance throughout the tonal range.

80. C — 8 times image height. AVIXA DISCAS recommends maximum viewing distance of 8× image height for basic decision-making content requiring general readability. This distance factor ensures text legibility for the content type, with analytical content requiring shorter 4× distances for fine detail discrimination.

81. B — 4 times image height. AVIXA DISCAS recommends maximum viewing distance of 4× image height for analytical decision-making content where viewers must discern fine detail. Analytical content requires substantially shorter viewing distances than basic content, making the 4× versus 8× distinction critical to room design.

82. A — Flat response with omnidirectional pattern. Measurement microphones are designed for analytical accuracy with flat frequency response (no tonal coloration) and omnidirectional polar pattern (equal sensitivity in all directions), producing measurements that reflect the room's actual sound without microphone artifacts.

83. D — Open interoperability between manufacturers' networked audio. AES67 is an open Audio Engineering Society standard enabling networked audio systems from different manufacturers to exchange audio using common protocols. Modern Dante implementations include AES67 compatibility as the interoperability layer.

84. C — All loudspeakers move in the same direction on the same signal. A polarity tester verifies that every loudspeaker responds with correct polarity to a reference signal. Polarity errors cause destructive interference between loudspeakers, substantially reducing low-frequency output and producing phase cancellation.

85. B — Insertion loss, return loss, NEXT, ANEXT, propagation delay, and other parameters. Category-rated cable certification tests multiple parameters that together demonstrate the cable's high-frequency performance meets specification. Simple continuity, voltage drop, or visual inspection tests are insufficient for verified Cat6A performance.

86. D — 4.5 Gbps. 1080p60 at 8-bit color depth requires approximately 4.5 Gbps of bandwidth. Cable infrastructure must support this bandwidth for reliable transmission because inadequate cable produces signal failure rather than gradual degradation.

87. A — 24 Gbps. 4K60 with 10-bit color and HDR requires approximately 24 Gbps of bandwidth, exceeding the 18 Gbps capacity of Premium High Speed HDMI (HDMI 2.0). Ultra High Speed HDMI (HDMI 2.1) is required for this content format.

88. C — 100 watts. 8 × 12.5 = 100 watts total tap load. This calculation sums all loudspeaker tap selections to determine amplifier demand, which would require a 125-watt or larger amplifier at 125% sizing.

Domain D — Perform Systems Close-Out

89. B — A-Level, B-Level, C-Level representing essential, specialized, and unique items. ANSI/AVIXA 10:2013 categorizes verification items into A-Level (essential functions verified on every installation), B-Level (specialized functions present on many but not all installations), and C-Level (unique requirements specific to particular installations). This categorization structures verification appropriately to installation complexity.

90. D — A substantive deficiency affecting system function. A non-functional system audio output prevents the system from performing its intended function, making it substantive rather than cosmetic. Substantive deficiencies receive priority for resolution because they affect system operation, while cosmetic deficiencies affect only appearance.

91. A — The system is ready for its intended use and warranty typically begins. Substantial completion is the contractual milestone where the installation is usable for its intended purpose, even though minor punch list items may remain. This triggers warranty effective dates, beneficial use, and final payment provisions.

92. C — Substantial completion when the client takes beneficial use. Warranty periods typically begin at substantial completion because that is when the system enters service and wear begins accumulating. Tying warranty to earlier dates (contract signing, equipment delivery) would reduce client warranty value by counting pre-service time.

93. B — The installed system's actual configuration for future reference. As-built documentation captures the system as it actually exists at installation completion, including all changes from original design. This documentation serves as the authoritative reference supporting future service, modifications, and expansions throughout the installation's service life.

94. D — Brief focused sessions on essential operations with hands-on practice. End-user training is most effective when concise, focused on essential operational tasks rather than detailed technical knowledge, and includes hands-on practice. Users who actually operate the system during training retain skills better than passive observers.

95. A — Essential functions with screenshots and simple instructions. Quick reference guides are typically one or two pages providing brief, accessible instruction on essential operational functions with screenshots and simple language. They serve as the most-used training material long after training sessions conclude.

96. C — Defined response times, scheduled preventive maintenance, and priority service. Service agreements typically combine response time commitments, preventive maintenance visits at scheduled intervals, remote support capability, priority over ad-hoc requests, and discounted rates for out-of-scope work. These elements together provide structured ongoing service.

97. B — Annual visits with more frequent visits for high-use environments. Professional preventive maintenance schedules recommend annual visits as baseline, with more frequent visits for high-

use, demanding, or mission-critical environments. The annual baseline captures most preventive needs cost-effectively.

98. D — A formal written record of client acceptance. Signed sign-off documents create the contractual record that the client has inspected, received training on, and accepted the installation as meeting requirements. This formal record protects both parties from later disputes about completion status.

99. A — The installer, client representative, and sometimes the general contractor. The substantial completion walk-through is a formal event where multiple parties walk through together to verify the installation and document remaining items. The specific participants reflect the installation's context and project scope.

100. B — That the system is ready for use even though minor work may remain. The certificate of substantial completion formally documents that the installation has reached the milestone where the client takes beneficial use, with remaining punch list items clearly identified and scheduled for resolution before final completion.

101. D — Formal signing authority for the client organization. Project completion documents must be signed by an authorized client representative with formal signing authority (typically a facilities director, project owner, or equivalent role). This formal authority makes the signed acknowledgment binding on the client organization.

102. A — As-built drawings, equipment manuals, warranty documentation, and verification reports. Comprehensive project closeout includes documentation of actual installed configuration, equipment operational information, warranty terms, and verification results. Each component supports the installation throughout its service life.

Domain E — Conducting Ongoing Project Responsibilities

103. B — Document activities, labor, materials, and issues for the project record. Daily progress reports create the ongoing record of installation work that supports schedule tracking, change management, billing, and historical reference. The reports become particularly valuable when disputes arise about what was accomplished when.

104. D — Obtain clarification from the design team on field-discovered issues. RFIs are formal written questions submitted to the design team requesting clarification or direction on issues encountered during installation. The RFI documents both the question and response, becoming part of the permanent project record.

105. C — A minor adaptation within installer authority requiring documentation. Substituting equivalent accessories is typically within installer authority and doesn't require formal change orders, but professional practice still documents these decisions in daily reports and as-built drawings for traceability.

106. A — The general contractor's superintendent and coordination meetings. The general contractor's superintendent has organizational authority over all trades on site, making the role the natural coordination point for trade interactions. Structured coordination meetings provide the forum for multi-trade interaction.

107. B — Work scope expands beyond original contract specifications. Change orders are required when work scope expands beyond the original contract, whether through client requests, field discoveries, design modifications, or coordination requirements. The change order documents the addition, impact, and obtains client approval.

108. D — Cable scraps, packaging, and debris managed continuously. Clean-as-you-go integrates debris management into installation work, placing cable scraps and packaging into appropriate containers as they are produced rather than allowing accumulation that requires time-consuming end-of-day cleanup.

109. A — The general contractor's construction waste management system. Construction debris from AV installation is typically disposed of through the general contractor's waste management infrastructure, which provides containers sized for construction-scale waste volumes and appropriate disposal routes.

110. C — The project manager who can coordinate response. Issues with other trades should be routed through the project manager who has authority and relationship with the general contractor to coordinate resolution. Direct confrontation damages relationships; other channels are inappropriate for routine coordination issues.

111. B — Water suppression, local exhaust ventilation, or respiratory protection. OSHA silica standard (29 CFR 1926.1153) requires specific dust controls during silica-generating activities. Standard N95 dust masks are insufficient for silica; outdoor performance alone doesn't address all work; carbide blade replacement doesn't reduce silica generation.

112. D — Conflict identification between MEP, fire protection, and technology systems. BIM coordination drawings show how all building systems fit into ceiling and wall spaces without conflicts. Coordination drawings developed during design reveal conflicts that would otherwise be discovered during construction at greater cost.

113. A — Reporting through appropriate channels for engineering review. Field-discovered conditions affecting design must be reported for engineering review rather than silently absorbed into the installation. Professional escalation enables design modifications to be properly authorized rather than becoming undocumented improvisations.

114. C — As soon as potential delay is identified, even if impact is uncertain. Delays reported early permit the project manager to develop mitigation strategies and communicate with the client before commitments are missed. Late reporting deprives the project manager of options.

115. B — Be routed through the project manager for change order processing. Scope changes must flow through formal change order processes with project manager coordination, cost and schedule impact assessment, and client approval. Performing scope-change work without authorization consumes labor and materials that may not be recovered through payment.

116. D — Labor and materials consumed without compensation. Unauthorized scope expansion typically results in labor and materials consumed without recovery because the work was not part of the original contract and was not authorized through formal change order. Professional installation firms maintain change order discipline.

117. A — Both as-built records and traceability of decisions under installer authority. Field engineering documentation supports both the as-built record of what was actually installed and the professional record of decisions made during installation, providing value for service support and demonstrating professional judgment.

118. C — Either perform firestopping correctly or coordinate with the firestop contractor. Firestopping is life-safety work requiring proper materials and installation methods matched to the specific wall assembly rating. The installer must either perform the work correctly or coordinate with qualified firestop contractors.

119. B — Stopping work immediately and contacting qualified abatement personnel. Asbestos exposure causes diseases emerging 20-50 years after exposure, making qualified abatement personnel with specialized training, equipment, and protocols essential. Continuing with PPE, capping cable ends, or client-only notification all fail to address the fundamental handling requirement.

120. D — Understands why the failure occurred so it does not recur. Root-cause analysis seeks the fundamental cause of failures so that addressing the cause prevents recurrence rather than just restoring function. Repairs addressing symptoms without root causes typically produce repeat failures that consume support resources.

121. A — 7 to 10 years. Professional AV installations typically have service life of 7-10 years before substantial refresh is required, with individual components having varying lives within that range. Planning for refresh at this timeframe supports client budgeting and installation firm capacity planning.

122. C — Increasing service frequency, declining reliability, parts unavailability. End-of-life indicators include increasing service calls, failures occurring during use, inability to support current needs, and unavailability of replacement parts from manufacturers. These signals support proactive refresh planning.

123. B — Factory-reset or data-wiped before leaving the client's site. Decommissioned equipment containing configuration data, credentials, network information, or proprietary client information must be reset before disposal to protect that information from exposure. Professional decommissioning includes data removal as a standard step.

124. A — Restricted materials in electronic equipment requiring responsible handling. RoHS (Restriction of Hazardous Substances) restricts the use of certain hazardous materials in electronic equipment manufacturing and requires responsible handling at end-of-life. Combined with WEEE directives, RoHS shapes how decommissioned AV equipment must be processed.

125. D — Through the entire service life via maintenance and service. The professional installer's relationship with an installation extends through maintenance, service, upgrades, and eventually decommissioning across the system's full service life. This long-term relationship is the foundation of recurring revenue and client loyalty.