PRACTICE EXAM 9: CONSTRUCTION ELECTRICIAN SIMULATION (100 QUESTIONS)

1. A worker must perform a lockout on a 600 V three-phase disconnect before servicing a feeder. After notifying the supervisor and operating the disconnect to the OFF position, what is the correct next sequence of steps?

A. Tag the switch, then test for absence of voltage, then apply the lock

B. Apply the lock, then tag the switch, then re-energize briefly to confirm

C. Apply the lock and tag, then test for absence of voltage before working

D. Test for absence of voltage, then apply the lock and tag afterward

2. Which document must be consulted to determine the safe handling, storage, and first-aid measures for a chemical solvent used to clean cable terminations?

A. The safety data sheet (SDS) for the product

B. The manufacturer's installation drawings

C. The Canadian Electrical Code, Part I

D. The site's daily toolbox-talk record

3. When fabricating a 90° stub-up bend in 21 mm (¾") EMT to a stub height of 300 mm, the take-up for the bender is 150 mm. At what point should the bender be placed measured from the end of the conduit?

A. At 300 mm from the end

B. At 150 mm from the end

C. At 450 mm from the end

D. At 75 mm from the end

4. A first-aid attendant arrives at a worker who has received an electrical shock and is unresponsive but the circuit is still energized. What is the first action the attendant must take?

A. Begin chest compressions immediately on the worker

B. Ensure the source of energy is removed before making contact

C. Pull the worker away from the source by the arm

D. Pour water on the contact point to break the circuit

5. Which type of fire extinguisher is appropriate for use on an energized electrical equipment fire?

A. Class A water-based extinguisher

B. Class B foam extinguisher

C. Class K wet-chemical extinguisher

D. Class C carbon dioxide (CO_2) extinguisher

6. When commissioning a newly installed branch circuit, an electrician performs an insulation resistance test. The acceptable result indicates that the insulation resistance reading is:

A. High, indicating minimal current leakage between conductors

B. Zero, indicating a solid bonded connection

C. Equal to the circuit conductor resistance

D. Lower than the measured load resistance

7. A support bracket for a cable tray must be anchored to a poured concrete ceiling. Which fastener is most appropriate for this application?

A. A plastic anchor with a wood screw

B. A toggle bolt rated for hollow walls

C. A wedge-type expansion anchor

D. A self-tapping sheet-metal screw

8. When decommissioning an electrical system that will be removed, what must be done to conductors that are abandoned in place but left connected at one end?

A. They may remain energized for future use

B. They should be coiled and labelled "spare"

C. They can be cut flush and left in the raceway

D. They must be de-energized and properly identified or removed

9. An apprentice is mentoring under a journeyperson. Which of the following best describes effective communication when receiving a verbal work instruction on a noisy job site?

A. Repeat the instruction back to confirm understanding

B. Begin the task immediately to show initiative

C. Wait until the end of the day to ask questions

D. Assume the standard method applies in all cases

10. A scaffold used to install conduit at height must be inspected before each shift. Who is responsible for ensuring the scaffold is safe to use prior to the worker accessing it?

A. The general contractor only

B. A competent person designated to inspect it

C. The equipment rental company

D. The provincial safety authority

11. Personal protective equipment for arc-flash protection is selected based on:

A. The conductor insulation temperature rating

B. The colour coding of the phase conductors

C. The ambient temperature of the work area

D. The incident energy and arc-flash boundary of the equipment

Block B — Distribution and Service Systems (Q12–39)

12. A single-phase 120/240 V service supplies a dwelling. The service conductors are sized based on the calculated load. According to the Canadian Electrical Code, the minimum ampacity of the service for a single dwelling is generally:

A. 60 A

B. 90 A

C. 100 A

D. 200 A

13. A current transformer (CT) used for metering has its secondary terminals. While the primary is energized, the secondary must never be:

A. Left open-circuited

B. Connected to the meter

C. Grounded at one point

D. Connected to a burden resistor

14. A fused disconnect protects a feeder. The fuses are rated for an interrupting rating (IR) that must:

A. Equal the continuous load current of the feeder

B. Be lower than the available fault current

C. Be equal to or greater than the available fault current

D. Match the voltage rating of the downstream motor

15. In a three-phase, 4-wire wye distribution system, the neutral conductor carries:

A. The full sum of the three phase currents added arithmetically

B. The unbalanced current of the three phase conductors

C. No current under any loading condition

D. Three times the phase current at all times

16. A surge protective device (SPD) installed at a service entrance is intended to:

A. Increase the system voltage during low-demand periods

B. Provide backup power during an outage

C. Correct the power factor of inductive loads

D. Divert transient overvoltages to ground

17. A bonding conductor connects non-current-carrying metal parts together. The primary purpose of bonding is to:

A. Provide a low-impedance path so overcurrent devices operate on a fault

B. Reduce the resistance of the neutral conductor under load

C. Increase the voltage available at the equipment terminals

D. Limit the magnetizing current of connected transformers

18. A grounding electrode system for a building uses a manufactured electrode. The minimum length of a driven rod electrode in contact with soil is generally:

A. 1.5 m

B. 2.0 m

C. 3.0 m

D. 4.5 m

19. An uninterruptible power supply (UPS) configured as a double-conversion (online) type provides power to the load by:

A. Switching to battery only when utility power fails

B. Continuously supplying the load through the inverter

C. Bypassing the inverter under normal conditions

D. Operating only the rectifier during normal operation

20. A photovoltaic (PV) array feeds a grid-tied inverter. A rapid shutdown system is required primarily to:

A. Increase the array's output during peak sunlight

B. Allow the inverter to operate during a grid outage

C. Improve the efficiency of the maximum power point tracker

D. Reduce shock hazard to firefighters by de-energizing conductors

21. A standby generator transfers load through an automatic transfer switch (ATS). The ATS is designed to prevent:

A. The generator and utility from being connected simultaneously

B. The generator from starting during a planned outage

C. The load from being disconnected during a transfer

D. The utility from supplying the load after restoration

22. A high-voltage cable is being terminated. A stress cone is installed at the termination to:

A. Increase the cable's current-carrying capacity

B. Provide mechanical support to the conductor

C. Seal the termination against moisture only

D. Control the electric field at the end of the insulation shield

23. A delta-wye (Δ-Y) connected transformer with a 12 470 V primary and 600/347 V secondary is being connected. The wye secondary provides:

A. A single voltage of 600 V only with no neutral

B. Two voltage levels: line-to-line and line-to-neutral

C. A higher current on the primary than the secondary

D. A phase shift that prevents paralleling under any condition

24. When connecting transformers in parallel, which of the following conditions must be satisfied?

A. The transformers must have different kVA ratings

B. The transformers must have opposite polarity markings

C. The transformers must have the same voltage ratio and phase relationship

D. The transformers must be physically the same size

25. A neutral grounding resistor (NGR) is installed on a transformer's wye-connected neutral to:

A. Boost the secondary voltage during faults

B. Eliminate the need for overcurrent protection

C. Limit the ground-fault current to a controlled value

D. Provide reactive power compensation to the system

26. Ground-fault protection of equipment (GFPE) on a solidly grounded wye service rated more than 1000 A at 150 V to ground is required to:

A. Trip instantaneously on any overload condition

B. Open the circuit on a ground fault above a set value

C. Provide protection only against phase-to-phase faults

D. Limit inrush current when energizing the service

27. The percent impedance (%Z) marked on a transformer nameplate is used to calculate:

A. The available short-circuit current on the secondary

B. The no-load magnetizing current of the transformer

C. The efficiency of the transformer at full load

D. The temperature rise of the windings under load

28. A 75 kVA, three-phase transformer has a 600 V primary. The approximate full-load line current on the primary is:

A. 125 A

B. 104 A

C. 90 A

D. 72 A

29. When installing a pad-mounted transformer, working clearance must be maintained in front of the access doors primarily to:

A. Improve the cooling airflow around the unit

B. Reduce the audible noise of the transformer

C. Allow safe access for operation and maintenance

D. Prevent moisture from entering the enclosure

30. A revenue meter measures energy in kilowatt-hours. To measure the energy consumed by a large three-phase load, the meter is connected through:

A. A potential transformer only

B. Both current and potential transformers

C. A neutral grounding resistor

D. A surge protective device

31. Battery storage for a renewable energy system uses lithium-ion cells. A key safety concern with these cells during installation is:

A. Thermal runaway if a cell is damaged or overcharged

B. The release of hydrogen gas during normal discharge

C. The need for continuous water topping-up

D. Their inability to operate below 50% state of charge

32. A distribution panelboard's main bonding jumper connects the:

A. Two ungrounded service conductors together

B. Line and load sides of the main breaker

C. Two adjacent panelboards in the same room

D. Neutral bus to the enclosure at the service

33. A consumer service is supplied by an underground lateral. The conductors entering the service box must be protected against physical damage where they emerge from the ground by:

A. A layer of warning tape only

B. A raceway suitable for the location

C. A bonding conductor run alongside

D. A weatherhead at the point of emergence

34. When testing a grounding electrode resistance using the fall-of-potential method, the auxiliary electrodes should be placed:

A. As close to the electrode under test as possible

B. Directly on top of the electrode under test

C. In a straight line at sufficient distance from the electrode

D. In a triangular pattern within 1 m of the electrode

35. A protection device must be coordinated with downstream devices so that on a fault:

A. The device closest to the fault opens first

B. The main breaker opens before any branch device

C. All devices open simultaneously

D. The largest-rated device opens first

36. A power generation system uses an inverter to convert DC to AC. The output frequency of a grid-tied inverter must:

A. Be higher than the utility to push power onto the grid

B. Be adjustable by the operator at any time

C. Remain independent of the utility frequency

D. Synchronize with the utility frequency and voltage

37. A high-voltage system rated at 13.8 kV requires that workers maintain a minimum approach distance. This distance is determined by:

A. The ambient humidity of the work area

B. The system voltage and the applicable safety standard

C. The colour of the insulation on the conductors

D. The length of the live-line tools available

38. A transformer's cooling class is marked "ONAN." The first letters indicate the internal cooling medium is:

A. Oil with natural circulation

B. Air forced by fans

C. Water through a heat exchanger

D. Dry-type with no liquid

39. A service entrance for a commercial building uses parallel conductors per phase. Conductors run in parallel must be:

A. Of different sizes to balance impedance

B. Run in separate buildings for redundancy

C. The same length, size, and material per phase

D. Connected only at the load end

40. A run of EMT contains four No. 10 AWG TW current-carrying conductors and one bonding conductor. When determining conduit fill, the bonding conductor is:

A. Counted as two current-carrying conductors

B. Included in the fill calculation but not as current-carrying

C. Always ignored for all fill purposes

D. Counted only if larger than No. 8 AWG

41. A device box has a total volume that permits a maximum of eight No. 14 AWG conductors. The box contains one fixture stud and one group of internal cable clamps. Under box-fill rules, the fixture stud counts as one conductor allowance and the cable clamp group counts as one conductor allowance. How many No. 14 AWG circuit conductors may the box actually contain?

A. 8 conductors

B. 7 conductors

C. 6 conductors

D. 5 conductors

42. A branch circuit supplies receptacles in a dwelling kitchen counter area. These receptacles must be protected by:

A. An arc-fault circuit interrupter only

B. A surge protective device at the panel

C. A 15 A fuse with time-delay characteristics

D. A ground-fault circuit interrupter (GFCI)

43. Electrical metallic tubing (EMT) supported horizontally must be secured within a certain distance of each box or fitting. That maximum distance is:

A. 1 m (3 ft)

B. 1.5 m (5 ft)

C. 2.5 m (8 ft)

D. 3 m (10 ft)

44. A baseboard electric heater rated 1500 W at 240 V is being connected. The current drawn by the heater is approximately:

A. 12.5 A

B. 10 A

C. 6.25 A

D. 15 A

45. A duct heater is installed in an HVAC air-handling system. To prevent the heater from operating without airflow, it must be interlocked with:

A. The room thermostat only

B. The building fire alarm panel

C. The supply air fan or an airflow proving switch

D. The main service disconnect

46. Exit and emergency lighting in a commercial building must remain operational during a power failure for a minimum period typically specified as:

A. 10 minutes

B. 30 minutes

C. 90 minutes

D. 4 hours

47. A cathodic protection system protects a buried steel pipe from corrosion by:

A. Coating the pipe with a non-conductive paint

B. Increasing the soil pH around the pipe

C. Heating the pipe to drive off moisture

D. Making the pipe the cathode using a sacrificial anode or impressed current

48. A 14/2 NMD90 cable run through wood studs must be protected from nails where it passes through a stud less than 32 mm (1¼") from the edge by:

A. A steel protection plate

B. Wrapping the cable in electrical tape

C. Increasing the cable size to 12/2

D. Running it in a flexible PVC sleeve only

49. When pulling conductors into a long raceway, a lubricant is used to:

A. Increase the conductor's ampacity

B. Reduce friction and pulling tension

C. Improve the insulation resistance

D. Prevent the conductors from overheating in service

50. A junction box for conductors No. 4 AWG and larger that contains an angle pull must have a minimum distance between the conductor entry and the opposite wall calculated as:

A. Twice the largest raceway diameter

B. Four times the largest raceway diameter

C. Six times the largest raceway diameter

D. Equal to the largest raceway diameter

51. Electric heating cable installed in a ceiling must not be installed:

A. Parallel to the ceiling joists

B. Within 50 mm of the ceiling surface

C. In rooms with high occupancy

D. Where it will be covered by thermal insulation or run over walls

52. A 15 A, 120 V general-purpose branch circuit in a dwelling can supply a maximum number of outlets (receptacles and lighting) of:

A. 12 outlets

B. 8 outlets

C. 16 outlets

D. 20 outlets

53. When terminating a conductor under a screw terminal, the conductor loop should be formed so that:

A. The loop opens in the counterclockwise direction

B. The loop wraps clockwise in the tightening direction of the screw

C. Two conductors are placed under the single screw

D. The bare conductor extends 25 mm past the screw

54. A flexible metal conduit (FMC) connection to a vibrating motor is used because it:

A. Increases the bonding capacity of the circuit

B. Provides better corrosion resistance than rigid conduit

C. Allows movement and reduces transmission of vibration

D. Eliminates the need for a separate bonding conductor

55. An air-conditioning condensing unit nameplate lists a minimum circuit ampacity (MCA) and a maximum overcurrent protection (MOCP). The conductor size is selected based on:

A. The minimum circuit ampacity (MCA)

B. The maximum overcurrent protection (MOCP)

C. The locked-rotor current of the compressor

D. The full-load current of the fan motor only

56. A raceway passing from a heated indoor space to a cold outdoor location may accumulate condensation. To address this, the raceway should be:

A. Filled completely with conductors to block airflow

B. Installed only in vertical runs

C. Insulated on the inside with foam

D. Sealed to prevent the circulation of moist air

57. When installing PVC rigid conduit, expansion fittings are required to compensate for:

A. The weight of the conductors inside

B. Thermal expansion and contraction of the conduit

C. The bonding requirements of the system

D. The reduction in conduit fill at high temperature

58. A switch controlling a luminaire from two locations requires:

A. Two single-pole switches in series

B. One double-pole switch at each location

C. A single three-way switch only

D. Two three-way switches

59. Conductors in a raceway exposed to direct sunlight on a rooftop must have their ampacity adjusted because:

A. Sunlight increases the voltage drop in the conductors

B. UV exposure reduces the conductor's cross-section

C. Solar heating raises the ambient temperature, reducing ampacity

D. The raceway material expands and pinches the conductors

60. A box mounted in a finished wall must have its front edge positioned so that:

A. It is flush with or set back appropriately from a combustible finished surface

B. It protrudes 25 mm beyond the wall surface

C. It is recessed 50 mm behind the wall surface

D. It is offset to one side of the stud cavity

61. A continuous load on a branch circuit must not exceed what percentage of the overcurrent device rating?

A. 100%

B. 80%

C. 125%

D. 50%

62. An electric furnace draws 48 A continuous. The minimum branch circuit conductor ampacity, accounting for the continuous load factor, must be at least:

A. 48 A

B. 50 A

C. 60 A

D. 40 A

63. When installing conductors in a vertical raceway, conductor supports are required at intervals to:

A. Prevent the weight of the conductors from damaging connections

B. Improve the bonding continuity of the raceway

C. Reduce the voltage drop over the vertical run

D. Allow heat to dissipate from the conductors

64. A receptacle installed in a damp or wet outdoor location must be provided with:

A. A standard indoor cover plate

B. A non-metallic faceplate only

C. A higher amperage rating than indoor receptacles

D. A weatherproof "in-use" (extra-duty) cover

65. A multi-wire branch circuit shares a neutral among two ungrounded conductors. The ungrounded conductors must be connected to:

A. The same phase to balance the load

B. A single-pole breaker for each conductor independently

C. The neutral bus before the breaker

D. Opposite phases so neutral current is the difference

66. Cable trays used as a support system for power cables must be bonded because:

A. The tray is a non-current-carrying metal part that could become energized on a fault

B. Bonding increases the cable's ampacity in the tray

C. The tray carries the neutral current of the circuits

D. Bonding prevents the tray from rusting over time

67. Cathodic protection rectifiers convert AC to DC. The DC output is connected so that the protected structure is:

A. The positive terminal (anode)

B. The negative terminal (cathode)

C. Isolated from both terminals

D. Connected through the neutral only

68. A run of conductors is derated when more than three current-carrying conductors share a raceway. With six current-carrying conductors, the ampacity adjustment factor applied is:

A. 100% (no derating)

B. 90%

C. 80%

D. 70%

69. An emergency lighting unit equipment ("bug-eye" battery pack) is tested to confirm it will operate on loss of normal power. The test is performed by:

A. Simulating a power failure and confirming the lamps illuminate

B. Measuring the AC line voltage at the unit

C. Checking the colour of the indicator LED only

D. Replacing the battery on a fixed schedule regardless of condition

70. A three-phase squirrel-cage induction motor's direction of rotation is reversed by:

A. Interchanging any two of the three line conductors

B. Reversing the connections to the overload relay

C. Reducing the supply voltage to the motor

D. Reversing only the neutral connection

71. An overload relay in a motor starter protects the motor against:

A. A short circuit between phases

B. A ground fault to the motor frame

C. Overvoltage from the supply

D. Sustained currents above the motor's rated value

72. A motor nameplate lists a service factor of 1.15. This means the motor can:

A. Operate at 115% of rated voltage continuously

B. Be safely overloaded to 115% of rated horsepower under defined conditions

C. Draw 1.15 times the locked-rotor current at start

D. Operate at 1.15 times its rated speed

73. A variable frequency drive (VFD) controls the speed of an AC induction motor by varying the:

A. Resistance in the rotor circuit

B. Number of poles in the stator

C. Frequency and voltage supplied to the motor

D. DC field excitation current

74. A "stop" pushbutton in a motor control circuit is wired using normally closed (NC) contacts so that:

A. Pressing it opens the circuit and de-energizes the coil

B. Pressing it energizes the holding coil

C. The motor continues running after release

D. A short circuit will start the motor automatically

75. A reduced-voltage starter is used on a large motor primarily to:

A. Increase the motor's running torque

B. Limit the inrush current during starting

C. Improve the motor's full-load efficiency

D. Reverse the rotation more quickly

76. A motor control centre (MCC) bucket contains a combination starter, which includes:

A. Only an overload relay and contactor

B. A transformer and a capacitor bank

C. Two contactors wired in parallel

D. A disconnecting means, short-circuit protection, contactor, and overload relay

77. A three-phase motor draws unequal current on its three phases while running. The most likely cause is:

A. A high power factor on the supply

B. A balanced three-phase supply voltage

C. A voltage imbalance or a developing fault in a winding

D. Correct operation under normal conditions

78. A holding (seal-in) contact in a start/stop control circuit is connected:

A. In parallel with the start pushbutton to maintain the coil energized

B. In series with the stop pushbutton to interrupt the coil

C. In parallel with the overload contacts

D. In series with the motor power conductors

79. A PLC (programmable logic controller) receives a signal from a normally open limit switch. When the switch is actuated, the input module sees:

A. A loss of the supply voltage at the input

B. A change of state from "off" to "on" at the input

C. An analog signal proportional to position

D. An output command sent to the field device

80. A motor is rated 10 hp at an efficiency of 100% (ideal). The approximate input power in watts, ignoring losses, is:

A. 746 W

B. 1000 W

C. 7460 W

D. 10 000 W

81. A soft starter differs from a VFD in that a soft starter:

A. Controls only the starting current and ramps voltage up, then runs at line frequency

B. Continuously varies the running speed of the motor

C. Converts the supply to DC for the motor

D. Adds resistance to the rotor during running

82. An automated control system uses a 4–20 mA current loop for an analog sensor signal because:

A. It carries more power to the field device

B. It eliminates the need for a power supply

C. It is less susceptible to voltage-drop errors over long distances

D. It can only transmit digital on/off signals

83. The full-load current of a three-phase motor is used to size the conductors. The branch-circuit conductor ampacity for a single continuous-duty motor must be at least:

A. Equal to the locked-rotor current

B. 125% of the motor full-load current

C. 80% of the motor full-load current

D. Equal to the overload relay setting

84. A normally open (NO) held-closed contact in a control circuit refers to a contact that is:

A. Open at all times regardless of actuation

B. Closed only when the coil is de-energized

C. Permanently welded in the closed position

D. Open in its resting state but held closed by an actuator or energized coil

85. A motor that fails to start and produces a humming sound with no rotation most likely has:

A. A correctly functioning starter

B. An overrated overcurrent device

C. A perfectly balanced load

D. A single-phasing condition (loss of one phase)

86. When connecting a dual-voltage (e.g., 230/460 V) three-phase motor for the lower voltage, the windings are connected:

A. In parallel

B. In series

C. In a delta-only arrangement

D. With one winding disconnected

87. A VFD generates harmonics on the supply line. To reduce harmonic distortion, a common mitigation method is to install:

A. A larger overload relay

B. A reduced-voltage autotransformer

C. A line reactor or harmonic filter on the input

D. A bypass contactor across the drive

88. An interlock between two motor starters that prevents both from running at the same time (e.g., forward/reverse) is achieved using:

A. Two parallel start pushbuttons

B. Auxiliary contacts of each contactor wired into the opposite control circuit

C. A single shared overload relay

D. A common neutral conductor for both circuits

89. A jogging (inching) circuit allows a motor to:

A. Run in short bursts without the seal-in contact maintaining operation

B. Run continuously at reduced speed

C. Reverse automatically at the end of travel

D. Start only after a time delay expires

90. The locked-rotor current of an induction motor at the instant of starting is typically:

A. Equal to the full-load current

B. About half the full-load current

C. Slightly above the full-load current

D. Several times the full-load current

91. A Category 5e (Cat 5e) data cable must not be untwisted at terminations beyond a small distance because excessive untwisting:

A. Reduces the cable's mechanical strength only

B. Increases the conductor resistance significantly

C. Degrades performance by increasing crosstalk

D. Changes the colour code of the pairs

92. A fire alarm initiating device circuit uses an end-of-line resistor to:

A. Allow the panel to detect an open (broken) circuit fault

B. Limit the current to the smoke detectors

C. Increase the loudness of the audible signal

D. Provide power to the notification appliances

93. Communication and data cabling run in the same raceway as power conductors is generally:

A. Permitted without restriction in all cases

B. Permitted only if the data cable is larger

C. Required by code for shared support

D. Not permitted, to avoid interference and for safety separation

94. A coaxial cable (e.g., for CATV) uses a specific characteristic impedance. A common impedance for video distribution coax is:

A. 50 ohms

B. 75 ohms

C. 100 ohms

D. 600 ohms

95. An integrated building control system links HVAC, lighting, and security through a common network. The primary advantage of this integration is:

A. It eliminates the need for any overcurrent protection

B. Centralized monitoring and coordinated control of the systems

C. It removes the requirement for system grounding

D. It allows higher voltages on the data network

96. A nurse-call signalling system in a healthcare facility is classified as a life-safety system and therefore requires:

A. Reliable operation, supervision, and often emergency power backup

B. Connection to the highest available voltage source

C. The same conductors as the lighting branch circuits

D. No testing once commissioned

97. When terminating fibre-optic cable, cleanliness of the connector end-face is critical because contamination:

A. Increases the electrical resistance of the fibre

B. Causes the fibre to carry current improperly

C. Causes signal loss (attenuation) and reflection at the joint

D. Changes the colour of the transmitted light

98. A twisted-pair cabling system terminated to the T568A or T568B standard ensures:

A. The cable can carry power as well as data

B. The cable is rated for outdoor burial

C. The shield is bonded at both ends

D. Consistent pin-to-pair assignment for proper connectivity

99. A passive infrared (PIR) sensor in a security or lighting control system detects:

A. Changes in ambient light level only

B. Movement by sensing changes in infrared (heat) energy

C. The radio frequency emitted by a transmitter

D. The weight of a person on a floor mat

100. A communication system's grounding/bonding for a structured cabling installation is important primarily to:

A. Increase the data transmission speed of the network

B. Allow the cable to carry higher current loads

C. Protect equipment and reduce electrical noise and surge damage

D. Reduce the physical length of cable required

Practice Exam 9: Answer Key and Explanations

1. C — Lock and tag are applied, then absence of voltage is verified before work begins. Locking and tagging the isolation device prevents re-energization, and the voltage test confirms the circuit is actually dead. Testing before working protects against stored energy or an isolation point that did not fully de-energize the conductors.

2. A — The SDS lists hazards, safe handling, storage, and first-aid measures for a chemical product. It is the authoritative source legally required to accompany hazardous materials on a worksite. Consulting it before use prevents exposure injuries and ensures the correct response if contact occurs.

3. B — Take-up is measured from the end of the conduit to the bender, so placement is at stub height minus take-up: 300 − 150 = 150 mm. The take-up distance accounts for the bend radius so the finished stub reaches the target height. Misplacing the bender produces a stub that is too short or too tall.

4. B — The energy source must be removed before touching the worker, or the rescuer becomes a second casualty. A person in contact with a live circuit may still be energized, and current through the rescuer can cause cardiac arrest. De-energizing first is the foundational rule of electrical rescue.

5. D — A CO_2 (Class C) extinguisher is non-conductive and safe on energized electrical fires. Water and foam conduct electricity and create a shock hazard. CO_2 smothers the fire without leaving residue, protecting both the rescuer and the equipment.

6. A — A high insulation resistance reading indicates minimal leakage current between conductors or to ground, confirming intact insulation. A low or zero reading would signal a fault or breakdown. The test verifies the circuit is safe to energize before commissioning.

7. C — A wedge-type expansion anchor is designed for solid poured concrete and develops high holding strength. Toggle bolts and plastic anchors are for hollow or light material, and sheet-metal screws will not hold in concrete. Matching the anchor to the base material ensures the support carries the cable tray load safely.

8. D — Abandoned conductors must be de-energized and either removed or clearly identified to prevent future hazards. A conductor left connected and unmarked can be mistaken for a live or spare circuit. Proper identification protects anyone who later works on the system.

9. A — Repeating the instruction back confirms it was heard and understood correctly, especially in a noisy environment. This closed-loop communication catches errors before work begins. It reduces rework and prevents safety incidents from misunderstood directions.

10. B — A competent person designated to inspect the scaffold is responsible for confirming it is safe before use. Competency means having the knowledge and authority to identify hazards. Pre-shift inspection by a qualified individual prevents collapses and falls.

11. D — Arc-flash PPE is selected based on the incident energy and arc-flash boundary at the equipment. These quantities determine the thermal hazard a worker could face. Matching PPE to the calculated incident energy ensures adequate protection without over- or under-protecting the worker.

12. C — A single dwelling generally requires a minimum 100 A service per the Canadian Electrical Code. This ensures adequate capacity for modern household loads. Undersizing the service risks nuisance tripping and inability to safely supply the calculated load.

13. A — A CT secondary must never be left open-circuited while the primary is energized. With no burden, dangerous high voltage develops across the open secondary, threatening insulation and personnel. The secondary is always shorted or connected to its burden before disconnecting a meter.

14. C — The interrupting rating must equal or exceed the available fault current so the device can safely clear a fault. A device with too low an IR can fail violently when interrupting a large fault. Proper IR selection protects equipment and personnel from catastrophic failure.

15. B — In a balanced 4-wire wye system the neutral carries only the unbalanced current of the three phases. When phases are equal, the vector sum is zero and neutral current is minimal. The neutral is sized to handle the maximum expected imbalance.

16. D — An SPD diverts transient overvoltages safely to ground, protecting connected equipment. It clamps voltage spikes from lightning or switching surges. By shunting the surge energy, it prevents insulation breakdown and equipment damage.

17. A — Bonding creates a low-impedance fault path so that overcurrent devices operate quickly to clear a ground fault. This limits the duration of dangerous touch voltages on metal parts. Effective bonding is essential for shock protection and reliable protective-device operation.

18. C — A driven rod grounding electrode must generally be at least 3.0 m in contact with the soil. Adequate length ensures sufficient contact with lower-resistance soil at depth. This achieves an acceptably low electrode resistance for the grounding system.

19. B — A double-conversion (online) UPS continuously supplies the load through its inverter, isolating it from utility disturbances. There is no transfer delay because the load is always inverter-fed. This provides the cleanest, most reliable power for sensitive equipment.

20. D — Rapid shutdown de-energizes PV conductors to reduce shock hazard to firefighters and emergency responders. Rooftop arrays remain live in sunlight even when the inverter is off. Rapid shutdown quickly brings conductor voltage to a safe level near the array.

21. A — An ATS prevents the generator and utility from being connected at the same time. Simultaneous connection (back-feed) endangers utility workers and can damage the generator. The transfer switch's break-before-make action enforces this separation.

22. D — A stress cone controls the concentration of the electric field at the end of the cable's insulation shield. Abruptly ending the shield creates high field stress that can break down insulation. The stress cone redistributes the field, preventing premature termination failure.

23. B — A wye secondary provides two voltage levels: line-to-line (600 V) and line-to-neutral (347 V). The neutral point makes the lower phase voltage available. This dual-voltage capability supplies both three-phase and line-to-neutral loads.

24. C — Transformers paralleled must share the same voltage ratio and phase relationship (and compatible impedance). Mismatched ratios cause circulating currents, and mismatched phasing causes severe fault currents. Matching these parameters allows the units to share load properly.

25. C — An NGR limits ground-fault current on a wye neutral to a controlled, lower value. This reduces equipment damage and arc-flash energy during a ground fault while allowing the fault to be detected. It is a key feature in resistance-grounded distribution systems.

26. B — GFPE opens the circuit when ground-fault current exceeds a set value on large solidly grounded services. It detects low-level ground faults that overcurrent devices would not clear quickly. This prevents destructive arcing-fault burndown at the service.

27. A — The transformer's %Z is used to calculate the available short-circuit current on the secondary. Lower impedance means higher available fault current. This value is essential for selecting equipment with adequate interrupting and withstand ratings.

28. D — Using $I = VA \div (E \times \sqrt{3})$: $75\,000 \div (600 \times 1.73) \approx 75\,000 \div 1038 \approx 72$ A. The $\sqrt{3}$ factor applies to three-phase line current. This full-load current sizes the primary conductors and protection.

29. C — Working clearance in front of access doors allows safe access for operation and maintenance. Adequate space lets workers stand clear and operate equipment without hazard. Code-mandated clearances protect personnel during energized work or switching.

30. B — A large three-phase revenue meter is connected through both current transformers and potential transformers. CTs scale down the high current and PTs scale down the voltage to meter-safe levels. This allows accurate energy measurement on high-capacity services.

31. A — The key hazard with lithium-ion cells is thermal runaway if a cell is damaged or overcharged. A failing cell can self-heat uncontrollably, leading to fire. Proper handling, charge control, and protection circuitry are essential to prevent this.

32. D — The main bonding jumper connects the neutral bus to the enclosure at the service. This is the single point where the grounded conductor is bonded to ground. It establishes the fault-return path while keeping the neutral isolated from ground downstream.

33. B — Service conductors emerging from the ground must be protected against physical damage by a suitable raceway. Mechanical protection prevents damage where conductors are exposed. This safeguards the conductors at a vulnerable transition point.

34. C — In the fall-of-potential method, auxiliary electrodes are placed in a straight line at sufficient distance from the electrode under test. Adequate spacing keeps the test probes outside the electrode's resistance area. This produces an accurate resistance measurement.

35. A — Selective coordination requires the device closest to the fault to open first, isolating only the affected portion. This keeps the rest of the system energized. Proper coordination minimizes the extent of an outage during a fault.

36. D — A grid-tied inverter must synchronize its output frequency and voltage with the utility. Matching frequency, voltage, and phase allows it to feed power without disturbance. Inverters disconnect automatically if the grid goes outside acceptable limits.

37. B — Minimum approach distance for high-voltage work is determined by the system voltage and the applicable safety standard. Higher voltage requires greater clearance to prevent flashover. Maintaining this distance protects workers from arc and contact hazards.

38. A — In ONAN, the first two letters indicate Oil as the internal medium with Natural circulation. The cooling-class code describes the internal and external cooling media and circulation method. This tells the installer how the transformer dissipates heat.

39. C — Parallel conductors per phase must be the same length, size, and material to share current equally. Differences in any of these cause unequal current division and overheating of one conductor. Matching the conductors ensures balanced loading.

40. B — A bonding conductor is included in conduit-fill calculations but is not counted as a current-carrying conductor for ampacity derating. It occupies space but does not normally carry load current. This distinction matters for both fill and derating.

41. C — The fixture stud and the cable-clamp group each require a one-conductor volume deduction, removing two from the box's capacity: 8 − 1 − 1 = 6. Box-fill rules require that internal fittings be accounted for so the enclosure is not overcrowded. Counting fittings against capacity protects conductor insulation from damage and overheating.

42. D — Kitchen counter receptacles must be protected by a GFCI. Wet locations near sinks present an elevated shock risk. GFCI protection interrupts the circuit on a small ground-fault current, protecting against electrocution.

43. A — EMT must be secured within 1 m (3 ft) of each box, fitting, or termination. Securing close to fittings prevents strain on connections. This support requirement keeps the raceway system mechanically sound.

44. C — I = P ÷ E = 1500 ÷ 240 = 6.25 A. Ohm's/power law gives current directly from wattage and voltage. This current value determines the conductor and breaker sizing for the heater.

45. C — A duct heater must be interlocked with the supply air fan or an airflow proving switch so it cannot energize without airflow. Operating without airflow causes overheating and fire risk. The interlock ensures heat is removed as it is generated.

46. C — Emergency lighting must remain operational for a minimum of 90 minutes in many commercial occupancies. This duration allows safe evacuation during an extended outage. Battery and unit equipment are sized to meet this requirement.

47. D — Cathodic protection makes the protected structure the cathode using a sacrificial anode or impressed-current system. A more active anode corrodes preferentially, sparing the structure. This electrochemical method prevents corrosion of buried metal.

48. A — A cable passing through a stud closer than 32 mm to the edge must be protected by a steel plate against nails and screws. The plate shields the cable from fasteners driven into the framing. This prevents accidental penetration and a future fault.

49. B — Pulling lubricant reduces friction and pulling tension on conductors in a long raceway. Lower tension protects insulation from damage and eases the pull. It does not affect the conductor's electrical properties.

50. C — For angle pulls with conductors No. 4 AWG and larger, the distance to the opposite wall must be at least six times the largest raceway diameter. This generous spacing prevents sharp bending of large conductors. Adequate box dimensions protect conductor insulation.

51. D — Heating cable must not be installed where it will be covered by thermal insulation or run over walls, because trapped heat causes overheating. Insulation prevents proper heat dissipation. Correct placement keeps cable temperature within safe limits.

52. A — A 15 A general-purpose dwelling circuit is limited to a maximum of 12 outlets. This limit prevents overloading the circuit. Counting outlets during layout keeps the installation code-compliant.

53. B — The conductor loop is formed clockwise so it wraps in the tightening direction of the screw. Tightening then draws the loop closed rather than pushing it open. This produces a secure, reliable termination.

54. C — Flexible metal conduit at a vibrating motor allows movement and reduces transmission of vibration to the rigid raceway. Rigid conduit would fatigue and crack under vibration. The flexible section absorbs motion and protects the wiring system.

55. A — Conductors for an HVAC unit are sized based on the minimum circuit ampacity (MCA) on the nameplate. The MCA already accounts for the compressor and fan loads. The MOCP only sets the maximum overcurrent device, not the conductor size.

56. D — A raceway between heated and cold spaces should be sealed to prevent circulation of moist air and condensation. Moving air carries moisture that condenses inside the raceway. Sealing prevents water accumulation that could damage conductors.

57. B — PVC conduit requires expansion fittings to compensate for thermal expansion and contraction. PVC has a high coefficient of thermal expansion, so long runs move significantly with temperature. Expansion fittings prevent buckling and joint failure.

58. D — Controlling a luminaire from two locations requires two three-way switches. Three-way switches provide the multiple travelers needed for control from either point. This is the standard arrangement for stairways and long hallways.

59. C — Conductors in a raceway in direct sunlight require ampacity adjustment because solar heating raises the ambient temperature. Higher ambient temperature reduces the conductor's allowable current. A temperature adder is applied for rooftop exposure.

60. A — A box in a finished wall must have its front edge flush with or appropriately set back from a combustible surface. Proper positioning prevents gaps and reduces fire risk. This ensures the cover plate seats correctly against the wall.

61. B — A continuous load must not exceed 80% of the overcurrent device rating. Equivalently, the device is sized at 125% of the continuous load. This margin prevents nuisance tripping and overheating from sustained current.

62. C — A 48 A continuous load requires conductor ampacity of at least $48 \times 1.25 = 60$ A. The 125% factor accounts for continuous heating. Sizing to 60 A ensures the conductors run safely under sustained load.

63. A — Vertical-raceway conductor supports prevent the conductors' weight from damaging terminations and connections. Long vertical runs impose significant tension at the top. Support at required intervals relieves this strain.

64. D — A receptacle in a wet outdoor location requires a weatherproof "in-use" (extra-duty) cover. This cover keeps water out even with a cord plugged in. It protects against moisture intrusion and shock hazard.

65. D — The ungrounded conductors of a multi-wire branch circuit must connect to opposite phases so the shared neutral carries only the difference current. Connecting to the same phase would overload the neutral with the sum of currents. Opposite-phase connection keeps neutral current safe.

66. A — Cable trays must be bonded because the tray is a non-current-carrying metal part that could become energized on a fault. Bonding provides a fault-return path so protective devices operate. This protects anyone who might contact the tray.

67. B — In cathodic protection, the protected structure is connected as the negative terminal (cathode) of the DC source. Driving the structure cathodic suppresses corrosion current leaving it. The anode bed carries the corrosion instead.

68. C — With four to six current-carrying conductors in a raceway, the ampacity adjustment factor is 80%. Bundling reduces heat dissipation, so allowable current is derated. Applying the factor prevents conductor overheating.

69. A — An emergency lighting unit is tested by simulating a power failure and confirming the lamps illuminate from the battery. This verifies the transfer and battery function under real conditions. Regular functional testing ensures reliability when needed.

70. A — Reversing a three-phase motor is done by interchanging any two of the three line conductors. Swapping two phases reverses the rotating magnetic field. This is the standard method for changing direction of rotation.

71. D — An overload relay protects the motor against sustained currents above its rated value. Prolonged overcurrent overheats the windings and degrades insulation. The relay trips on a time-current curve matched to the motor's thermal limits.

72. B — A 1.15 service factor means the motor can be safely overloaded to 115% of rated horsepower under defined conditions. It provides a margin for temporary overloads. Continuous operation in the service-factor range shortens insulation life.

73. C — A VFD controls induction-motor speed by varying both the frequency and voltage supplied. Speed follows frequency, and voltage is adjusted to maintain torque. This V/Hz control gives smooth, efficient speed adjustment.

74. A — A stop button uses normally closed contacts so pressing it opens the circuit and de-energizes the coil. Releasing the seal-in then stops the motor. NC wiring also stops the motor if a wire breaks, which is fail-safe.

75. B — A reduced-voltage starter limits the high inrush current during motor starting. Lower starting current reduces voltage dip and mechanical stress. It is used where full-voltage starting would disturb the supply or driven load.

76. D — A combination starter includes a disconnecting means, short-circuit protection, a contactor, and an overload relay in one assembly. This integrates isolation, fault protection, switching, and overload protection. The MCC bucket packages these for a motor branch circuit.

77. C — Unequal phase currents on a running three-phase motor usually indicate a voltage imbalance or a developing winding fault. Even small voltage imbalance causes disproportionately large current imbalance and heating. Investigating early prevents motor failure.

78. A — The holding (seal-in) contact is wired in parallel with the start pushbutton to keep the coil energized after the button is released. This maintains the circuit until the stop button breaks it. It is the basis of standard three-wire control.

79. B — When a normally open limit switch is actuated, the PLC input module sees a change of state from "off" to "on." The input registers the closed contact as a logic-on signal. The program then acts on that input state.

80. C — 10 hp × 746 W/hp = 7460 W. The conversion 1 hp = 746 W gives the equivalent electrical power. This figure is used for power and current calculations on motor circuits.

81. A — A soft starter ramps the voltage up to limit starting current, then runs the motor at line frequency. Unlike a VFD, it does not vary running speed. It is a simpler, lower-cost solution where only controlled starting is needed.

82. C — A 4–20 mA current loop is less susceptible to voltage-drop errors over long distances because current is constant along the loop. Wire resistance does not change the signal current. This makes it reliable for remote analog sensors.

83. B — A single continuous-duty motor's branch-circuit conductors must be rated at least 125% of the motor full-load current. The margin handles continuous heating and normal running current. This sizing protects the conductors over the motor's duty cycle.

84. D — A normally open held-closed contact is open in its resting state but held closed by an actuator or energized coil. Its "normal" state is the de-energized condition. Understanding the resting versus actuated state is essential for reading control diagrams.

85. D — A motor that hums but does not rotate is typically single-phasing from the loss of one phase. With one phase open, the motor cannot develop starting torque. Continued single-phasing rapidly overheats the remaining windings.

86. A — For the lower voltage on a dual-voltage motor, the windings are connected in parallel. Parallel connection presents the windings to the lower supply voltage correctly. Series connection is used for the higher voltage.

87. C — Harmonics from a VFD are reduced by installing a line reactor or harmonic filter on the drive input. These limit harmonic current drawn from the supply. Mitigation protects other equipment and improves power quality.

88. B — Forward/reverse interlocking uses each contactor's auxiliary contacts wired into the opposite control circuit. Energizing one contactor opens the other's coil path. This prevents both from closing at once, which would cause a phase-to-phase short.

89. A — A jogging circuit lets the motor run in short bursts without the seal-in contact maintaining operation. Releasing the jog button stops the motor immediately. This allows precise positioning of driven equipment.

90. D — Locked-rotor (starting) current of an induction motor is several times the full-load current. At standstill the motor behaves like a shorted transformer, drawing high inrush. This is why starting current and its duration drive protection and starter design.

91. C — Excessive untwisting of a Cat 5e pair at terminations degrades performance by increasing crosstalk. The twist cancels electromagnetic interference between pairs. Keeping untwist minimal preserves the cable's rated transmission performance.

92. A — An end-of-line resistor lets the fire alarm panel supervise the circuit and detect an open (broken) wire fault. The panel monitors the small current through the resistor. Loss of that current signals a fault, ensuring the circuit's integrity is continuously verified.

93. D — Power and communication conductors are generally not permitted in the same raceway, to avoid interference and maintain safety separation. Power circuits can induce noise and pose a hazard to low-voltage cabling. Separation preserves signal integrity and safety.

94. B — Video distribution coaxial cable commonly has a characteristic impedance of 75 ohms. Matching impedance minimizes signal reflections along the line. Proper impedance ensures clean signal transmission for CATV and video.

95. B — Integrating building systems provides centralized monitoring and coordinated control of HVAC, lighting, and security. A common network lets the systems share information and respond together. This improves efficiency and simplifies management.

96. A — A nurse-call life-safety system requires reliable operation, supervision, and often emergency power backup. Lives depend on the system functioning during emergencies and outages. These requirements ensure availability when it is most needed.

97. C — A contaminated fibre end-face causes signal loss (attenuation) and reflection at the joint. Dirt scatters and blocks light at the connector interface. Cleaning before mating is essential for low-loss optical connections.

98. D — Terminating to T568A or T568B ensures consistent pin-to-pair assignment for proper connectivity. Both ends following the same standard guarantees correct pair matching. This prevents miswiring and split-pair faults.

99. B — A PIR sensor detects movement by sensing changes in infrared (heat) energy from a moving body. It responds to shifts in the thermal pattern across its field of view. This makes it effective for occupancy and intrusion detection.

100. C — Bonding/grounding of structured cabling protects equipment and reduces electrical noise and surge damage. A proper ground reference diverts surges and minimizes interference. This safeguards both the network electronics and signal quality.