PRACTICE EXAM 15: CTS-I SIMULATION

QUESTIONS 1–125

Domain A — Conducting Pre-Installation Activities

1. An installer arrives at a jobsite and discovers that architectural drawings show different ceiling heights than observed in the field. The most appropriate response is:

A. Proceed with installation based on the drawings

B. Document the discrepancy and request clarification from the design team

C. Accept the field conditions and modify the installation

D. Cancel installation until drawings are completely redrawn

2. A pre-installation site survey identifies that wireless microphone frequencies specified in the drawings conflict with FCC regulations in the installation region. The appropriate response is:

A. Operate at reduced power to comply

B. Use the specified frequencies and accept interference

C. Install wired microphones instead

D. Coordinate with the design team for compliant frequency selection

3. NEC fill limits for three or more cables in a conduit restrict cumulative cable cross-sectional area to:

A. 40% of conduit internal area

B. 53% of conduit internal area

C. 31% of conduit internal area

D. 25% of conduit internal area

4. The acronym AVIXA stands for:

A. Audio Video Integration eXperience Association

B. Audio Video Industry eXchange Association

C. Audiovisual and Integrated Experience Association

D. American Video Installation eXpert Alliance

5. A wiring schedule primarily documents:

A. HVAC ductwork routing

B. Cable sources, destinations, types, and lengths for installation

C. Electrical panel distribution

D. Architectural wall sections

6. A pre-installation review identifies conflict between AV drawings and mechanical drawings. The appropriate response is:

A. Document the conflict and request design team resolution

B. Use the AV drawings as authoritative

C. Use the mechanical drawings as authoritative

D. Select the more recent drawing without verification

7. A 1.5-inch EMT conduit has internal cross-sectional area of 2.04 square inches. Maximum cable area at 40% fill is:

A. 0.612 square inches

B. 0.702 square inches

C. 0.780 square inches

D. 0.816 square inches

8. A cable take-off calculation for 15 runs averaging 60 feet with 3-foot service loops at each end plus 12% contingency yields approximately:

A. 900 feet

B. 990 feet

C. 1,108 feet

D. 1,200 feet

9. An OSHA 10-hour construction safety card is commonly required for:

A. Only personnel handling hazardous materials

B. General worker access on commercial construction jobsites

C. Only personnel operating aerial lifts

D. Only supervisory personnel

10. The acronym RFI in project coordination stands for:

A. Request for Information

B. Review of Field Installation

C. Report on Field Issue

D. Release for Installation

11. A pre-installation walkthrough identifies that specified equipment operating temperature range (68-75°F) cannot be maintained in the proposed equipment room. The appropriate response is:

A. Install equipment anyway and monitor

B. Use portable cooling equipment

C. Specify lower-quality equipment

D. Coordinate with mechanical engineering to address cooling

12. A pre-installation review shows that the specified rack door requires 36 inches of clearance but the equipment room provides only 30 inches. The appropriate response is:

A. Install the rack without doors

B. Cut the rack to fit the smaller space

C. Coordinate resolution with the design team — typically removing doors for transport

D. Use adhesive panels instead of doors

13. The primary reason NEC fill limits exist is to:

A. Protect cables from pulling damage and thermal degradation

B. Document cable counts for billing

C. Simplify design calculations

D. Provide cost estimates

14. A pre-installation site survey is best documented through:

A. Verbal summary to the project manager

B. Written report with photographs distributed to stakeholders

C. Audio recording for later reference

D. Personal field notebook only

15. A pre-installation meeting with the client should address:

A. Only equipment delivery confirmation

B. Only safety protocols

C. Only schedule alignment

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

16. A 0.35-inch diameter cable has cross-sectional area of approximately:

A. 0.0385 square inches

B. 0.0770 square inches

C. 0.0962 square inches

D. 0.1225 square inches

17. A pre-installation review identifies equipment listed in specifications but not on the manufacturer's current roadmap. The appropriate response is:

A. Verify availability through formal substitution request or procurement

B. Assume the equipment is available

C. Substitute alternatives without coordination

D. Proceed without verification

18. Structural blocking for wall-mounted equipment should be installed by:

A. The AV installer during mounting

B. The general contractor or framing trade during construction

C. The drywall contractor during finishing

D. The electrical contractor during rough-in

19. The AVIXA CTS-I credential represents:

A. Certified Technical Systems Integrator

B. Certified Technology Specialist Intermediate

C. Certified Technology Supervisor-Installer

D. Certified Technology Specialist-Installation

20. A pre-installation walkthrough reveals inadequate lighting in the installation area. The appropriate response is:

A. Use flashlights during installation

B. Schedule all work during daylight hours

C. Request additional lighting before AV work begins

D. Proceed without adequate lighting

21. The acronym NEC in AV installation context refers to:

A. Network Electrical Certification

B. National Electrical Code

C. Northeast Electrical Commission

D. National Electronics Council

22. A pre-installation review of drawings should include:

A. Systematic review of all drawings, specifications, and schedules

B. Review of only the wiring schedule

C. Review of only the architectural drawings

D. Skipping review to save time

23. A pre-installation meeting reveals that scope changes have been requested by the client after contract signing. The appropriate response is:

A. Accept the changes without documentation

B. Absorb the changes to maintain client relationship

C. Refuse the changes without discussion

D. Document the changes formally through change order process

24. A pre-installation site survey identifies that the equipment room temperature regularly exceeds 82°F. The appropriate response is:

A. Accept the condition since equipment tolerates it

B. Install portable cooling equipment

C. Coordinate with HVAC engineering to address temperature

D. Reduce equipment scope to generate less heat

25. A wiring schedule specifies Cat6A cable, but the installer's inventory contains only Cat6. The appropriate response is:

A. Use Cat6 cable to save time

B. Procure the specified Cat6A cable

C. Consult the client on preferred cable

D. Mix Cat6 and Cat6A based on specific run requirements

26. The acronym OSHA in safety context represents:

A. Official Standards for Health Administration

B. Occupational Safety Health Association

C. Occupational Safety and Health Administration

D. Organizational Safety Health Authority

27. A pre-installation walkthrough identifies that the proposed cable pathway conflicts with existing fire sprinkler infrastructure. The appropriate response is:

A. Coordinate alternative pathway through design team

B. Remove sprinkler infrastructure

C. Install cables at reduced spacing

D. Accept the conflict

28. A pre-installation review identifies power requirements exceeding dedicated circuit capacity. The primary response is:

A. Accept and proceed

B. Coordinate with electrical engineer to resolve capacity

C. Use general-purpose office circuits

D. Reduce equipment scope

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

29. OSHA construction fall protection is required at heights of:

A. 4 feet or greater

B. 8 feet or greater

C. 10 feet or greater

D. 6 feet or greater

30. A worker on a boom lift platform must wear:

A. No fall protection required

B. Fall arrest anchored to the ground

C. Personal fall arrest attached to a designated platform anchor

D. Fall arrest attached to adjacent structure

31. The 4-to-1 rule for extension ladders means:

A. The ladder is 4 times stronger than the load

B. The base extends 1 foot per 4 feet of working height

C. The ladder rungs are 4 inches apart

D. The ladder angle is 4 degrees from vertical

32. OSHA requires fall arrest anchor points to have minimum capacity of:

A. 5,000 pounds per worker

B. 3,500 pounds per worker

C. 2,500 pounds per worker

D. 1,000 pounds per worker

33. Concrete masonry walls require fasteners of type:

A. Wood lag bolts

B. Plastic expansion anchors

C. Sheet metal screws

D. Concrete-rated wedge anchors or sleeve anchors

34. A cable bent tighter than 4× diameter during installation experiences:

A. Improved flexibility

B. No adverse effects

C. Permanent internal geometry damage and performance degradation

D. Enhanced signal performance

35. Asbestos discovery during deinstallation requires:

A. Continuing with respiratory protection

B. Stopping work and contacting qualified asbestos abatement personnel

C. Capping cable ends and continuing

D. Notifying only the client

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

A. 360 degrees

B. 270 degrees

C. 450 degrees

D. 180 degrees

37. The jam ratio in cable pulling is:

A. Ratio of pulling tension to maximum

B. Ratio of cable count to fill

C. Ratio of conduit length to distance

D. Ratio of conduit internal diameter to cable outside diameter

38. A cable with high pulling tension indicates:

A. Normal pulling conditions

B. Adequate lubrication

C. Approaching damage threshold — stop and investigate

D. Faster pull speed is needed

39. A J-hook cable support in plenum space must be:

A. Made of any metal

B. Plenum-rated and attached to structural members

C. Color-coded red

D. Spaced at 12-foot intervals

40. OSHA silica controls during concrete cutting include:

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

B. Standard N95 dust masks

C. Outdoor cutting only

D. Carbide blade replacement

41. A scaffold worker at 20 feet requires:

A. Fall arrest attached to adjacent walls

B. No fall protection required

C. Spotters watching only

D. Guardrails on all open sides of the scaffold

42. Structural blocking spanning multiple studs is typically installed:

A. After drywall finishing

B. By the AV installer during mounting

C. By the general contractor or framing trade during construction

D. By the electrical contractor during rough-in

Domain C — Installing Audiovisual Systems

43. The 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 24U rack device occupies vertical space of:

A. 40 inches

B. 42 inches

C. 45 inches

D. 48 inches

46. The 80% rule applied to a 20-ampere circuit limits continuous loads to:

A. 14 amperes

B. 18 amperes

C. 20 amperes

D. 16 amperes

47. Converting watts to BTU/hour uses the factor:

A. 3.412

B. 4.182

C. 2.541

D. 5.675

48. The XLR connector assigns Pin 1 to:

A. Hot/positive signal

B. Cold/negative signal

C. Ground/shield

D. Phantom power return

49. Phantom power for condenser microphones is standardized at:

A. 24 volts DC

B. 48 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. Four conductors plus shield

D. Two conductors plus shield

51. A 3 dB increase in audio power represents:

A. A tenfold power increase

B. A tripling of power

C. A halving of power

D. A doubling of power

52. The decibel formula for power ratios uses multiplier:

A. 20

B. 10

C. 15

D. 5

53. A 70V amplifier rated at 400 watts should drive maximum tap load of approximately:

A. 320 watts

B. 400 watts

C. 500 watts

D. 240 watts

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

A. Provides phantom power

B. Converts AC to DC

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

D. Boosts signal for long runs

55. Cat6A cable supports maximum frequency of:

A. 100 MHz

B. 250 MHz

C. 350 MHz

D. 500 MHz

56. The maximum permissible untwist at Cat6A termination is:

A. 0.5 inches

B. 0.25 inches

C. 0.75 inches

D. 1.0 inches

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

A. RS-232 serial control

B. Video signal transport including SDI and CATV

C. Communications RF

D. Speaker-level audio

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

A. 50 meters

B. 75 meters

C. 200 meters

D. 100 meters (328 feet)

59. EDID information flows between source and display through:

A. A separate management network

B. Manual configuration

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

D. RS-232 connection

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. 300 meters

C. 200 meters

D. 400 meters

62. APC fiber connectors are color-coded:

A. Blue

B. Beige

C. Yellow

D. Green

63. Dante typical latency is:

A. 50 to 100 milliseconds

B. 10 to 20 milliseconds

C. 0.25 to 1 millisecond

D. 5 to 10 milliseconds

64. SDVoE requires minimum network of:

A. 10 Gbps Ethernet

B. 1 Gbps Ethernet

C. 100 Mbps Ethernet

D. Wireless 802.11ac

65. IEEE 802.3at provides device power 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. Only 10.0.0.0/8

B. Only 192.168.0.0/16

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

D. Only 172.16.0.0/12

68. RS-232 typical baud rates range between:

A. 1200 and 4800 bps

B. 9600 and 115200 bps

C. 250000 and 500000 bps

D. 4800 and 9600 bps

69. RS-232 configuration requires matching:

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

B. IP address, subnet mask, gateway

C. MAC address and VLAN

D. Frequency, modulation, encryption

70. IR control is generally:

A. Bidirectional with feedback

B. Effective at 500 feet

C. Compatible with all equipment

D. Unidirectional with no status feedback

71. A control processor with no response from IP device 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. 0.20 ohms

B. 0.40 ohms

C. 0.50 ohms

D. 0.10 ohms

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

A. 2.67 ohms

B. 4 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 chrominance

B. Audio levels

C. Video signal amplitude over time

D. Network bandwidth

76. A vectorscope displays:

A. Video chrominance on a polar plot

B. Video signal amplitude

C. Audio frequency

D. Network packet loss

77. A projector with throw ratio 1.6:1 at 24 feet produces image width of:

A. 14 feet

B. 18 feet

C. 15 feet

D. 10 feet

78. The target white point for video calibration is:

A. 5500K

B. 6500K (D65)

C. 7500K

D. 9300K

79. The target gamma for standard video content is:

A. 2.2

B. 1.8

C. 2.4

D. 2.0

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

A. 4 times image height

B. 6 times image height

C. 12 times image height

D. 8 times image height

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

A. 8 times image height

B. 6 times image height

C. 4 times image height

D. 12 times image height

82. A measurement microphone has:

A. Cardioid pattern

B. Flat response with omnidirectional pattern

C. Hypercardioid pattern

D. Ribbon transducer

83. AES67 primarily provides:

A. Open interoperability between manufacturers' networked audio

B. Audio encryption

C. Power delivery

D. Frequency analysis

84. A polarity tester confirms:

A. Amplifier output voltage

B. Audio signal level

C. Cable shielding

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

85. Cable certification for Cat6A tests:

A. Length and continuity only

B. Voltage drop only

C. Insertion loss, return loss, NEXT, ANEXT, propagation delay, and other parametric measurements

D. Visual inspection only

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

A. 3.0 Gbps

B. 4.5 Gbps

C. 6.0 Gbps

D. 9.0 Gbps

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

A. 24 Gbps

B. 18 Gbps

C. 12 Gbps

D. 36 Gbps

88. A 70V system with 10 loudspeakers at 15-watt taps has total tap load of:

A. 100 watts

B. 125 watts

C. 130 watts

D. 150 watts

Domain D — Perform Systems Close-Out

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

A. Primary, Secondary, Tertiary

B. Level 1, Level 2, Level 3

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

D. Critical, Important, Optional

90. A non-functional video input port is classified as:

A. A cosmetic deficiency

B. A substantive deficiency affecting system function

C. A pre-existing condition

D. A user training issue

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. First day of installation

D. Substantial completion when the client takes beneficial use

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 is characterized by:

A. Extended technical sessions

B. Lecture-style presentation

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

D. Self-paced video training

95. A quick reference guide should include:

A. Complete signal flow diagrams

B. Manufacturer service information

C. Detailed technical specifications

D. Essential functions with screenshots and simple instructions

96. A service agreement typically provides:

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

B. Complete upgrades at no additional cost

C. Free equipment replacement

D. Manufacturer warranty extension

97. A typical preventive maintenance schedule recommends:

A. Monthly visits for all installations

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

C. Only when problems occur

D. Quarterly visits universally

98. Signed sign-off documentation at project completion creates:

A. Tax depreciation documentation

B. Warranty registration authorization

C. Trigger for next construction phase

D. A formal written record of client acceptance

99. A substantial completion walk-through involves:

A. Only the lead installer

B. Only the design engineer

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

D. Only client accounting

100. A certificate of substantial completion documents:

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

B. Original equipment costs

C. Serial numbers

D. Expected service life

101. A client representative signing project completion documents typically holds:

A. Limited informal authority

B. Authority to verify date only

C. Formal signing authority for the client organization

D. Authority to modify contract terms

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 equipment serial numbers

C. Track individual installer productivity

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

104. An RFI is used to:

A. Document materials consumed

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

C. Request labor resources

D. Submit invoices

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 occurs during evening hours

C. Equipment fails during installation

D. Work scope expands beyond original contract specifications

108. "Clean as you go" means:

A. Weekly cleanup sweeps

B. Cable scraps, packaging, and debris managed continuously

C. Specialized cleaning contractors handle everything

D. Cleanup deferred to close-out

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 with the trade

B. Social media platforms

C. The project manager who can coordinate response

D. Formal grievance to building owner

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 primarily 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. Modifying installation without notification

C. Waiting for design team discovery

D. Documenting only for as-builts

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

A. Only after missed milestone

B. At next coordination meeting only

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

D. Only when cause is definitively determined

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 rates

B. Automatic invoice addition

C. Default client acceptance at original rates

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 to:

A. Defer to the 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 respiratory protection

B. Stopping work immediately and contacting qualified abatement personnel

C. Capping cable ends

D. Notifying only the client

120. Root-cause analysis after service incident:

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. Workplace safety

B. Building codes

C. Warranty terms

D. Restricted materials in electronic equipment requiring responsible handling

125. The installer-installation relationship typically extends:

A. Through the entire service life via maintenance and service

B. Only through client handover

C. Through manufacturer warranty only

D. Until next management election

PRACTICE EXAM 15: ANSWER KEY WITH FULL ANSWER EXPLANATIONS

Questions 1–125

Domain A — Conducting Pre-Installation Activities

1. B — Document the discrepancy and request clarification from the design team. Drawing discrepancies between field observations and architectural documentation indicate coordination issues that only the design team can resolve authoritatively. They possess the context of design decisions and can determine which representation is correct, whether field conditions warrant a design modification, or if the drawings require correction. Proceeding with installation based on incorrect drawings or improvising field solutions bypasses design authority and creates liability exposure for the installer.

2. D — Coordinate with the design team for compliant frequency selection. Wireless microphone frequency regulations vary by region and change as the FCC reallocates spectrum, creating compliance complexity that requires informed coordination. The design team can specify FCC-compliant alternatives matched to current regional spectrum conditions, ensuring legal operation and avoiding interference. Operating non-compliant frequencies, reducing power to skirt regulations, or unilaterally switching to wired microphones all compromise the design or create legal exposure.

3. A — 40% of conduit internal area. NEC fill limits for three or more cables restrict cumulative cross-sectional area to 40% of conduit internal area to ensure adequate space for heat dissipation and minimize pulling damage. Single cables may fill to 53%, and two cables are limited to 31% due to geometric interactions. These specific percentages reflect empirical analysis of how cables behave in conduits and must be strictly observed for code compliance.

4. C — Audiovisual and Integrated Experience Association. AVIXA is the industry trade association that maintains the CTS credential family and publishes AV industry standards. The organization was renamed from InfoComm International to AVIXA in 2017 to reflect its broader scope in integrated experience design rather than just traditional audiovisual equipment installation.

5. B — Cable sources, destinations, types, and lengths for installation. The wiring schedule is the primary project document documenting every cable run required for the installation, serving as the definitive reference during procurement, installation, and service phases. Installers rely on this

document to plan pulls, verify procurement quantities, and document completion. Other documents serve complementary purposes — architectural drawings show building layout, electrical panels document power distribution, but none comprehensively document AV cable runs like the wiring schedule.

6. A — Document the conflict and request design team resolution. Conflicts between AV and mechanical drawings indicate design coordination issues that only the design team can resolve authoritatively. Using either drawing as authoritative bypasses the formal design authority; selecting by recency alone may not reflect the current design intent across the coordinated trades. Formal escalation preserves design integrity while providing the installer with clear authorization to proceed.

7. D — 0.816 square inches. The 40% fill multiplied by 2.04 square inches internal area equals 0.816 square inches. This calculation determines the maximum cumulative cable area permissible per NEC for three or more cables in this conduit. The calculation is straightforward multiplication but critical to verify that planned cable counts comply with code requirements before installation begins.

8. C — 1,108 feet. Each run: 60 + 3 + 3 = 66 feet base length; 15 runs × 66 = 990 feet base. Adding 12% contingency (990 × 1.12) yields approximately 1,109 feet, rounding to 1,108 feet. Professional take-off calculations incorporate service loops and contingency to ensure adequate cable supply for the installation without shortages that would disrupt work.

9. B — General worker access on commercial construction jobsites. The OSHA 10-hour card documents completion of standardized 10-hour construction safety training under federally-regulated curriculum, serving as the baseline safety certification for general worker access on commercial construction sites. The broader 30-hour card is typically required for supervisory personnel. Neither card is limited to specific work categories like hazardous materials or aerial lifts, which typically require additional specialized certifications.

10. A — Request for Information. RFIs are formal written questions submitted to the design team requesting clarification or direction on issues encountered during installation that are not clear from the design documentation. The RFI creates a permanent project record of both the question and the response, becoming part of the documentation supporting decisions made during installation. This formal process distinguishes field coordination from casual communication.

11. D — Coordinate with mechanical engineering to address cooling. Equipment operating temperature ranges are critical specifications that must be maintained for reliable equipment operation and service life. Inadequate room cooling is a mechanical engineering issue requiring engineering-level resolution through HVAC system modification, supplemental cooling, or design adjustment. Installing equipment in inadequate conditions compromises reliability; portable cooling is typically a temporary solution inappropriate for permanent installations; specifying lower-quality equipment abandons the original design intent.

12. C — Coordinate resolution with the design team — typically removing doors for transport. Dimensional conflicts between equipment and building access require coordinated resolution rather than improvised field solutions. The typical professional approach removes doors for transport and reinstalls in the equipment room, preserving the rack's designed functionality. Cutting the rack to fit compromises structural integrity; installing without doors may not be appropriate for the specific application; adhesive panels don't replace rack door functionality.

13. A — Protect cables from pulling damage and thermal degradation. NEC fill limits serve two primary protective functions — preventing damage during cable pulls when excessive fill produces friction and jamming, and maintaining adequate space for heat dissipation during operation when densely packed cables cannot shed heat adequately. Both protections directly affect cable service life and installation reliability, making these limits a code requirement rather than just guidance.

14. B — Written report with photographs distributed to stakeholders. Professional site survey documentation creates an objective record that can be preserved, referenced, and distributed to stakeholders throughout the project lifecycle. Written reports with photographs provide durable visual and textual evidence of conditions; verbal summaries don't persist or distribute effectively; audio recordings require transcription before utility; personal field notebooks aren't accessible to other stakeholders who need the information.

15. D — Schedule, access, scope, safety, communication, and key personnel. Comprehensive pre-installation meetings establish shared understanding across all aspects of the upcoming work before installation begins, preventing the gaps and misunderstandings that otherwise produce conflicts during installation. Limiting meetings to single topics like equipment delivery, safety protocols, or schedule alone leaves other critical areas unaddressed. Professional practice uses the comprehensive approach to achieve complete alignment.

16. C — 0.0962 square inches. Cross-sectional area $= \pi \times (d/2)^2 = \pi \times (0.175)^2 = \pi \times 0.0306 \approx 0.0962$ square inches. This formula applies uniformly to all circular cable cross-sections and is fundamental to NEC fill calculations. Accurate calculation requires precise application of the formula with the diameter/2 squared — not the diameter squared.

17. A — Verify availability through formal substitution request or procurement. Equipment not on current manufacturer roadmaps may be unavailable or approaching end-of-life, creating procurement uncertainty that must be resolved formally. Formal substitution requests allow design team evaluation of alternatives against original specifications; formal procurement with adequate lead time ensures specified equipment availability. Assuming availability, substituting without coordination, or proceeding without verification creates procurement failures at critical installation points.

18. B — The general contractor or framing trade during construction. Structural blocking must be installed during framing before walls close with drywall, making this a construction-phase activity that the general contractor or framing trade handles. AV installers cannot typically install blocking

after drywall without compromising wall integrity; drywall and electrical contractors don't have scope for structural work. Coordination with the general contractor during construction ensures blocking is in place when AV mounting begins.

19. D — Certified Technology Specialist-Installation. The CTS-I credential specifically certifies AV professionals in installation-focused competencies, distinguishing it from the general CTS and the design-focused CTS-D credentials. This specialization recognizes expertise in physical installation of AV systems including cable installation, equipment mounting, rack builds, and system commissioning. The credential is often pursued after initial CTS certification for AV professionals focused on installation work.

20. C — Request additional lighting before AV work begins. Adequate lighting is a prerequisite for safe and quality installation work affecting both worker safety and installation precision. Requesting additional lighting through the general contractor before AV work begins ensures conditions support proper installation. Flashlights are inadequate for extended installation work; daylight-only schedules are inefficient; proceeding without adequate lighting produces quality problems and safety hazards.

21. B — National Electrical Code. The NEC, formally known as NFPA 70, is the primary code governing electrical and low-voltage installations in the United States. AV installers particularly reference Articles 725 (Class 1, 2, 3 circuits), 770 (optical fiber cables), and 800 (communications circuits) which address low-voltage systems. NEC compliance is both a legal requirement and a professional standard for quality installation.

22. A — Systematic review of all drawings, specifications, and schedules. Complete pre-installation documentation review encompasses architectural drawings (showing building layout and construction), specifications (defining quality and performance requirements), and schedules (defining cable runs and equipment). Reviewing only selected documents misses critical information — wiring schedules without architectural context lack spatial understanding; architectural drawings without AV specifics miss installation requirements. Systematic review of all documentation produces the complete picture necessary for successful installation.

23. D — Document the changes formally through change order process. Client-requested scope changes must be documented through formal change order processes that assess cost and schedule impact, obtain appropriate approvals, and create project records. Accepting changes without documentation creates unauthorized scope; absorbing changes damages project profitability; refusing changes without professional discussion damages client relationships. Formal change order processing preserves the professional relationship while protecting project viability.

24. C — Coordinate with HVAC engineering to address temperature. Equipment rooms regularly exceeding 82°F substantially exceed the 68-75°F standard for AV equipment operation, creating a mechanical engineering issue requiring professional resolution. Accepting the condition compromises equipment reliability and service life; portable cooling provides inadequate

permanent solutions; reducing equipment scope abandons the original design. HVAC engineering coordination produces proper ventilation or cooling matching the equipment requirements.

25. B — Procure the specified Cat6A cable. Specified Cat6A cable reflects design judgment about bandwidth requirements — Cat6 may be inadequate for specified applications like video-over-IP, HDBaseT 4K60, or future-proofing. Professional practice procures the specified cable to meet design requirements; using Cat6 without coordination compromises performance; client consultation on technical cable selection bypasses the design engineer's role; mixing cable types creates inconsistent installations.

26. C — Occupational Safety and Health Administration. OSHA is the federal agency established to ensure safe working conditions through workplace safety standards enforcement. Under the Department of Labor, OSHA publishes and enforces 29 CFR 1910 (general industry) and 1926 (construction) standards that govern AV installation safety requirements. Understanding OSHA's role is fundamental to AV installation safety practice.

27. A — Coordinate alternative pathway through design team. Cable pathway conflicts with life-safety infrastructure like fire sprinklers require coordinated resolution through the design team, which can develop appropriate alternatives. Fire sprinkler infrastructure cannot be removed or modified without fire code considerations; reducing cable spacing doesn't resolve the underlying conflict; accepting conflicts produces code violations. Design team coordination produces code-compliant pathway alternatives.

28. B — Coordinate with electrical engineer to resolve capacity. Power requirements exceeding dedicated circuit capacity is an electrical engineering issue requiring engineering-level resolution through circuit additions, load redistribution, or design modification. Accepting and proceeding creates operational problems; using general-purpose circuits introduces AV-quality issues; reducing equipment scope abandons the original design intent. Professional practice resolves electrical capacity through electrical engineering.

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

29. D — 6 feet or greater. OSHA construction fall protection standards under 29 CFR 1926 Subpart M require fall protection at heights of 6 feet or greater, stricter than the 4-foot general industry standard under 29 CFR 1910. Construction work inherently involves greater fall hazards, energy hazards, and dynamic conditions warranting the stricter requirement. AV installers working on construction sites must comply with the 6-foot construction standard.

30. C — Personal fall arrest attached to a designated platform anchor. Boom lifts can experience whipping motion that ejects workers over guardrails, creating fall hazards not addressed by the guardrails alone. OSHA requires personal fall arrest in addition to guardrails, with the fall arrest system attached to a designated anchor point on the platform itself. Anchoring to the ground defeats the system's purpose; anchoring to adjacent structures prevents the lift from moving; no fall protection is never appropriate at these heights.

31. B — The base extends 1 foot per 4 feet of working height. The 4-to-1 rule sets the ladder angle at approximately 75 degrees from horizontal, providing the balance between stability (preventing tip-over from shallow angles) and safe climbing (preventing pull-away from too-vertical angles). The ratio means for every 4 feet of working height above the base, the ladder base is positioned 1 foot from the supporting surface. This rule applies to extension ladders and is fundamental to ladder safety.

32. A — 5,000 pounds per worker. OSHA 29 CFR 1926.502 requires fall arrest anchor points to have minimum rated capacity of 5,000 pounds per worker attached, providing the safety margin needed to arrest a falling worker's dynamic load. Engineered anchor systems designed specifically for fall arrest may use lower capacities documented through engineering analysis, but the 5,000-pound minimum applies to typical anchor points without specific engineering design.

33. D — Concrete-rated wedge anchors or sleeve anchors. Concrete masonry requires fasteners specifically engineered for concrete engagement including wedge anchors, sleeve anchors, or other concrete-rated fasteners installed per manufacturer specifications. Wood lag bolts cannot engage concrete; plastic expansion anchors lack adequate capacity for substantial AV loads; sheet metal screws cannot develop sufficient holding in concrete. Concrete-specific anchors provide the mechanical engagement required for reliable AV equipment mounting.

34. C — Permanent internal geometry damage and performance degradation. Cable bend radius specifications protect internal cable geometry — twist rates for Category cable, fiber orientation for fiber optic cable, and wire positioning for specialty cables. Tighter bends than specified permanently deform this internal geometry, causing performance degradation that cannot be recovered. No adverse effects, improved flexibility, and enhanced performance are incorrect — tight bends are always harmful to cable performance.

35. B — Stopping work and contacting qualified asbestos abatement personnel. Asbestos exposure causes diseases including mesothelioma and asbestosis that may emerge 20-50 years after exposure, making qualified abatement personnel with specialized training, equipment, and protocols essential for any disturbance. Continuing with respiratory protection doesn't address the qualified handling requirement; capping cable ends doesn't prevent exposure; notifying only the client without stopping work continues the exposure.

36. A — 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 that can damage cables and requires adding intermediate pull points (pull boxes) to reduce cumulative bends below the limit. This is an absolute code requirement that cannot be exceeded regardless of installation convenience.

37. D — Ratio of conduit internal diameter to cable outside diameter. The jam ratio is a geometric relationship describing whether three cables can wedge together in conduit during pulling. Specific jam ratios (approximately 2.8 to 3.2) cause the three cables to lock together as they encounter

bends, dramatically increasing pulling tension. Understanding this relationship helps identify conduit sizing that avoids jamming conditions.

38. C — Approaching damage threshold — stop and investigate. High pulling tension indicates the cable is near or exceeding manufacturer-specified damage thresholds, risking invisible internal damage that degrades performance permanently. Professional practice stops the pull to identify and address the cause — increased bend angles, inadequate lubrication, conduit obstructions — rather than forcing the pull to completion. Normal conditions, adequate lubrication, and faster pull speed are all incorrect responses that compound the risk.

39. B — 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 rather than ductwork, ceiling grid, or ceiling tiles. This combination addresses both fire safety (plenum-rated materials limit smoke and flame spread) and mechanical support (structural attachment provides reliable load support).

40. A — Water suppression, local exhaust ventilation, or respiratory protection. OSHA silica standard under 29 CFR 1926.1153 requires specific engineering and administrative controls matched to exposure level — water suppression applied at the point of cutting, local exhaust ventilation with HEPA filtration, or appropriate respiratory protection. Standard N95 dust masks are insufficient for silica exposure; outdoor cutting may not eliminate exposure in ventilated spaces; carbide blades don't reduce silica generation.

41. D — Guardrails on all open sides of the scaffold. Scaffold fall protection requires guardrails on all open sides of the platform, providing passive fall protection that doesn't depend on worker action. This is the standard fall protection method for scaffold work and is typically sufficient without additional personal fall arrest. Ground-anchored fall arrest, spotters alone, and unprotected work at 20 feet all fail to provide adequate protection.

42. C — By the general contractor or framing trade during construction. Structural blocking must be installed during framing before walls close with drywall, making it a construction-phase activity appropriate to the general contractor or framing trade. Installation after drywall is inadequate; AV installers typically lack scope and tools for structural work; drywall contractors focus on wall finishing; electrical contractors handle electrical rough-in. Proper coordination with the general contractor during framing is professional practice.

Domain C — Installing Audiovisual Systems

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

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 standard developed from telephone equipment and allows compatible equipment from any manufacturer to mount into any compatible rack, supporting the modular equipment ecosystem.

45. B — 42 inches. A 24U device occupies 24 × 1.75 = 42 inches of vertical mounting height. Multiplying rack units by 1.75 gives the precise vertical space requirement for any equipment, supporting accurate rack space planning and ensuring equipment fits in the allocated rack space.

46. D — 16 amperes. The 80% rule limits continuous loads to 80% of circuit rating to provide headroom against thermal accumulation that causes breaker trips, so 20 × 0.80 = 16 amperes continuous. This rule is essential for AV equipment rooms where equipment operates continuously for extended periods, distinct from momentary loads which can use the full rating briefly.

47. A — 3.412. Converting watts to BTU/hour uses the factor 3.412, based on thermodynamic unit conversions. This calculation is essential for HVAC sizing in equipment rooms — the heat generated by AV equipment must be removed by the cooling system, and BTU/hour is the standard HVAC capacity unit. The other values are factors for different conversions.

48. C — Ground/shield. 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 standardization ensures XLR cables function consistently across professional audio equipment and is so universally adopted that deviations would be incompatible with virtually all professional audio equipment.

49. B — 48 volts DC. Phantom power for condenser microphones is standardized at 48 volts DC, delivered through balanced audio cables in a configuration that doesn't affect the audio signal on the same conductors. Lower voltages like 12V exist for specific microphones but are not the standard; 48V is the dominant standard across professional audio equipment.

50. D — 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 balanced operation that distinguishes balanced from unbalanced audio — common-mode interference couples onto both conductors equally and cancels at the differential receiver.

51. D — A doubling of power. A 3 dB increase represents a power ratio of 2:1, one of the fundamental decibel reference values along with 6 dB (4× power, 2× voltage) and 10 dB (10× power). This relationship derives from the logarithmic nature of the decibel scale and is essential for calculating system gain and loss in professional audio.

52. B — 10. The decibel formula for power ratios uses the multiplier 10 (10 × log(P1/P2)), while the voltage formula uses 20 (because power scales with voltage squared, doubling the multiplier). Understanding which formula applies to which quantity prevents common calculation errors — using 10 with voltage ratios produces half the correct dB value.

53. A — 320 watts. Professional practice sizes amplifiers at approximately 125% of total tap load, meaning a 400-watt amplifier drives maximum tap load of 400 ÷ 1.25 = 320 watts. This headroom provides operating margin against peak program content that exceeds average power, preventing amplifier clipping and protection circuit engagement during use.

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

55. D — 500 MHz. Cat6A cable supports maximum frequency of 500 MHz, twice Cat6's 250 MHz capability. This higher bandwidth supports modern applications including 10GBase-T Ethernet, 4K60 HDBaseT, and other high-bandwidth AV protocols. Selecting appropriate cable category for the application is fundamental to reliable installation.

56. A — 0.5 inches. Cat6A cable specifications permit maximum 0.5 inches of untwist at termination to preserve the cable's twist geometry and maintain high-frequency performance. Excess untwist degrades near-end crosstalk (NEXT) rejection and other high-frequency characteristics, causing the cable to fail certification testing even if physical termination appears correct.

57. B — 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 impedance value reflects optimization for video signal transmission; 50-ohm coaxial cable is used for RF communications applications where that impedance optimizes power transfer to antennas.

58. D — 100 meters (328 feet). The HDBaseT specification supports 4K60 video transmission over Cat6A cable up to 100 meters, matching general Ethernet physical layer distance limits. This extended reach enables centralized equipment with remote displays, distinguishing HDBaseT from standard HDMI which is practically limited to much shorter distances.

59. C — The DDC channel embedded within the HDMI or DisplayPort cable. EDID (Extended Display Identification Data) information is exchanged via the Display Data Channel, which runs on dedicated pins within the HDMI or DisplayPort cable. This embedded channel allows automatic EDID exchange without separate connections, enabling source devices to automatically configure output to match display capabilities.

60. A — 4K UHD content from compatible sources. HDCP 2.2 (and later versions like HDCP 2.3) is required for 4K UHD 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 — a single non-compliant device anywhere in the chain prevents protected content from displaying.

61. B — 300 meters. OM3 multimode fiber supports 10 Gbps Ethernet transmission to 300 meters, substantially exceeding the 100-meter limit for copper Ethernet. OM4 extends this to 400 meters, and OM5 supports even longer distances. This extended reach makes fiber the practical choice for long-distance AV networking applications.

62. D — Green. APC (Angled Physical Contact) fiber connectors are color-coded green to distinguish them from blue PC (Physical Contact) and beige UPC (Ultra Physical Contact) connectors. This color coding prevents accidental mating of incompatible connector types — mating APC with PC or UPC connectors causes signal loss and potential connector 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 the specific configuration. This low latency is essential for professional audio applications where perceptible delay would degrade user experience, particularly in live sound, broadcast, and conferencing applications.

64. A — 10 Gbps Ethernet. SDVoE distributes uncompressed 4K60 video over 10 Gbps Ethernet, which provides the bandwidth required for the uncompressed stream plus protocol overhead. Uncompressed 4K60 video consumes approximately 12 Gbps, so 10 Gbps provides the practical bandwidth matching compression and transport overhead. Lower-speed networks cannot carry this bandwidth reliably.

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 between source output and powered device input accounts for cable losses during transmission — longer cables lose more power and provide 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, leaving 254 usable host addresses. This is the standard subnet size for many local network deployments and provides enough addresses for typical AV installation subnets.

67. C — 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 AV installations depending on the client's network architecture and existing addressing schemes, requiring coordination with the client's IT department.

68. B — 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 for AV equipment control. Higher rates support greater throughput but require shorter cable lengths, creating a tradeoff in system design.

69. A — Baud rate, data bits, parity, stop bits. RS-232 communication requires matching configuration of 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 of the connection.

70. D — Unidirectional with no status feedback. IR control transmits commands from controller to device but receives no feedback from the device, making it limited compared to bidirectional protocols like serial or IP control. This fundamental limitation means IR-controlled systems cannot verify command reception or read device status, which is increasingly problematic in modern control systems expecting feedback-based operation.

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

72. B — 0.40 ohms. The 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. Proper gauge selection for the cable run length achieves this limit.

73. A — 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 $1/R(total) = 1/R1 + 1/R2 + 1/R3$ simplifies for equal impedances to $R \div N$. Dropping below the amplifier's minimum load specification damages the amplifier, so these calculations are critical.

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 rather than degrading gracefully. This binary success/failure characteristic fundamentally distinguishes digital from analog signal behavior and affects troubleshooting approach.

75. C — 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-based characteristics. Modern software waveform monitors integrate with capture hardware in video verification workflows. Vectorscopes display chrominance; other answers describe different measurements.

76. A — 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 multiple video sources and confirms color accuracy in video systems. Waveform monitors and vectorscopes are complementary tools used together.

77. C — 15 feet. Image width = image distance ÷ throw ratio = $24 \div 1.6 = 15$ feet. The throw ratio formula relates projector positioning to image size — larger throw ratios produce smaller images

at given distances, while shorter throw ratios produce larger images at the same distance. This calculation is fundamental to projector positioning planning.

78. B — 6500K (D65). The D65 white point references 6500 Kelvin and is the international standard for video content calibration, matching the color temperature under which video content is created. Calibrating to D65 ensures white content appears correctly without warm or cool tints, producing accurate reproduction of the content creator's color intent.

79. A — 2.2. Standard video content is encoded for gamma 2.2, establishing the nonlinear relationship between input signal and displayed brightness that matches human visual perception. Display calibration adjusts gamma to match this standard so midtones appear correctly bright, preserving the intended image appearance throughout the tonal range.

80. D — 8 times image height. The AVIXA DISCAS standard recommends maximum viewing distance of 8 times image height for basic decision-making content where text must be readable from the back of the room. This distance factor ensures text legibility for the content type; different content types (analytical, inspirational) have different distance recommendations.

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

82. B — 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. This distinguishes them from performance microphones designed for tonal character and directional pickup.

83. A — Open interoperability between manufacturers' networked audio. AES67 is an open standard from the Audio Engineering Society that enables networked audio systems from different manufacturers to exchange audio using common protocols. Modern Dante implementations include AES67 compatibility as the interoperability layer, allowing proprietary systems to communicate across manufacturer boundaries.

84. D — 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 that degrades audio quality. Polarity testing is a fundamental audio system verification.

85. C — Insertion loss, return loss, NEXT, ANEXT, propagation delay, and other parametric measurements. Category-rated cable certification tests multiple parameters that together demonstrate the cable's high-frequency performance meets the specified category. Simple

continuity tests, length-only tests, voltage drop, or visual inspection are insufficient for verified Cat6A performance — comprehensive parametric testing is required.

86. B — 4.5 Gbps. 1080p60 at 8-bit color depth requires approximately 4.5 Gbps of bandwidth. Cable infrastructure must support this bandwidth because inadequate cable produces signal failure rather than gradual degradation. This is a fundamental bandwidth specification for HD video applications.

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) or equivalent infrastructure is required for this signal specification — older HDMI versions cannot support it.

88. D — 150 watts. 10 loudspeakers × 15 watts each = 150 watts total tap load. This is the amplifier demand that must be compared against amplifier capacity (with 125% sizing producing a 187.5-watt or larger amplifier recommendation) to verify the system operates within proper parameters.

Domain D — Perform Systems Close-Out

89. C — 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 appropriate to the installation's scope.

90. B — A substantive deficiency affecting system function. A non-functional video input port prevents the system from performing intended functions, making it substantive rather than cosmetic. Substantive deficiencies affect system operation and typically receive priority for resolution, while cosmetic deficiencies affect only appearance. The classification drives punch list priority and completion planning.

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 work may remain. This triggers warranty effective dates, beneficial use, and final payment provisions. The milestone is distinct from final completion which requires all punch list items resolved.

92. D — 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 warranties to earlier dates (contract signing, equipment delivery, first installation day) would reduce client warranty value by counting warranty time before system service.

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, updated wiring schedules, rack elevations showing actual equipment placement, and configuration records. This documentation serves as the authoritative reference supporting service, modifications, and expansions throughout the installation's service life.

94. C — Brief focused sessions on essential operations with hands-on practice. End-user training is most effective when concise and focused on essential operational tasks rather than detailed technical knowledge, with hands-on practice supporting retention. Users who actually operate the system during training retain skills better than passive observers of extended technical sessions, lecture-style presentations, or self-paced video.

95. D — 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, so accessibility and clarity matter more than technical detail.

96. A — 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 service requests, and discounted rates for work outside the agreement scope. These elements together provide structured ongoing service that supports both the client and the installer firm.

97. B — Annual visits with more frequent visits for high-use environments. Professional preventive maintenance schedules typically 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 for typical installations, while high-use environments warrant more frequent attention proportional to use intensity.

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 and creates clear demarcation of project completion for warranty and payment purposes.

99. C — 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 any remaining items. The specific combination of parties reflects the installation's context — simpler installations involve only installer and client; larger construction projects typically include the general contractor or commissioning authority.

100. A — 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 any remaining punch list items clearly identified and scheduled for resolution before final completion. This formal documentation creates the contractual record of milestone achievement.

101. C — Formal signing authority for the client organization. Project completion documents must be signed by an authorized client representative who has formal signing authority for the organization (typically a facilities director, project owner, or equivalent role). This formal authority makes the signed acknowledgment binding on the client organization; signatures by unauthorized personnel may not provide the intended legal protection.

102. A — As-built drawings, equipment manuals, warranty documentation, and verification reports. Comprehensive project closeout includes documentation of the actual installed configuration (as-builts), equipment operational and service information (manuals), warranty terms and contacts (warranty documentation), and verification results (reports). Each component supports the installation throughout its service life — partial closeout packages leave support gaps.

Domain E — Conducting Ongoing Project Responsibilities

103. D — 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, creating durable evidence of actual project activities.

104. B — 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 discovered during installation that are not clear from design documentation. The RFI documents both the question and the response, becoming part of the permanent project record supporting decisions made during installation.

105. C — A minor adaptation within installer authority requiring documentation. Substituting equivalent accessories during installation 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. Documentation supports both the project record and traceability of decisions made under installer authority.

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 with agendas provide the forum for multi-trade interaction, while direct trade-to-trade communication without supervision lacks authority and typically fails to resolve conflicts effectively.

107. D — 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, cost impact, schedule impact, and obtains client approval before the work is performed.

108. B — 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. This continuous practice prevents the time-consuming end-of-day cleanup that accumulated debris would require.

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 general construction waste containers, recyclable material containers, and appropriate disposal routes for different waste types. This system is sized and equipped for construction-scale waste volumes.

110. C — The project manager who can coordinate response. Issues with other trades should be routed through the project manager who has the authority and relationship with the general contractor to coordinate resolution. Direct confrontation with other trades damages working relationships and rarely produces effective solutions; social media and formal grievances are inappropriate for routine coordination issues.

111. B — Water suppression, local exhaust ventilation, or respiratory protection. OSHA's silica standard (29 CFR 1926.1153) requires specific dust controls during silica-generating activities including water suppression at the point of cutting, local exhaust ventilation with HEPA filtration, or respiratory protection appropriate for the exposure level. Standard N95 dust masks are insufficient for silica; other options don't address the silica requirements.

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 — mechanical, electrical, plumbing, fire protection, structural, and technology systems all coexist in limited space. Coordination drawings developed during design reveal conflicts that would otherwise be discovered during construction at much 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 through RFI, field change order, or design coordination rather than becoming undocumented improvisations that may not serve the client's interest.

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 and produces surprise schedule slips. Professional practice reports potential delays proactively rather than waiting for confirmed impact.

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; ignoring changes may miss legitimate client needs.

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 to ensure all work is properly authorized and compensated.

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. This dual function makes documentation valuable for service support, future modifications, and demonstrating professional judgment when questions arise later about installation decisions.

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 with appropriate training and materials, or coordinate with qualified firestop contractors — deferring all firestopping to the general contractor without coordination leaves penetrations unaddressed.

119. B — Stopping work immediately and contacting qualified abatement personnel. Asbestos exposure causes diseases emerging 20-50 years after exposure, making specialized handling by qualified abatement personnel essential. Continuing with respiratory protection is insufficient; capping and continuing doesn't address the exposure; client notification alone without stopping work continues the exposure. Only qualified abatement contractors with appropriate training and equipment should handle asbestos-containing materials.

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 that address symptoms without root causes typically produce repeat failures that consume support resources over time and damage client relationships through repeated issues.

121. A — 7 to 10 years. Professional AV installations typically have service life of 7 to 10 years before substantial refresh is required, with individual components having varying lives within that range — displays and projectors may last 5-7 years, rack equipment may last 8-10 years, and infrastructure may last 15+ years. 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 rather than being caught by preventive maintenance, inability to support current needs, and unavailability of replacement parts

from manufacturers. These signals support refresh planning before catastrophic failure forces emergency replacement.

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 during disposal, recycling, or resale. Professional decommissioning includes data removal as a standard step.

124. D — 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 (Waste Electrical and Electronic Equipment) directives, RoHS shapes how decommissioned AV equipment must be processed to minimize environmental impact.

125. A — 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 — typically 7-10 years. This long-term relationship is the foundation of recurring revenue and client loyalty, supporting both the installation firm and the client through the complete installation lifecycle.