PRACTICE EXAM 5 — 150 QUESTIONS

Domain 1 — Electrical Skills (Questions 1–68)

Cluster 1A (Q1–4): A technician is patching a small conventional rig. Each fixture is 575 watts on a 120-volt system, and circuits are protected by 20-amp breakers.

1. What current does one 575-watt fixture draw on the 120-volt circuit?

A. 0.21 amps

B. 4.79 amps

C. 9.58 amps

D. 69,000 amps

2. Applying the 80% continuous-load rule, what is the usable current on the 20-amp breaker?

A. 20 amps

B. 25 amps

C. 16 amps

D. 4 amps

3. How many 575-watt fixtures can safely run continuously on one 20-amp, 120-volt circuit?

A. 3 fixtures

B. 4 fixtures

C. 5 fixtures

D. 6 fixtures

4. If the technician mistakenly loaded the circuit to its full 20-amp nameplate, what is the risk?

A. Exceeding the continuous-load limit and nuisance tripping

B. Increasing the supply frequency

C. Improving the power factor

D. Lowering the conductor's ampacity

Cluster 1B (Q5–8): A balanced three-phase load is fed at 208 volts line-to-line, drawing 50 amps per line, at a power factor of 1.0.

5. What is the line-to-neutral voltage of this wye system?

A. 360 volts

B. 120 volts

C. 416 volts

D. 240 volts

6. What constant must be used to calculate three-phase power here?

A. 0.707

B. 1.414

C. 1.732

D. 0.866

7. What is the approximate total three-phase power?

A. 10,400 watts

B. 6,000 watts

C. 18,012 watts

D. 36,000 watts

8. If the load were unbalanced instead, what would change in the neutral?

A. Current would flow in the neutral

B. The line voltage would double

C. The frequency would drop

D. The power factor would rise to 1.5

Cluster 1C (Q9–12): A technician troubleshoots a DMX lighting chain where the last several fixtures flicker erratically.

9. A single DMX universe carries how many channels down this chain?

A. 256 channels

B. 512 channels

C. 1,024 channels

D. 128 channels

10. The technician finds no terminator on the last fixture. What value terminator restores stable data?

A. 50 ohms

B. 75 ohms

C. 120 ohms

D. 600 ohms

11. What problem does the missing terminator cause?

A. Excessive voltage drop

B. Signal reflections corrupting the data

C. Harmonic distortion of the power

D. A blown branch breaker

12. To feed three separate daisy-chains from one output while isolating each branch, the technician adds what?

A. A merger

B. An opto-splitter

C. A buck/boost transformer

D. A network router

Cluster 1D (Q13–16): A technician is sizing a portable generator for a festival stage with a 60 kW running load at 0.8 power factor.

13. What apparent power must the generator supply?

A. 48 kVA

B. 60 kVA

C. 75 kVA

D. 96 kVA

14. Adding roughly 25% headroom, what minimum generator size should be selected?

A. 60 kVA

B. 75 kVA

C. 100 kVA

D. 48 kVA

15. Why must the generator not be loaded to 100% of its rating?

A. To increase the supply frequency

B. To leave headroom for inrush, imbalance, and additions

C. To raise the power factor

D. To reduce the line voltage

16. Which generator rating should govern this continuous-duty festival use?

A. The standby rating

B. The peak surge rating

C. The starting-battery rating

D. The prime (continuous) rating

Cluster 1E (Q17–20): A technician ties feeder into a company switch using single-pole cam connectors.

17. Which color connector is the ground?

A. Green

B. White

C. Black

D. Blue

18. What is the correct connection sequence?

A. Hots, then neutral, then ground

B. Neutral, then hots, then ground

C. Ground, then neutral, then hots

D. All simultaneously

19. When de-energizing a portable power distribution system for disconnection, what is the correct sequence for removing the cam-lock connectors?

A. Hots, then neutral, then ground

B. Neutral, then ground, then hots

C. Ground, then neutral, then hots

D. All simultaneously

20. Why does the ground connect first and disconnect last?

A. So the ground reference is always present when hots are live

B. To raise the supply voltage

C. To reduce the data latency

D. To increase the power factor

Cluster 1F (Q21–24): A technician measures a wye distribution panel and reads 277 volts line-to-neutral.

21. What is the approximate line-to-line voltage?

A. 277 volts

B. 360 volts

C. 480 volts

D. 160 volts

22. This 277/480 V service is typically used for what?

A. Only 120 V practical lamps

B. Larger loads and three-phase distribution

C. DMX data only

D. Battery charging only

23. The neutral in this wye serves what purpose for standard loads?

A. It carries the line-to-line voltage

B. It allows lower-voltage loads to share the service

C. It eliminates the need for grounding

D. It doubles the available current

24. If only non-linear dimmer loads are connected, the neutral may carry high current due to what?

A. Triplen harmonics adding in the neutral

B. A loose ground connection

C. Excessive line voltage

D. A reversed phase rotation

Cluster 1G (Q25–28): A technician inspects fixtures and instruments before a show.

25. A meter used at the 480 V company switch must carry which minimum category?

A. CAT I

B. CAT II

C. CAT III or IV

D. No rating needed

26. Before trusting a "dead" reading, the technician must do what?

A. Check the wire colors

B. Measure the resistance

C. Prove the meter on a known-live source

D. Assume zero means safe

27. To read current on a live feeder without breaking it, which tool is used?

A. A series multimeter

B. An ohmmeter

C. A megohmmeter

D. A clamp meter

28. A clamp meter reads near zero on a loaded cable. What is the likely error?

A. The frequency is wrong

B. The clamp encircles both hot and neutral

C. The load is too bright

D. The meter is in DC mode

Cluster 1H (Q29–32): A technician evaluates dimming options for a mixed rig of tungsten and LED fixtures.

29. The tungsten fixtures are controlled by which device?

A. A relay rack

B. A node

C. A dimmer

D. An opto-splitter

30. A forward-phase dimmer reduces power by doing what?

A. Doubling the frequency

B. Chopping the leading edge of each half-cycle

C. Inverting the polarity

D. Adding a DC offset

31. Forward-phase dimming of these tungsten loads contributes to what system problem?

A. Reduced line voltage

B. Increased power factor

C. Lower ampacity

D. Triplen harmonics loading the neutral

32. The LED fixtures must instead be fed how?

A. From a forward-phase dimmer

B. From constant (non-dimmed) power

C. From a half-wave rectifier

D. From reverse polarity

Cluster 1I (Q33–36): A technician examines a battery-based backup system rated 48 V, 200 Ah.

33. What is the stored energy of this battery bank?

A. 200 watt-hours

B. 48 watt-hours

C. 9,600 watt-hours

D. 4.2 watt-hours

34. Ignoring losses, how long can it power a 1,200-watt load?

A. 2 hours

B. 4 hours

C. 16 hours

D. 8 hours

35. Real runtime will be shorter than the ideal calculation because of what?

A. The supply frequency

B. The cable color

C. The phase rotation

D. Conversion losses and depth-of-discharge limits

36. Which device provides instantaneous backup the moment input power fails?

A. A UPS

B. A standby generator

C. A buck/boost transformer

D. A company switch

Cluster 1J (Q37–40): A technician sets up a networked lighting control system.

37. The console outputs sACN over the network. Which device converts it to physical DMX at the fixtures?

A. A merger

B. A node

C. A terminator

D. A buck/boost transformer

38. Each node output port carries how many DMX universes?

A. 512 universes

B. 8 universes

C. 4 universes

D. 1 universe

39. Two networked devices connect physically but cannot communicate. The likely cause is what?

A. A missing gobo

B. Incompatible IP address ranges

C. A blown lamp

D. An unbalanced phase

40. A truss-mounted node is powered without a separate cable using what technology?

A. A buck/boost transformer

B. An isolation transformer

C. Power over Ethernet (PoE)

D. A DMX terminator

Cluster 1K (Q41–44): A technician selects cable and connectors for a distribution run.

41. A standard 19-pin Socapex multi-cable carries how many circuits?

A. Three

B. Twelve

C. Six

D. Nineteen

42. Six fully loaded circuits bundled in one jacket raise concern about what?

A. Heat buildup and ampacity derating

B. Loss of the ground reference

C. DMX channel overflow

D. Power-factor correction

43. A bare-end feeder lug must be secured by doing what?

A. Leaving it slightly loose

B. Coiling the excess cable

C. Painting the lug

D. Torquing to specification

44. A loose termination becomes a fire hazard because it does what?

A. Lowers the load current

B. Raises the supply frequency

C. Increases resistance and generates heat

D. Improves the power factor

Cluster 1L (Q45–48): A technician maintains and re-lamps fixtures after a run.

45. A tungsten-halogen lamp must never be touched with bare fingers because what?

A. It holds a residual charge

B. It is too fragile to grip

C. Skin oil creates a hot spot shortening lamp life

D. It contains pressurized mercury

46. A xenon arc lamp requires what handling precaution?

A. Full protective gear due to explosion risk

B. Bare-hand positioning is fine

C. No cooling time is needed

D. Power left on during the change

47. A fixture's beam has an uneven, dark center. The corrective maintenance is what?

A. Replacing the DMX cable

B. Optimizing the lamp-to-reflector position

C. Adding a terminator

D. Increasing the breaker size

48. Which fixture type produces a hard-edged beam and accepts gobos?

A. A PAR can

B. A cyc light

C. A Fresnel

D. An ellipsoidal (profile)

Cluster 1M (Q49–52): A technician reviews AC fundamentals for the crew.

49. The peak voltage of a 120 V RMS supply is approximately what?

A. 120 volts

B. 85 volts

C. 170 volts

D. 240 volts

50. The RMS value equals the peak times what factor?

A. 1.414

B. 1.732

C. 0.866

D. 0.707

51. North American utility frequency is what?

A. 60 Hz

B. 50 Hz

C. 25 Hz

D. 400 Hz

52. The three phases of a three-phase supply are offset by how many degrees?

A. 90 degrees

B. 180 degrees

C. 240 degrees

D. 120 degrees

Cluster 1N (Q53–56): A technician analyzes a resistive circuit network.

53. Two 30-ohm resistors in parallel give what total resistance?

A. 60 ohms

B. 15 ohms

C. 30 ohms

D. 0.067 ohms

54. Three 12-ohm resistors in series give what total resistance?

A. 36 ohms

B. 4 ohms

C. 12 ohms

D. 1,728 ohms

55. A 10-ohm resistor in series with a parallel pair of two 10-ohm resistors gives what total?

A. 15 ohms

B. 30 ohms

C. 10 ohms

D. 5 ohms

56. Using product over sum, two parallel resistors of 12 and 24 ohms give what?

A. 36 ohms

B. 8 ohms

C. 18 ohms

D. 0.125 ohms

Cluster 1O (Q57–60): A technician selects extension cords for various runs.

57. A longer cord run primarily increases what, requiring a larger gauge?

A. The voltage drop along the run

B. The supply frequency

C. The power factor

D. The load's current draw

58. A fixture at the end of a long undersized cord runs dim. The cause is what?

A. A dirty gobo

B. A wrong DMX address

C. Too high a frequency

D. Excessive voltage drop

59. A cord is found with a missing ground pin. The correct action is what?

A. Tape it and continue

B. Remove it from service

C. Use it for low loads only

D. Reverse the connectors

60. Cord gauge must be matched to both current and what?

A. The gel color

B. The fixture's DMX address

C. The run length

D. The console model

Cluster 1P (Q61–64): A technician explains data protocols to an apprentice.

61. Which protocol adds two-way communication to DMX512?

A. sACN

B. RDM

C. Art-Net

D. PoE

62. Which is the ratified standard for streaming DMX universes over IP?

A. sACN (E1.31)

B. RDM

C. PoE

D. Wireless DMX

63. A rig needing 1,500 channels requires how many universes at minimum?

A. 3 universes

B. 2 universes

C. 1 universe

D. 5 universes

64. Wireless DMX is risky at a crowded festival because of what?

A. Excessive voltage drop

B. RF interference and dropout

C. Harmonic distortion of power

D. A blown receiver fuse

Cluster 1Q (Q65–68): A technician measures and verifies circuits during troubleshooting.

65. The resistance (ohms) function must be used in what state?

A. Energized at full voltage

B. Carrying load current

C. De-energized

D. Energized at reduced voltage

66. An OL reading on the ohmmeter across a cable indicates what?

A. A perfect connection

B. A short circuit

C. An open conductor

D. Excess voltage

67. A voltmeter is connected to a circuit how?

A. In parallel across the points

B. In series in the current path

C. Through the current jacks only

D. Only after de-energizing

68. A continuity test on a good fuse should produce what?

A. An open (OL) reading

B. A high-resistance reading

C. A doubled voltage

D. A near-zero resistance reading or beep

Domain 2 — Regulations, Codes & Life Safety (Questions 69–103)

Cluster 2A (Q69–72): An inspector reviews the regulatory framework for a touring production.

69. Which document governs how the temporary power system is installed in the US?

A. The National Electrical Code (NFPA 70)

B. NFPA 70E

C. ANSI E1.31

D. The UL White Book

70. Which standard governs safe work practices and arc flash for US workers?

A. The NEC

B. ANSI E1.11

C. NFPA 70E

D. The CEC

71. Which is the Canadian installation code equivalent to the NEC?

A. CSA Z462

B. NFPA 70E

C. The Canadian Electrical Code (CSA C22.1)

D. ANSI E1.20

72. Who has final authority to approve the installation on this specific site?

A. The Authority Having Jurisdiction

B. The lighting designer

C. The equipment manufacturer

D. The console operator

Cluster 2B (Q73–76): A worker prepares to service an energized-capable distro.

73. Per NFPA 70E, what is the safest condition for the work?

A. Energized with insulated tools

B. Energized at reduced load

C. Energized with a spotter

D. De-energized, verified, and locked out

74. During lock-out/tag-out, who may remove the worker's personal lock?

A. The site supervisor

B. Any qualified electrician

C. Venue security

D. Only the worker who applied it

75. What stored-energy hazard may remain after disconnecting?

A. The supply frequency

B. Charge in capacitors or batteries

C. The conductor color

D. The cable ampacity

76. What is the core NFPA 70E principle regarding energized work?

A. It is always faster and preferred

B. De-energize wherever feasible; energized work is the exception

C. PPE makes it fully safe

D. Voltage below 480 V is never hazardous

Cluster 2C (Q77–80): A bystander contacts a live conductor and collapses.

77. What is the rescuer's first action?

A. Pull the victim off immediately

B. Throw water on the contact point

C. Wait for the breaker to trip

D. De-energize the source first

78. Why must the rescuer not touch the victim while contact persists?

A. It improves wireless reception

B. It raises the supply voltage

C. It balances the phases

D. The rescuer would become a second victim

79. Severe shock can cause which lethal heart rhythm?

A. Bradycardia

B. Hypertension

C. Ventricular fibrillation

D. Tachypnea

80. Which device can correct that rhythm?

A. An AED

B. A clamp meter

C. A multimeter

D. A GFCI

Cluster 2D (Q81–84): A technician runs atmospheric effects near performers.

81. Fog and haze exposure limits come from ESTA/ANSI and which body?

A. Actors' Equity Association

B. The FCC

C. The EPA

D. The DOT

82. Fog and haze are best described as what kind of matter?

A. A purely creative choice with no limits

B. A regulated health-and-safety matter

C. An optional decorative add-on only

D. A data-network consideration

83. If the effect may trigger smoke detection, the technician must do what?

A. Disable detectors permanently without notice

B. Coordinate with the venue and AHJ

C. Ignore the detectors

D. Run the effect only at full output

84. Why must fog never be allowed to obscure exits?

A. Obscured exits endanger evacuation

B. It raises the supply frequency

C. It unbalances the phases

D. It increases voltage drop

Cluster 2E (Q85–88): A worker prepares PPE and fire safety for a high-energy install.

85. PPE is considered which line of defense?

A. The first line

B. The only line

C. An optional line

D. The last line

86. For a high arc-flash hazard, the clothing requirement is what?

A. Ordinary cotton clothing

B. Arc-rated clothing matched to the incident energy

C. A high-visibility vest only

D. A particle respirator only

87. Which class of fire involves energized electrical equipment?

A. Class C

B. Class A

C. Class K

D. Class B

88. Why must water never be used on this energized fire?

A. It evaporates too fast

B. It triggers the alarm

C. It raises the fire's temperature

D. It conducts electricity and can electrocute the user

Cluster 2F (Q89–92): An inspector checks listing and jurisdiction details.

89. Which mark indicates testing by a Nationally Recognized Testing Laboratory?

A. A gel maker's logo

B. A union local stamp

C. A DMX-compatible sticker

D. A UL, ETL, or CSA mark

90. Which agency recognizes UL, ETL, and CSA as testing labs?

A. ANSI

B. NFPA

C. OSHA

D. ESTA

91. The AHJ has final say over which of the following?

A. The performers' contracts

B. The console programming

C. The gel palette

D. Which code edition applies and its interpretation

92. ESTA's Technical Standards Program develops what?

A. Government enforcement rules

B. Performer contracts

C. Rental pricing guides

D. Industry consensus standards for entertainment technology

Cluster 2G (Q93–96): A worker reviews shock and protection fundamentals.

93. A GFCI trips to protect a person at approximately what current?

A. 5 amps

B. 5 milliamps

C. 100 amps

D. 500 milliamps

94. Fatal ventricular fibrillation can occur at approximately what current?

A. 1 milliamp

B. 100 milliamps

C. 20 amps

D. 100 amps

95. A GFCI and a breaker differ because the GFCI does what?

A. Protects people from shock

B. Protects conductors from overload

C. Increases the line voltage

D. Converts AC to DC

96. Moisture increases shock danger because it does what?

A. Lowers the body's resistance

B. Raises the supply frequency

C. Increases the voltage

D. Improves ampacity

Cluster 2H (Q97–100): A worker handles hazardous materials and emergencies.

97. Which hazardous material is found in many HID and arc lamps?

A. Lead

B. Asbestos

C. Radon

D. Mercury

98. Suspected asbestos in older equipment should be handled how?

A. Sand it to inspect

B. Do not disturb it; use qualified abatement

C. Remove it with hand tools

D. Paint over it

99. Generator exhaust in an enclosed space presents what hazard?

A. Harmonic distortion

B. High fault current

C. DMX interference

D. Carbon monoxide poisoning

100. Emergency egress lighting must do what if normal power fails?

A. Illuminate the paths to the exits

B. Flash to the booth

C. Shut off to save battery

D. Switch the show to blackout

Cluster 2I (Q101–103): A worker applies lock-out/tag-out procedures.

101. What is the purpose of lock-out/tag-out?

A. To track cable inventory

B. To balance the phases

C. To prevent re-energizing during work

D. To isolate the data network

102. Which is NOT a valid lock-out/tag-out step?

A. Re-energizing to test before working

B. Isolating the disconnect

C. Verifying zero energy

D. Locking and tagging

103. An electrically safe work condition requires which sequence?

A. Reduce voltage, then work

B. Lock out, then skip verification

C. Energize with PPE, then verify

D. De-energize, verify, lock out

Domain 3 — Entertainment Electrical Systems Planning (Questions 104–150)

Cluster 3A (Q104–107): A planner sizes the service for a production with the following connected loads: lighting 40 kW, audio 12 kW, video 8 kW, all at 0.8 power factor.

104. What is the total connected load in kilowatts?

A. 60 kW

B. 48 kW

C. 75 kW

D. 96 kW

105. Converting to apparent power at 0.8 PF, what must the service supply?

A. 48 kVA

B. 60 kVA

C. 75 kVA

D. 100 kVA

106. Why might the planner apply load diversity to this total?

A. Not all equipment runs at full power simultaneously

B. The voltage drops on long runs

C. Harmonics add in the neutral

D. The frequency varies

107. To which of these loads should diversity NOT be applied?

A. Decorative accent lighting

B. Critical/safety equipment that runs continuously at full

C. Spare circuits

D. House lighting only

Cluster 3B (Q108–111): A planner assesses tying into an existing 400-amp company switch.

108. What must be confirmed first about the service?

A. The gel palette

B. The console model

C. Its amperage rating and overcurrent protection

D. The performers' schedule

109. The planner checks the available fault current at the tie-in. Why?

A. So equipment SCCR and breaker AIC exceed it

B. To select the gel colors

C. To set the DMX addresses

D. To balance the truss load

110. The tie-in panel's lugs and bus bars are checked for what?

A. The DMX universe count

B. Physical adequacy to accept the connection

C. The gobo size

D. The fixture focus

111. If a smaller conductor is tapped off the feeder without protection at its ampacity, what governs how it is done?

A. The tap rules limiting conductor length

B. The gel-cut list

C. The console channel count

D. The wireless channel plan

Cluster 3C (Q112–115): A planner sizes conductors for a 75-foot feeder run carrying 100 amps.

112. Besides ampacity, what must the planner check on this long run?

A. The gel color

B. The console model

C. The DMX universe

D. The voltage drop

113. The run meets ampacity but delivers low voltage at the distro. What governs the conductor choice?

A. The connector color

B. Voltage drop

C. The supply frequency

D. The fixture focus

114. The recommended voltage-drop limit on a feeder-plus-branch path is about what?

A. 5 percent total

B. 25 percent total

C. 50 percent total

D. 0.5 percent total

115. The remedy for excessive voltage drop on this run is what?

A. Adding a terminator

B. Changing the gel

C. Lowering the frequency

D. Using a larger conductor or shorter run

Cluster 3D (Q116–119): A planner reviews the production's design documents.

116. Which document shows the power system structure from source to loads?

A. A lighting plot

B. A gel-cut sheet

C. A channel hookup

D. A single-line diagram

117. Which document shows each fixture's position, type, and focus?

A. A single-line diagram

B. A crew schedule

C. A lighting plot

D. A shop order

118. Which document maps each fixture to its circuit and control channel?

A. A single-line diagram

B. A budget summary

C. A hookup (channel schedule)

D. A weather forecast

119. The shop order (equipment list) is derived from what?

A. The catering plan

B. The design documents

C. The parking layout

D. The forecast

Cluster 3E (Q120–123): A planner verifies fault-current ratings for the distribution equipment.

120. The available fault current at a point is what?

A. The normal load current there

B. The average of the phase currents

C. The maximum short-circuit current the system can deliver there

D. The breaker's trip rating

121. Equipment SCCR must do what relative to available fault current?

A. Be lower than it

B. Be exactly half of it

C. Be unrelated to it

D. Equal or exceed it

122. A breaker's interrupting rating (AIC) must do what relative to available fault current?

A. Be lower than it

B. Be exactly half of it

C. Meet or exceed it

D. Be unrelated to it

123. Installing an under-rated breaker for the available fault current risks what?

A. The breaker rupturing during a fault

B. Improved selective coordination

C. Lower voltage drop

D. Higher power factor

Cluster 3F (Q124–127): A planner calculates the load on an overhead truss.

124. What must be included in the total truss load?

A. Only the heaviest fixture

B. Only the moving lights

C. Only the data cables

D. Fixtures, cable, distribution gear, and the truss itself

125. Why is cable weight especially important to include?

A. It changes the beam angle

B. It affects the DMX address

C. It alters the frequency

D. A long run can weigh as much as the fixtures

126. A heavy unit placed at unsupported midspan creates what hazard?

A. A point load that can overstress the truss

B. Improved load distribution

C. Lower truss weight

D. Reduced voltage drop

127. A rigging component must never be loaded beyond which figure?

A. Its breaking strength

B. Its own weight

C. Its maximum span

D. Its Working Load Limit

Cluster 3G (Q128–131): A planner addresses overhead safety for the hang.

128. Every overhead fixture must have which secondary device?

A. A spare gel frame

B. A rated safety cable attached to the structure

C. A second data cable

D. A backup lamp

129. Why should safety cables be kept short?

A. To save steel cost

B. To improve beam quality

C. To reduce data latency

D. To limit fall distance and shock load

130. A worker focusing at height must use which fall protection?

A. A full-body harness, lanyard, and rated anchor

B. A tool belt only

C. Insulating gloves only

D. A respirator only

131. The area below overhead work must be cleared to address what hazard?

A. Dropped objects striking people

B. Voltage drop

C. Harmonic distortion

D. Phase imbalance

Cluster 3H (Q132–135): A planner finalizes documentation and logistics.

132. Why include spares in the shop order?

A. To inflate the invoice

B. To meet union staffing

C. To satisfy the designer

D. To cover inevitable failures and consumables

133. A crew schedule assigns what to each phase?

A. The DMX addresses

B. The gel colors

C. Appropriately skilled personnel

D. The breaker ratings

134. Administering inventory helps prevent what?

A. Excessive harmonics

B. Phase imbalance

C. Missing equipment discovered at load-in

D. High fault current

135. A control/riser diagram communicates what?

A. The truss load distribution

B. The control and data distribution layout

C. The gel cuts

D. The fuel schedule

Cluster 3I (Q136–139): A planner sequences and verifies the distribution design.

136. The correct single-line order from the source is what?

A. Source, disconnect, overcurrent protection, distribution, loads

B. Loads, distros, disconnect, source

C. Distros, source, loads

D. Loads, source, disconnect

137. Designing so only the device nearest a fault opens is called what?

A. Phase balancing

B. Voltage dropping

C. Harmonic filtering

D. Selective coordination

138. Without selective coordination, a single branch fault could do what?

A. Improve the power factor

B. Trip the main and drop the whole show

C. Lower the supply frequency

D. Increase the ampacity

139. Overcurrent device ratings should be verified against fault current when?

A. After the show closes

B. During planning of the distribution system

C. Only for LED rigs

D. Never, breakers self-adjust

Cluster 3J (Q140–143): A planner sizes a generator and accounts for motor loads.

140. Why must inrush current be considered?

A. It lowers the frequency permanently

B. It reduces cable ampacity

C. It improves the power factor

D. Motors draw several times running current at startup

141. A generator should be loaded to about what level for reliability?

A. 100 percent of connected load

B. 75 to 80 percent

C. 110 percent

D. 50 percent of standby

142. Whether to bond the generator's neutral to ground depends on what?

A. The gel color

B. The DMX universe count

C. Whether it is a separately derived system

D. The fixture focus

143. Undersizing the generator causes what under load?

A. Improved power factor

B. Higher ampacity

C. Lower harmonics

D. Voltage sag and frequency droop

Cluster 3K (Q144–147): A planner reviews the means of disconnect and feeders.

144. A means of disconnect must meet what requirement?

A. Match the gel color

B. Convert AC to DC

C. Transmit DMX

D. Be readily accessible and lockable

145. A feeder is best described as what?

A. The high-capacity cable from source to distribution

B. The final cable to a single fixture

C. The data cable to a node

D. The safety cable on a truss

146. A node's DMX output port carries how much?

A. Three-phase power

B. A 120-volt branch

C. One DMX universe

D. A feeder connection

147. A show floor power diagram is most relevant to what?

A. Power locations across an exhibit floor

B. The gel-cut requirements

C. The followspot cues

D. The performers' rider

Cluster 3L (Q148–150): A planner reflects on the role of the planning domain.

148. A conductor on a long run must satisfy ampacity and what other limit?

A. The console channel count

B. The gobo size

C. The dimmer curve

D. The acceptable voltage drop

149. Applying load diversity too aggressively risks what?

A. Reduced harmonic distortion

B. Overload when many loads run full at once

C. Improved generator efficiency

D. Excessive voltage at the load

150. Why is the planning domain considered the mark of the advanced practitioner?

A. It eliminates the need for grounding

B. It replaces the codes

C. It converts knowledge into a safe, documented, installable system

D. It removes the need for safety cables

Full Answer Key & Explanations

Domain 1 — Electrical Skills

1. B — Using I = P ÷ E, 575 W ÷ 120 V = 4.79 amps. Knowing each fixture's draw lets the technician total the circuit load accurately.

2. C — The 80% continuous limit on a 20-amp breaker is 20 × 0.80 = 16 amps. Continuous loads must not exceed this to avoid nuisance tripping and overheating.

3. A — Usable power = 16 A × 120 V = 1,920 W; 1,920 ÷ 575 = 3.3, so 3 fixtures fit (round down). Exceeding the limit is never allowed, so the fractional result rounds down.

4. A — Loading to the full 20-amp nameplate exceeds the 16-amp continuous limit, risking nuisance tripping and overheating. The 80% rule exists precisely to prevent this.

5. B — Line-to-neutral = line-to-line ÷ 1.732 = 208 ÷ 1.732 ≈ 120 V. This is why a 120/208 V service gives 120 V to neutral and 208 V between phases.

6. C — The factor 1.732 (√3) is used in all three-phase power calculations with line-to-line voltage. Recognizing "three-phase" cues its use.

7. C — P = E × I × 1.732 × PF = 208 × 50 × 1.732 × 1.0 ≈ 18,012 watts. Both the 1.732 factor and the power factor apply to three-phase real power.

8. A — An unbalanced load leaves a residual current the neutral must carry, since the phase currents no longer fully cancel. Balancing minimizes this neutral current.

9. B — One DMX universe carries 512 channels down the chain. Rigs needing more channels require additional universes.

10. C — The last device needs a 120-ohm terminator to absorb the signal and prevent reflections. This restores stable data on the chain.

11. B — A missing terminator causes signal reflections that corrupt the data, producing the flicker observed. It is a classic, easily misdiagnosed DMX fault.

12. B — An opto-splitter takes one input and produces multiple optically isolated outputs, feeding several chains while protecting each branch. The isolation is its defining feature.

13. C — Apparent power = kW ÷ PF = 60 ÷ 0.8 = 75 kVA. A generator's kVA rating must meet or exceed this.

14. C — 75 kVA × 1.25 ≈ 94 kVA, so a generator of at least 100 kVA should be selected. Headroom covers inrush, imbalance, and additions.

15. B — A generator must not be loaded to 100% so headroom remains for inrush, imbalance, and additions. Full loading leaves no margin for reliability.

16. D — Continuous-duty festival use should be sized to the prime (continuous) rating, not the higher short-duration standby figure. Sizing to standby overestimates sustainable capacity.

17. A — Green is the ground color in single-pole cam connectors. White is neutral, and black, red, and blue are the hots.

18. C — The connection sequence is ground, then neutral, then the hots last, so the ground and neutral references are present before any hot becomes live.

19. C. Disconnection sequence — Remove hot conductors first, then the neutral, and disconnect ground last so the system stays bonded and any fault current has a safe path until the final connection is broken.

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20. A — Connecting ground first and disconnecting it last ensures the ground reference is always present whenever a hot conductor is live. This prevents an energized, unreferenced condition.

21. C — Line-to-line = line-to-neutral × 1.732 = 277 × 1.732 ≈ 480 V. This is the common 277/480 V wye service for larger loads.

22. B — A 277/480 V service is used for larger loads and three-phase distribution, with step-down for 120 V practical loads. Higher distribution voltage reduces current and conductor size.

23. B — The neutral allows lower-voltage (120 V) loads to share the service alongside higher-voltage three-phase loads. This is a key advantage of the wye configuration.

24. A — With only non-linear dimmer loads, triplen harmonics add in the neutral rather than canceling, producing high neutral current. This is why such rigs need oversized neutrals.

25. C — Work at the 480 V company switch requires a CAT III or CAT IV meter rated for the voltage, due to high transient fault energy near the source. An under-rated meter risks a catastrophic arc.

26. C — Before trusting a "dead" reading, the meter must be proven on a known-live source (live-dead-live). A single zero reading can come from a faulty meter.

27. D — A clamp meter reads current magnetically around a single conductor without breaking the live feeder. A series multimeter would require interrupting it and is unsafe at that current.

28. B — A near-zero clamp reading on a loaded cable usually means the clamp also encircles the neutral, whose opposing field cancels the reading. A clamp must read one conductor at a time.

29. C — A dimmer controls the intensity of conventional tungsten fixtures by regulating delivered power. Relays only switch, and nodes and splitters handle data.

30. B — A forward-phase (leading-edge) dimmer chops the leading edge of each half-cycle, switching on partway through to reduce power. This chopping generates harmonics.

31. D — Forward-phase chopping generates triplen harmonics that add in the neutral, loading it heavily. This is why heavily dimmed rigs need oversized neutrals and K-rated transformers.

32. B — LED fixtures must be fed from constant (non-dimmed) power and dim internally via data. A chopped dimmer waveform can damage their power supplies.

33. C — Energy = V × Ah = 48 × 200 = 9,600 watt-hours. This figure lets a technician estimate backup runtime.

34. D — Runtime = Energy ÷ Load = 9,600 Wh ÷ 1,200 W = 8 hours (ideal). Real runtime is shorter due to conversion losses and depth-of-discharge limits.

35. D — Real runtime is shorter than ideal because of inverter conversion losses and depth-of-discharge limits that protect battery life. The calculated figure is a theoretical maximum.

36. A — A UPS provides instantaneous backup from internal batteries the moment input fails. A generator takes seconds to start, so the UPS bridges that gap.

37. B — A node (Ethernet-to-DMX gateway) converts sACN network data into physical DMX outputs at the fixtures. It is the bridge between the network and DMX gear.

38. D — Each node output port carries one DMX universe (512 channels). A node typically provides several such ports.

39. B — Networked devices that connect physically but can't communicate usually sit on incompatible IP address ranges. Aligning the IP scheme resolves this common fault.

40. C — Power over Ethernet (PoE) delivers power and data over one cable, powering a truss-mounted node without a separate supply. The supplying switch and cable must support PoE.

41. C — A standard 19-pin Socapex carries six 20-amp circuits. Bundling these conductors requires ampacity derating consideration.

42. A — Six fully loaded circuits in one jacket trap heat, raising ampacity-derating concerns. The conductors cannot each carry full breaker rating simultaneously without derating.

43. D — A bare-end feeder lug must be torqued to specification; a loose lug creates resistance, heat, and fire risk. "By feel" is not acceptable on high-current terminations.

44. C — A loose termination increases resistance, which generates heat ($P = I^2R$) in a runaway cycle. This is why loose terminations are a leading cause of electrical fires.

45. C — Skin oil from bare fingers creates a hot spot on a tungsten-halogen envelope, shortening lamp life or causing failure. Lamps must be handled with a cloth or glove.

46. A — A xenon arc lamp is pressurized and can explode, requiring full protective gear and the manufacturer's procedure. It must also be cooled and de-energized first.

47. B — An uneven beam with a dark center is corrected by optimizing the lamp-to-reflector position for an even field. Poor alignment wastes output and creates hot spots or dark centers.

48. D — An ellipsoidal (profile) fixture produces a hard-edged beam and accepts gobos. PARs, cyc lights, and Fresnels produce softer beams without sharp gobo projection.

49. C — $V_{pk} = V_{rms} \times 1.414 = 120 \times 1.414 \approx 170$ V. The 120 V RMS rating peaks near 170 V.

50. D — RMS equals peak times 0.707 ($V_{rms} = V_{pk} \times 0.707$). The 1.414 factor converts the other direction, RMS to peak.

51. A — North American utility frequency is 60 Hz. Europe and many touring destinations use 50 Hz.

52. D — The three phases are offset by 120 electrical degrees, one-third of a cycle. This staggered spacing keeps combined power delivery smooth.

53. B — Two equal parallel resistors halve: 30 ÷ 2 = 15 ohms. Total parallel resistance always falls below the smallest branch.

54. A — Series resistances add: 12 + 12 + 12 = 36 ohms. In series, the total is the sum of the parts.

55. A — The parallel pair = (10 × 10) ÷ 20 = 5 Ω; in series with 10 Ω, total = 15 ohms. Simplify the parallel group first, then add the series element.

56. B — Product over sum = (12 × 24) ÷ (12 + 24) = 288 ÷ 36 = 8 ohms. This shortcut applies to exactly two parallel resistors.

57. A — A longer run increases resistance and therefore voltage drop, which may require a larger gauge. Cord gauge must be matched to length, not just current.

58. D — A dim fixture at the end of a long undersized cord indicates excessive voltage drop over the run's resistance. A larger gauge or shorter run restores voltage.

59. B — A cord with a missing ground pin must be removed from service; a missing ground is never acceptable. Taping or limiting load does not restore safety.

60. C — Cord gauge must be matched to both the current and the run length, because length drives voltage drop. Sizing for current alone underperforms on long runs.

61. B — RDM adds two-way communication to DMX512, allowing remote device management. All components in the path must be RDM-compatible.

62. A — sACN (E1.31) is the ratified standard for streaming DMX universes over IP. Art-Net is a widely used predecessor.

63. A — 1,500 channels ÷ 512 per universe = 2.93, rounding up to 3 universes. Two universes cover only 1,024 channels.

64. B — Wireless DMX shares the radio spectrum and suffers interference and dropout in crowded RF environments. This is why critical control is often kept wired.

65. C — The resistance function supplies its own test current and must be used de-energized. Measuring live gives false readings and can damage the meter.

66. C — An OL (open line) reading indicates a broken, open conductor with no continuous path. A good conductor reads near zero ohms.

67. A — A voltmeter is connected in parallel across the points being measured, because its high resistance draws negligible current. The rule is voltage in parallel, current in series.

68. D — A good fuse shows continuity — a near-zero resistance reading or a beep. An open (OL) reading would indicate a blown fuse.

Domain 2 — Regulations, Codes & Life Safety

69. A — The National Electrical Code (NFPA 70) governs how the temporary power system is installed in the US. NFPA 70E instead governs safe work practices.

70. C — NFPA 70E governs safe work practices and arc flash for US workers. The NEC governs installation, and ANSI E1.11 is a control protocol.

71. C — The Canadian Electrical Code (CSA C22.1) is the Canadian installation code equivalent to the NEC. CSA Z462 is the safe-work counterpart.

72. A — The Authority Having Jurisdiction (AHJ) has final authority to approve the installation on a specific site. Codes set the baseline, but the AHJ decides.

73. D — NFPA 70E's safest condition is de-energized, verified, and locked out. Energized work is permitted only when de-energizing is genuinely infeasible.

74. D — Only the worker who applied a personal lock may remove it, guaranteeing no one re-energizes while that worker is exposed. Removing another's lock is strictly prohibited.

75. B — Charge stored in capacitors or batteries can remain lethal after disconnection. Zero energy must be verified and stored energy discharged before contact.

76. B — NFPA 70E's core principle is to de-energize wherever feasible, treating energized work as the exception requiring hazard analysis and PPE. "Faster to leave it live" is never acceptable.

77. D — The rescuer must de-energize the source first, or they become a second victim by joining the circuit. Only after the power is removed is it safe to assist.

78. D — Touching a victim still in contact with a live source makes the rescuer a second victim by joining the circuit. The source must be removed first.

79. C — Severe electric shock can cause ventricular fibrillation, a lethal disruption of the heart's rhythm, at currents as low as ~100 mA. This is why GFCI protection trips far lower.

80. A — An AED can analyze the rhythm and deliver a shock to correct ventricular fibrillation. Prompt use is lifesaving for an electrocution victim.

81. A — Fog and haze exposure limits come from ESTA/ANSI standards and Actors' Equity agreements. Atmospherics are a regulated health-and-safety matter.

82. B — Fog and haze are a regulated health-and-safety matter, with exposure limits on fluids, concentration, and time. They are not a limit-free creative choice.

83. B — Effects that may trigger smoke detection must be coordinated with the venue and AHJ, never by defeating detectors without authorization. Detection systems are life-safety equipment.

84. A — Fog that obscures exits endangers evacuation, which is why it must never be allowed to do so. Exit visibility is a critical life-safety concern.

85. D — PPE is the last line of defense, used only when the hazard cannot be eliminated or reduced. Eliminating the hazard takes priority.

86. B — A high arc-flash hazard requires arc-rated clothing matched to the incident energy from the hazard analysis. Ordinary clothing can ignite under arc-flash energy.

87. A — A Class C fire involves energized electrical equipment and requires a non-conductive agent. Water must never be used on energized equipment.

88. D — Water conducts electricity, so using it on an energized fire can electrocute the user. The equipment must be de-energized first.

89. D — A UL, ETL, or CSA mark indicates listing by a Nationally Recognized Testing Laboratory, confirming testing to safety standards. The AHJ may require listed equipment.

90. C — OSHA recognizes UL, ETL, and CSA as Nationally Recognized Testing Laboratories. This recognition gives their listing marks regulatory standing.

91. D — The AHJ has final say over which code edition applies and how requirements are interpreted for the site. It does not control contracts, programming, or gel choices.

92. D — ESTA's Technical Standards Program develops industry consensus standards for entertainment technology, including the ANSI E1 series. ESTA also administers the ETCP certifications.

93. B — A GFCI trips at about 5 milliamps of ground-fault imbalance, set below the level that can stop a heart. It protects people, unlike a breaker.

94. B — Fatal ventricular fibrillation can occur at currents as low as about 100 milliamps. This is why GFCI protection trips at a far lower 5 mA threshold.

95. A — A GFCI protects people from shock by detecting tiny hot-neutral imbalances, while a breaker protects conductors from overload. They do different jobs.

96. A — Moisture lowers the body's resistance, allowing more current to flow for a given voltage. This is why wet locations demand GFCI protection and extra caution.

97. D — Many HID and arc lamps contain mercury, which is toxic and released if broken, requiring special handling and disposal. They must never go in regular trash.

98. B — Suspected asbestos must not be disturbed; qualified abatement is required. Sanding, removing, or painting over it can release carcinogenic fibers.

99. D — Generator exhaust contains carbon monoxide, which causes poisoning in enclosed or poorly ventilated spaces. Generators must never run enclosed.

100. A — Egress lighting must illuminate the paths to the exits when normal power fails, so occupants can evacuate. It is a life-safety system that must never be defeated.

101. C — Lock-out/tag-out prevents equipment from being re-energized while someone is working on it. It is the procedure that keeps de-energization reliably safe.

102. A — Re-energizing to test before working is never a LOTO step; it would defeat the lockout. Isolating, verifying zero energy, and locking/tagging are correct steps.

103. D — An electrically safe work condition requires de-energizing, verifying de-energized, and locking out. Reducing voltage or skipping verification does not meet the standard.

Domain 3 — Entertainment Electrical Systems Planning

104. A — Total connected load = 40 + 12 + 8 = 60 kW. This sum is the starting figure before diversity is applied.

105. C — Apparent power = kW ÷ PF = 60 ÷ 0.8 = 75 kVA. The service's kVA capacity must meet or exceed this.

106. A — Load diversity is applied because not all equipment runs at full power simultaneously, so actual demand is less than the connected total. It allows economical sizing.

107. B — Diversity must not be applied to critical/safety equipment that runs continuously at full, because it genuinely peaks. Applying diversity there risks overload.

108. C — Before tie-in, the service's amperage rating and overcurrent protection must be confirmed. You cannot draw more than the service is rated to supply.

109. A — Available fault current is checked so the equipment SCCR and breaker AIC can be confirmed to exceed it. Under-rated equipment can fail catastrophically in a fault.

110. B — The tie-in panel's lugs and bus bars are checked for physical adequacy to safely accept the connection. The connection point must accommodate the feeder.

111. A — A smaller conductor tapped off a feeder without protection at its ampacity is governed by the tap rules limiting conductor length. The length limit prevents an undetected overload.

112. D — A long run must be checked for voltage drop in addition to ampacity, since length and current can drop voltage even when ampacity is met. The larger required size governs.

113. B — A run meeting ampacity but delivering low voltage is governed by voltage drop, requiring a larger conductor. Long runs are frequently dictated by voltage drop.

114. A — The recommended voltage-drop limit on a feeder-plus-branch path is about 5 percent total (about 3 percent on the branch alone). Staying within this keeps equipment performing.

115. D — Excessive voltage drop is remedied by using a larger conductor (lower resistance) or a shorter run. Adding a terminator or changing gel does nothing for voltage drop.

116. D — A single-line diagram shows the power system structure from source to loads. It conveys the system's electrical layout at a glance.

117. C — A lighting plot shows each fixture's position, type, and focus. Electricians use it to hang and circuit the rig.

118. C — A hookup (channel schedule) maps each fixture to its circuit and control channel. It ties physical fixtures to control assignments.

119. B — The shop order is derived from the design documents — the plot, hookup, and single-line. Building it methodically from the plans ensures nothing needed is forgotten.

120. C — Available fault current is the maximum short-circuit current the system can deliver at a given point. Equipment and device ratings must exceed it.

121. D — The equipment's SCCR must equal or exceed the available fault current at its location, so a fault doesn't destroy it. An under-rated SCCR is a severe hazard.

122. C — A breaker's interrupting rating (AIC) must meet or exceed available fault current so it can interrupt a fault rather than rupturing. An under-rated breaker can explode.

123. A — Installing an under-rated breaker risks it rupturing rather than interrupting during a fault, producing an arc blast. Ratings must always exceed available fault current.

124. D — Total truss load must include the fixtures, cable, distribution gear, and the truss itself. Cable weight in particular is routinely underestimated.

125. D — Cable weight matters because a long run can weigh as much as the fixtures it serves. Omitting it risks overloading the structure.

126. A — A heavy unit at unsupported midspan creates a concentrated point load that can overstress a truss rated for distributed load. Load must follow the structure's rated distribution.

127. D — A rigging component must never be loaded beyond its Working Load Limit. The breaking strength is higher, but the safety factor between them is not usable capacity.

128. B — Every overhead fixture needs a rated safety cable attached to the structure as secondary suspension if the primary clamp fails. It is the most important habit in overhead work.

129. D — Short safety cables limit the fall distance and resulting shock load if the clamp fails. A long cable lets the fixture drop far and build dangerous force.

130. A — Working at height requires a full-body harness, lanyard, and rated anchor for fall arrest. A tool belt or gloves provide no fall protection.

131. A — Clearing the area below overhead work protects people from dropped objects, since even a small dropped tool from height can be lethal. Tool tethers and cordoning support this.

132. D — Spares are included to cover inevitable failures and consumables, such as extra lamps and connectors. Their small cost is trivial next to a stalled load-in.

133. C — A crew schedule assigns appropriately skilled personnel to each phase of the work. The best design fails without enough qualified hands in the available time.

134. C — Administering inventory prevents missing equipment from being discovered at load-in, when there is no time to recover. A complete, cross-checked shop order with spares prevents this.

135. B — A control/riser diagram communicates the control and data distribution layout — consoles, nodes, and network paths. It is used to wire the rig's data network.

136. A — The correct single-line sequence from the source is source, disconnect, overcurrent protection, distribution, then loads. This reflects how power actually flows.

137. D — Designing so only the device nearest a fault opens is selective coordination. It keeps a localized fault from dropping the entire show.

138. B — Without selective coordination, a single branch fault could trip the main breaker and drop the whole show. Coordination keeps a localized fault localized.

139. B — Overcurrent device ratings must be verified against available fault current during planning, before installation. Under-rated devices create a severe arc-flash hazard.

140. D — Motors draw several times their running current at startup (inrush), which generator sizing must accommodate. Ignoring it can cause voltage sag or stalling.

141. B — A generator should be loaded to about 75 to 80 percent for reliability, leaving headroom for inrush, imbalance, and additions. Loading to 100 percent leaves no margin.

142. C — Whether to bond the generator's neutral to ground depends on whether it is a separately derived system. Getting this wrong creates either an ungrounded system or objectionable parallel paths.

143. D — Undersizing a generator causes voltage sag and frequency droop under load, which can damage sensitive equipment and overheat the unit. Correct sizing protects both show and machine.

144. D — A means of disconnect must be readily accessible and lockable for safety, maintenance, and emergencies. The company switch commonly serves this role.

145. A — A feeder is the high-capacity cable from the source to the distribution equipment, the system's backbone. Branch circuits carry the final leg to fixtures.

146. C — Each node output port carries one DMX universe (512 channels) for the fixtures. A node typically provides several such ports.

147. A — A show floor power diagram shows power locations across an exhibit floor. It is particularly relevant to portable power distribution work.

148. D — On a long run, a conductor must satisfy both ampacity and the acceptable voltage drop, and the larger required size governs. A conductor adequate for ampacity may still drop too much voltage.

149. B — Applying load diversity too aggressively risks overload when many loads run full at once, such as during a worst-case cue. Diversity must be applied conservatively.

150. C — Planning converts knowledge into a safe, documented, installable system, integrating load calculations, conductor sizing, grounding, and codes. It defines the practitioner who designs rather than merely installs.