PRACTICE EXAM 5: CONSTRUCTION ELECTRICIAN SIMULATION (100 QUESTIONS)

1. A worker is about to begin servicing a 600 V motor control centre. After de-energizing and locking out the disconnect, what is the final step required before the circuit can be considered safe to work on?

A. Apply a personal danger tag listing the worker's name and date

B. Notify the building owner that power has been interrupted

C. Test for absence of voltage using a meter verified before and after on a known source

D. Wait a minimum of 15 minutes for stored charge to dissipate

2. During a group lockout on a large industrial project, several trades must work on the same equipment. Which device allows each worker to apply an individual lock to a single energy isolation point?

A. A lockout hasp

B. A breaker lockout clip

C. A multi-pin cylinder

D. A spring-loaded scissor clamp

3. A class C fire involving energized electrical equipment breaks out in a switchgear room. Which extinguishing agent is appropriate?

A. Foam, because it smothers the flame quickly

B. Water under pressure to cool the conductors

C. A wet chemical agent designed for kitchen fires

D. Carbon dioxide, because it is non-conductive and leaves no residue

4. You must lift a coil of armoured cable weighing approximately 28 kg from the floor. What is the correct manual lifting technique?

A. Bend at the waist and lift with a smooth pulling motion

B. Bend the knees, keep the back straight, and lift with the legs

C. Twist toward the load while raising it to reduce strain

D. Lift with arms fully extended to keep the load away from the body

5. A bending operation requires you to make a 90° stub-up in 3/4-in. EMT to a height of 250 mm. Using a hand bender with a take-up of 150 mm, where do you place the mark for the back of the bend?

A. 250 mm from the end of the conduit

B. 100 mm from the end of the conduit

C. 400 mm from the end of the conduit

D. 150 mm from the end of the conduit

6. When fabricating a support system for a horizontal cable tray run, which factor most directly determines the maximum spacing between supports?

A. The manufacturer's load/span rating for the tray

B. The colour coding of the conductors inside

C. The ambient temperature of the room

D. The total number of bends in the run

7. Before commissioning a newly installed distribution panel, a journeyperson performs an insulation resistance test. A reading of near-zero ohms between a phase conductor and ground indicates:

A. The insulation is in excellent condition

B. The test leads are reversed

C. A normal capacitive charging condition

D. A ground fault or insulation breakdown

8. While decommissioning an old service, which document confirms the sequence and authorization for removing equipment from service?

A. The conductor ampacity table

B. The manufacturer's wiring diagram

C. A lockout/tagout and switching order procedure

D. The original electrical permit

9. An apprentice is mentoring under a journeyperson and is unsure how to terminate a particular connector. According to good mentoring practice, the journeyperson should first:

A. Complete the termination themselves to save time

B. Tell the apprentice to find the answer online

C. Demonstrate the procedure and then observe the apprentice perform it

D. Report the apprentice's uncertainty to the supervisor

10. Which personal protective equipment rating system is used to specify the arc-rated clothing required for a given incident energy level?

A. Arc flash PPE category (cal/cm^2)

B. The CSA conductor temperature rating

C. The NEMA enclosure rating

D. The ingress protection (IP) code

11. When organizing materials for a large installation, the practice of staging materials near their point of use primarily serves to:

A. Increase the visible inventory for the client

B. Reduce wasted motion and improve productivity

C. Satisfy a Canadian Electrical Code requirement

D. Allow easier counting at the end of the day

12. A single-phase 120/240 V residential service is being installed. The consumer's service conductors are sized for a 200 A service. What is the minimum size of the bonding conductor for the service if copper is used, per typical CEC requirements?

A. No. 10 AWG

B. No. 8 AWG

C. No. 4 AWG

D. No. 6 AWG

13. A revenue meter on a commercial service uses instrument transformers. The purpose of a current transformer (CT) in this application is to:

A. Step down high line current to a standard low value for metering

B. Step up the voltage for accurate measurement

C. Provide ground-fault protection for the service

D. Isolate the neutral from the grounded conductor

14. A fuse is marked with an interrupting rating of 200 kA. This rating describes the fuse's ability to:

A. Carry continuous load current indefinitely

B. Limit the voltage across the load

C. Safely interrupt the maximum available fault current

D. Operate only on overload conditions

15. When coordinating overcurrent protection in a radial distribution system, "selective coordination" ensures that:

A. All breakers trip simultaneously during a fault

B. The main breaker always trips before any branch device

C. The largest available fault current is reduced at the source

D. Only the device nearest the fault opens, isolating the smallest portion

16. A three-phase 480 V load draws a line current of 50 A at a power factor of 0.85. What is the approximate total real power consumed?

A. 24 kW

B. 35 kW

C. 42 kW

D. 49 kW

17. An uninterruptible power supply (UPS) is described as "online double-conversion." The primary advantage of this topology is:

A. The lowest possible cost per kVA

B. Continuous isolation of the load from utility power disturbances

C. Zero standby power consumption

D. Elimination of the need for batteries

18. A surge protective device (SPD) is installed at the service entrance. Its primary function is to:

A. Divert transient overvoltages to ground

B. Correct a low power factor on the service

C. Provide overload protection for the feeder

D. Step down the service voltage to utilization level

19. A solidly grounded system experiences a single line-to-ground fault. Compared to a high-resistance grounded system, the solidly grounded system will generally produce:

A. A lower fault current that allows continued operation

B. No fault current until a second fault occurs

C. A high fault current that trips the overcurrent device quickly

D. A floating neutral with elevated phase voltages

20. Ground fault protection of equipment (GFPE) on a 600 V service is required to limit damage from:

A. Line-to-line short circuits only

B. Overloads on the service conductors

C. Lightning strikes to the building

D. Arcing ground faults below the level that trips overcurrent devices

21. A photovoltaic array is connected to the grid through an inverter. The inverter's anti-islanding function is designed to:

A. Disconnect the array from the grid when utility power is lost

B. Increase the DC output voltage of the panels

C. Store excess energy in a battery bank

D. Track the maximum power point of the array

22. A battery energy storage system uses lithium-ion cells. A key safety hazard specific to these batteries during a fault is:

A. The release of mercury vapour

B. The generation of hydrogen gas requiring venting

C. Acid spillage requiring neutralization

D. Thermal runaway leading to fire

23. High-voltage cable terminations require stress cones primarily to:

A. Increase the current-carrying capacity of the cable

B. Reduce the cable's resistance to ground

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

D. Provide mechanical support for the conductor

24. A delta-wye transformer is used to step down 4160 V to 600/347 V. The wye secondary configuration is commonly chosen because it:

A. Eliminates all harmonic currents

B. Allows a higher secondary current rating

C. Provides a neutral point for single-phase loads and grounding

D. Requires no overcurrent protection

25. A transformer nameplate lists an impedance of 5.75%. This value is used to calculate:

A. The transformer's full-load efficiency

B. The available short-circuit current on the secondary

C. The no-load excitation current

D. The transformer's turns ratio

26. When energizing a new dry-type transformer, the inrush current can be several times the full-load current. This inrush is caused primarily by:

A. A short circuit in the secondary winding

B. The resistive heating of the windings

C. The mechanical movement of the core laminations

D. Magnetic saturation of the core during the first cycles

27. A 25 kVA single-phase transformer supplies a 240 V secondary. What is the rated full-load secondary current?

A. 60 A

B. 84 A

C. 104 A

D. 125 A

28. Power distribution equipment in a wet location must use enclosures rated to prevent the entry of water. Which NEMA enclosure type is suitable for outdoor, rain-exposed installations?

A. NEMA 3R

B. NEMA 1

C. NEMA 12

D. NEMA 7

29. A neutral grounding resistor (NGR) is installed on the wye point of a generator. Its function is to:

A. Increase the available ground-fault current

B. Limit the ground-fault current to a safe value

C. Improve the generator's power factor

D. Provide a path for harmonic currents only

30. During paralleling of two generators, which condition must be matched in addition to voltage and frequency before closing the breaker?

A. Oil temperature

B. Phase rotation and phase angle

C. Fuel consumption rate

D. Exciter brush wear

31. A consumer's service entrance conductors must be protected against physical damage where they pass through a wall. The most appropriate method is to:

A. Wrap the conductors in electrical tape

B. Increase the conductor size by two AWG

C. Paint the conductors with a protective coating

D. Install them in a suitable raceway or sleeve

32. When testing a transformer's polarity, a journeyperson finds that the markings indicate subtractive polarity. In subtractive polarity, the high-voltage and low-voltage leads of the same polarity are:

A. Located directly across from each other (adjacent)

B. Located diagonally across the transformer

C. Connected internally to the core

D. Both grounded to the tank

33. A standby generator is connected through a transfer switch. An automatic transfer switch (ATS) with an "open transition" momentarily:

A. Parallels the generator with the utility

B. Increases the generator output voltage

C. Disconnects the load from both sources during transfer

D. Bypasses the generator's overcurrent protection

34. The grounding electrode conductor connects the service grounded conductor to the grounding electrode. Its minimum size is determined by:

A. The number of branch circuits in the panel

B. The length of the service entrance

C. The size of the service entrance conductors

D. The ambient temperature of the location

35. A current-limiting fuse reduces the let-through energy during a fault by:

A. Clearing the fault before the first half-cycle peak is reached

B. Increasing the circuit impedance permanently

C. Switching the load to an alternate source

D. Delaying its operation until the second cycle

36. When installing a pad-mounted distribution transformer outdoors, the working clearance in front of the equipment must be maintained to:

A. Reduce audible noise from the transformer

B. Improve the cooling airflow only

C. Match the colour of adjacent equipment

D. Allow safe access for operation and maintenance

37. A power conditioning system corrects voltage sags using a series-connected device. This type of equipment is best described as a:

A. Capacitor bank for power factor correction

B. Dynamic voltage restorer

C. Harmonic filter for the neutral

D. Phase rotation meter

38. On a high-voltage system, a potential transformer (PT) is used to:

A. Limit the fault current to the meter

B. Step down the line voltage to a safe value for metering and relaying

C. Provide a grounding path for the system

D. Increase the secondary current for protection

39. Renewable energy systems feeding the grid must have a means of disconnection accessible to the utility. This requirement primarily protects:

A. Utility workers from back-feed during line maintenance

B. The homeowner's appliances from surges

C. The inverter from overvoltage

D. The battery from deep discharge

40. A run of rigid PVC conduit is installed in a location subject to a temperature change of 40 °C. The installer must account for thermal expansion by:

A. Increasing the conduit diameter by one trade size

B. Using only metallic fittings at each end

C. Installing an expansion coupling

D. Reducing the support spacing by half

41. When calculating conduit fill for three No. 8 AWG RW90 conductors in EMT, the maximum allowable fill percentage of the conduit's cross-sectional area is:

A. 53%

B. 31%

C. 60%

D. 40%

42. A cable tray contains power conductors operating at 600 V and signal cables. To prevent interference, these should be:

A. Twisted together to cancel the fields

B. Run in the same bundle for efficiency

C. Connected to the same ground bar

D. Separated by a barrier or adequate spacing

43. A box contains five No. 12 AWG conductors, two internal cable clamps, and one receptacle (two yoke positions). For box-fill calculation, the receptacle counts as:

A. One conductor volume

B. Two conductor volumes based on the largest conductor connected

C. No additional volume

D. Four conductor volumes

44. When supporting EMT runs, the maximum distance between supports for a horizontal run is generally:

A. Within 1 m of each box and at intervals not exceeding 1.5 m

B. Only at the boxes, with no intermediate supports

C. Every 5 m regardless of conduit size

D. Only where the conduit changes direction

45. A branch circuit supplying a 15 A receptacle in a dwelling kitchen counter area must be protected by:

A. A standard non-grounding receptacle

B. A 30 A breaker for higher capacity

C. A GFCI device

D. A time-delay fuse only

46. Arc-fault circuit interrupter (AFCI) protection is required for certain dwelling branch circuits because AFCIs detect:

A. Ground faults to the equipment ground

B. Overcurrent due to overloaded circuits

C. Dangerous arcing conditions in conductors

D. Reverse polarity at the receptacle

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

A. 80%

B. 100%

C. 125%

D. 60%

48. When installing an HVAC rooftop unit, the disconnecting means must be located:

A. Inside the building's main electrical room only

B. Within sight of and readily accessible to the equipment

C. A minimum of 10 m from the unit

D. Behind a locked panel accessible only to the utility

49. Electric heating cable for floor warming is installed in a concrete slab. The cable must not be:

A. Connected to a thermostat

B. Tested before the pour

C. Spaced more than 50 mm apart

D. Cut or shortened in the field

50. A baseboard electric heater rated at 1500 W operates at 240 V. What is the operating current?

A. 12.5 A

B. 10.4 A

C. 8.3 A

D. 6.25 A

51. Exit and emergency lighting must remain operational during a power failure. The minimum duration the emergency lighting must operate is typically:

A. 5 minutes

B. 15 minutes

C. 30 minutes

D. 4 hours

52. A self-contained emergency lighting unit ("battery pack") includes a charger that:

A. Maintains the battery at full charge during normal operation

B. Operates only when the lights are illuminated

C. Increases the lamp voltage above battery rating

D. Disconnects the battery during normal power

53. Cathodic protection systems protect buried metal structures from corrosion by:

A. Increasing the soil resistivity around the pipe

B. Making the protected structure the cathode of an electrochemical cell

C. Coating the structure with an insulating paint only

D. Heating the structure to drive off moisture

54. When installing conductors in a raceway in a high ambient temperature location, the conductor ampacity must be:

A. Increased to match the temperature

B. Left unchanged because raceways are sealed

C. Derated using the appropriate correction factor

D. Doubled to compensate for heat

55. A multi-wire branch circuit shares a neutral between two phase conductors. To prevent the neutral from being overloaded, the two phase conductors must be:

A. Connected to opposite phases (different ungrounded legs)

B. Connected to the same phase

C. The same colour as the neutral

D. Protected by a single-pole breaker

56. When pulling conductors into a conduit, the maximum pulling tension is limited to prevent:

A. Excessive voltage drop

B. Reverse polarity

C. Insufficient box fill

D. Damage to the conductor and insulation

57. A junction box installed in a concealed location must remain:

A. Painted to match the wall

B. Accessible without removing building structure

C. Filled with sealing compound

D. Below the level of the receptacles

58. Electrical non-metallic tubing (ENT) is best suited for installation:

A. Exposed on a rooftop in direct sunlight

B. In hazardous locations with flammable vapours

C. As a service mast above the roofline

D. Concealed within walls, floors, or ceilings

59. A 240 V electric duct heater installed in an HVAC system requires an airflow interlock. The purpose of this interlock is to:

A. Prevent the heater from energizing without airflow

B. Reduce the fan speed at high temperatures

C. Increase the voltage to the heating elements

D. Disable the thermostat during cooling

60. When terminating an aluminum conductor at a lug, an antioxidant compound is applied to:

A. Increase the conductor's ampacity

B. Reduce the torque required on the lug

C. Inhibit oxidation that increases resistance

D. Improve the colour coding of the connection

61. A 3-way switch arrangement controls a single light from two locations. The conductors connecting the two 3-way switches are called:

A. Grounded conductors

B. Traveller conductors

C. Bonding conductors

D. Service conductors

62. When installing flat conductor cable (FCC) under carpet squares, the system is limited to:

A. Wet outdoor locations

B. Hazardous classified areas

C. Branch circuits in accessible interior floor areas

D. Service entrance conductors only

63. A heating system uses a line-voltage thermostat. Compared to a low-voltage thermostat, the line-voltage type:

A. Always requires a separate transformer

B. Operates only on DC control circuits

C. Switches the full load current of the heater directly

D. Cannot be used with baseboard heaters

64. When determining the number of receptacles on a 15 A general-purpose branch circuit in a commercial occupancy, each receptacle is typically assigned a load of:

A. 1 A per receptacle (using the CEC allowance)

B. 5 A per receptacle

C. 15 A per receptacle

D. 0.5 A per receptacle

65. A raceway passing from a heated interior space to a cold exterior location may experience condensation. To address this, the installer should:

A. Increase the conduit support spacing

B. Use larger conductors

C. Paint the raceway white

D. Provide a means to drain or seal against moisture

66. Exit signs in a commercial building must be:

A. Connected to a switched lighting circuit

B. Illuminated continuously and supplied from an emergency source

C. Powered only by the utility with no backup

D. Located only at the main entrance

67. A conductor's insulation is marked "RW90 XLPE." The "90" indicates:

A. The conductor's ampacity in amperes

B. The minimum bend radius in millimetres

C. The voltage rating in hundreds of volts

D. The maximum operating temperature in degrees Celsius

68. When installing armoured cable (AC90) the anti-short bushing ("red head") is used to:

A. Protect the conductors from the cut edge of the armour

B. Increase the cable's pulling strength

C. Provide a grounding connection

D. Seal the cable against moisture

69. A branch circuit feeds a continuous lighting load of 12 A. The minimum conductor ampacity and breaker rating must be based on:

A. 12 A × 1.25 = 15 A

B. 12 A exactly

C. 12 A × 0.8 = 9.6 A

D. 12 A × 2 = 24 A

70. A magnetic motor starter uses a holding (seal-in) contact to:

A. Provide overload protection for the motor

B. Reverse the direction of rotation

C. Maintain the coil circuit after the start button is released

D. Limit the inrush current at startup

71. Overload relays in a motor starter protect the motor from:

A. Short circuits and ground faults

B. Sustained currents above the motor's rated full-load current

C. Overvoltage on the supply

D. Phase reversal only

72. A three-phase squirrel-cage induction motor is reversed by:

A. Reversing the connections to the overload relay

B. Interchanging any two of the three line leads

C. Adding a capacitor to one phase

D. Reducing the supply voltage

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

A. Motor's physical pole spacing

B. Resistance in the rotor circuit

C. Voltage only, at fixed frequency

D. Frequency and voltage supplied to the motor

74. When a VFD is installed, long motor cables can cause reflected wave voltage spikes that damage the motor insulation. A common mitigation is to install:

A. A larger overload relay

B. A power factor capacitor at the motor

C. An output (load) reactor or dV/dt filter

D. A second VFD in parallel

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

A. Limit the starting inrush current and mechanical shock

B. Increase the motor's running torque

C. Eliminate the need for overload protection

D. Convert the motor to single-phase operation

76. The nameplate of a three-phase motor lists the full-load current (FLC) as 28 A. The branch circuit conductors supplying a single continuous-duty motor must have an ampacity of at least:

A. 28 A

B. 22.4 A

C. 28 A × 2.5

D. 28 A × 1.25 = 35 A

77. A motor control circuit uses a normally open (NO) momentary pushbutton for "start" and a normally closed (NC) momentary pushbutton for "stop." When the stop button is pressed, it:

A. Energizes the holding contact

B. Reverses motor rotation

C. Opens the control circuit, dropping out the coil

D. Increases the coil voltage

78. A programmable logic controller (PLC) replaces hardwired relay logic. A key advantage of a PLC is that the control logic can be:

A. Modified through software without rewiring

B. Operated without any power supply

C. Run only on 600 V control circuits

D. Used only for lighting control

79. In a PLC system, a discrete input module typically receives signals from:

A. An analog temperature transmitter producing 4–20 mA

B. On/off field devices such as limit switches and pushbuttons

C. The PLC's internal clock only

D. The motor's rotating shaft directly

80. A wye-delta (star-delta) starter reduces starting current by initially connecting the motor windings in:

A. Delta for full voltage

B. Series across two phases

C. A single-phase configuration

D. Wye, then switching to delta for running

81. A motor is rated 10 hp. Approximately how many watts of output power does this represent?

A. 7460 W

B. 1000 W

C. 13 400 W

D. 746 W

82. When troubleshooting a motor that hums but will not start, a likely cause is:

A. Excessive supply voltage on all phases

B. The overload relay set too high

C. A correctly functioning seal-in contact

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

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

A. Controls both speed and torque continuously while running

B. Controls only the starting and stopping voltage ramp

C. Converts AC to DC for the motor

D. Requires no overload protection

84. A motor control centre (MCC) "bucket" provides:

A. A grounding electrode for the building

B. A removable, self-contained starter unit for a single motor

C. The main service disconnect for the facility

D. Power factor correction for the entire plant

85. Dynamic braking of a DC motor is accomplished by:

A. Disconnecting the armature from the supply and connecting it across a resistor

B. Increasing the field current to maximum

C. Reversing the supply polarity instantly

D. Mechanically locking the rotor

86. A pressure switch (PS) in a control circuit is used to:

A. Measure the motor's running current

B. Convert AC to DC for the control logic

C. Open or close the control circuit based on system pressure

D. Provide overcurrent protection

87. When installing a motor, the disconnecting means must:

A. Be located inside the motor terminal box

B. Be rated only for the control voltage

C. Be within sight of the motor or capable of being locked open

D. Be shared with at least three other motors

88. An analog output module on a PLC commonly drives:

A. A simple indicator lamp

B. A normally closed relay contact

C. A discrete solenoid valve (on/off only)

D. A VFD speed reference signal (e.g., 0–10 V)

89. A three-phase motor's rotation must be confirmed before coupling to a pump. The best practice is to:

A. Bump (jog) the motor briefly and observe shaft direction

B. Run the motor at full load for one hour first

C. Measure the insulation resistance only

D. Reverse the overload heaters and observe

90. A motor overload relay is described as "ambient compensated." This feature ensures the relay:

A. Trips faster as the motor ages

B. Trips based on motor current regardless of surrounding air temperature

C. Increases the motor's full-load rating

D. Eliminates the need for a contactor

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

A. Increase the loudness of the horns

B. Provide power to the smoke detectors

C. Reduce the system voltage to 24 V

D. Allow the panel to supervise the circuit for open faults

92. Category 6 (Cat 6) cabling used for a structured data network has a maximum recommended channel length of:

A. 305 m

B. 50 m

C. 100 m

D. 500 m

93. When terminating twisted-pair data cable, the amount of untwisting of the pairs at the termination should be:

A. At least 50 mm to ease handling

B. Increased on higher categories of cable

C. Minimized to maintain performance and reduce crosstalk

D. Eliminated by soldering each conductor

94. A passive infrared (PIR) motion sensor in a security system detects:

A. Changes in infrared energy caused by a moving body's heat

B. The weight of an intruder on the floor

C. Sound waves above the audible range only

D. Magnetic field changes at a doorframe

95. In a fire alarm system, an addressable device differs from a conventional device because it:

A. Operates at a higher voltage

B. Requires no wiring to the panel

C. Cannot be supervised by the panel

D. Reports its specific identity and location to the panel

96. A nurse-call or signalling system is classified as a low-voltage circuit. The conductors for such Class 2 circuits are limited primarily to control:

A. The full building lighting load

B. Power and current to safe, low-energy levels

C. The motor branch circuits

D. The main service entrance

97. When integrating a building automation system that controls HVAC, lighting, and security, a common open communication protocol used is:

A. 120 V AC line signalling

B. The fire alarm SLC loop exclusively

C. A standard 15 A branch circuit

D. BACnet

98. Coaxial cable (e.g., for CATV) uses a characteristic impedance that must be matched to the equipment, commonly:

A. 100 ohms

B. 75 ohms

C. 600 ohms

D. 4 ohms

99. A fire alarm notification appliance circuit (NAC) supplies power to:

A. Horns, strobes, and other audible/visible signalling devices

B. The smoke and heat detectors only

C. The building's main lighting panel

D. The HVAC dampers exclusively

100. When installing communication cabling in a plenum air-handling space, the cable must be:

A. Run in liquid-tight flexible conduit only

B. Spliced every 3 m for accessibility

C. Plenum-rated (low smoke, flame-resistant) as required by code

D. Energized at 120 V for testing

Practice Exam 5: Answer Key and Explanations

1. C — Verifying the absence of voltage with a tested meter is the final step that confirms a circuit is de-energized before work begins. The "test before touch" principle (test the meter on a known live source, test the dead circuit, then re-test the meter) catches a faulty meter that might otherwise give a false "dead" reading. Locking and tagging alone do not prove the absence of voltage.

2. A — A lockout hasp accepts multiple padlocks on a single isolation point, allowing each worker to apply their own lock for group lockout. The energy source cannot be re-energized until every worker removes their personal lock. This guarantees no one is exposed while another worker controls the equipment.

3. D — Carbon dioxide is non-conductive and leaves no residue, making it appropriate for a Class C fire involving energized electrical equipment. Water and foam conduct electricity and create a shock hazard, while wet chemical agents are designed for cooking-oil (Class K) fires. CO_2 smothers the fire by displacing oxygen without damaging equipment.

4. B — Bending the knees, keeping the back straight, and lifting with the leg muscles protects the spine from injury. The powerful leg muscles handle the load rather than the vulnerable lower-back structures. Bending at the waist or twisting under load are leading causes of musculoskeletal injury on the job.

5. B — With a take-up of 150 mm subtracted from the 250 mm desired stub height, the mark for the back of a 90° bend is placed 100 mm from the end (250 − 150 = 100). Take-up accounts for the distance the bend "consumes" along the conduit. Marking the raw stub height would overshoot the target.

6. A — The manufacturer's load/span rating directly defines the maximum support spacing for a cable tray under its rated load. The tray must support the combined weight of conductors plus any environmental loads within that rating. Conductor colour, room temperature, and bend count do not govern structural support spacing

7. D — A near-zero ohm reading between phase and ground on an insulation resistance (megger) test indicates a ground fault or breakdown of the insulation. Good insulation produces very high resistance (megohms); near-zero means current is leaking to ground. This must be located and repaired before energizing.

8. C — A lockout/tagout and switching order procedure documents the authorized sequence and approvals for removing equipment from service. It ensures decommissioning happens in a controlled, traceable order so no live hazard is left behind. Ampacity tables and wiring diagrams describe the system but do not authorize the switching steps.

9. C — Effective mentoring follows demonstrate-then-observe: the journeyperson shows the technique, then watches the apprentice perform it to confirm competence. This builds the apprentice's skill while ensuring the work is done safely and correctly. Doing it for them or sending them away teaches nothing.

10. A — Arc flash PPE is specified by category based on the calculated incident energy in cal/cm². The arc-rated clothing and equipment must meet or exceed the incident energy the worker could be exposed to. NEMA and IP codes rate enclosures, not personal protection.

11. B — Staging materials near their point of use reduces wasted movement and handling, directly improving labour productivity. Less time spent fetching materials means more time on productive installation. It is a work-organization practice, not a code requirement.

12. D — For a 200 A copper service, the CEC bonding conductor sizing table specifies a minimum No. 6 AWG copper. The bonding conductor is sized to the service rating to safely carry fault current back to the source. No. 4 would exceed the minimum and smaller sizes would be inadequate.

13. A — A current transformer steps down high primary line current to a standard low secondary value (typically 5 A) suitable for metering instruments. This lets a small meter safely measure large currents and isolates the operator from the primary. CTs handle current, not voltage step-up or grounding.

14. C — The interrupting rating is the maximum fault current a fuse can safely interrupt without rupturing or failing. A 200 kA rating means the device can clear faults up to that level. This is distinct from the continuous current rating and the overload response.

15. D — Selective coordination ensures only the overcurrent device nearest the fault opens, isolating the smallest possible portion of the system. Upstream devices remain closed, keeping the rest of the system energized. This minimizes outage scope and improves reliability.

16. B — Three-phase power = E × I × √3 × PF = 480 × 50 × 1.73 × 0.85 ≈ 35 000 W, or about 35 kW. The √3 factor and power factor are both required for real three-phase power. Omitting PF would inflate the result.

17. B — Online double-conversion continuously rectifies incoming AC to DC and re-inverts it back to clean AC, fully isolating the load from utility disturbances. The load never sees raw utility power, so sags, surges, and frequency variations are filtered out. This is why it is preferred for sensitive critical loads.

18. A — A surge protective device diverts transient overvoltages (such as lightning-induced surges) safely to ground, clamping the voltage seen by downstream equipment. It protects insulation and electronics from damaging voltage spikes. It does not correct power factor or provide overload protection.

19. C — A solidly grounded system produces a high line-to-ground fault current that quickly trips the overcurrent device and clears the fault. The low-impedance ground path lets large fault current flow immediately. High-resistance grounding instead limits the current to allow continued operation.

20. D — Ground fault protection of equipment limits damage from arcing ground faults whose current is below the level that would trip the overcurrent device. Such low-magnitude arcing faults can cause severe equipment burndown if undetected. GFPE senses this leakage and opens the circuit.

21. A — Anti-islanding causes a grid-tied inverter to disconnect the array when utility power is lost, preventing it from energizing a "dead" line. This protects utility line workers from unexpected back-feed during maintenance. It is a mandatory safety function for grid-interactive inverters.

22. D — The defining hazard of lithium-ion cells during a fault is thermal runaway, a self-sustaining temperature rise that can lead to fire and cell venting. Once initiated, it can propagate cell-to-cell. This drives the special fire-suppression and isolation requirements for battery storage rooms.

23. C — A stress cone controls the concentration of the electric field where the cable's insulation shield is terminated. Cutting the shield creates a sharp field discontinuity that would otherwise overstress and degrade the insulation. The stress cone reshapes the field gradually, preventing premature failure.

24. C — A wye secondary provides a neutral point, allowing both single-phase line-to-neutral loads (347 V) and a grounding reference. This makes 600/347 V wye ideal for commercial buildings needing both three-phase and single-phase supplies. The neutral also serves system grounding.

25. B — The transformer's percent impedance determines the available short-circuit current on the secondary (approximately rated current ÷ %Z). A 5.75% impedance limits the maximum fault current the transformer can deliver. This value is essential for selecting equipment with adequate interrupting ratings.

26. D — Inrush current results from magnetic saturation of the core during the first few cycles after energization, before flux stabilizes. The core briefly draws a large magnetizing current that decays as steady-state is reached. It is a normal transient, not a fault.

27. C — Secondary current = VA ÷ E = 25 000 ÷ 240 ≈ 104 A. This is the rated full-load current the 240 V secondary can deliver. It is used to size secondary conductors and overcurrent protection.

28. A — A NEMA 3R enclosure is rated for outdoor use, protecting against rain, sleet, and external ice formation. NEMA 1 is indoor general-purpose, NEMA 12 is indoor dust/drip, and NEMA 7 is for hazardous gas locations. 3R is the standard choice for rain-exposed outdoor distribution.

29. B — A neutral grounding resistor limits ground-fault current to a safe, predetermined value while still allowing fault detection. This reduces equipment damage and arc-flash energy during a ground fault. It is common on generators and medium-voltage systems where continued operation is desired.

30. B — Before paralleling, phase rotation (sequence) and phase angle must match, in addition to voltage and frequency. Closing the breaker with mismatched phase angle or rotation produces severe circulating currents and mechanical shock. All four conditions must align for a safe synchronization.

31. D — Service entrance conductors passing through a wall must be protected from physical damage by a suitable raceway or sleeve. The raceway shields the conductors from abrasion and impact at the penetration. Tape, paint, or upsizing do not provide mechanical protection.

32. A — In subtractive polarity, the high-voltage and low-voltage leads of the same polarity are physically adjacent (directly across from each other), so a jumper between them produces a voltage equal to the difference. Polarity must be confirmed before paralleling or interconnecting transformers. Most distribution transformers are subtractive.

33. C — An open-transition (break-before-make) automatic transfer switch momentarily disconnects the load from both sources during transfer, ensuring the two sources never connect. This prevents back-feeding the generator into the utility. The brief interruption is acceptable for most standby applications.

34. C — The grounding electrode conductor is sized according to the size of the service entrance conductors per the CEC table. Larger service conductors require a correspondingly larger grounding electrode conductor to handle potential fault current. Branch circuit count and conductor length do not determine its size.

35. A — A current-limiting fuse clears a high fault before the first half-cycle current peak is reached, dramatically reducing the let-through energy. By interrupting within milliseconds, it limits the thermal and magnetic stress on downstream equipment. This is why current-limiting fuses protect equipment with lower interrupting ratings.

36. D — Working clearance in front of a pad-mounted transformer must be maintained to allow safe access for operation and maintenance. Adequate space lets workers operate switches and service the unit without hazard. Clearance requirements are about safe access, not noise or cooling alone.

37. B — A dynamic voltage restorer is a series-connected device that injects compensating voltage to correct sags and disturbances. It rapidly restores the load voltage to nominal during a sag event. Capacitor banks correct power factor and harmonic filters address harmonics, not sag correction.

38. B — A potential (voltage) transformer steps down high line voltage to a safe, standard value (typically 120 V) for metering and protective relaying. This isolates instruments from the high-voltage system and allows safe measurement. PTs handle voltage; CTs handle current.

39. A — A utility-accessible disconnect protects utility workers from inverter back-feed during line maintenance. If the grid is down for repairs, the disconnect ensures the renewable source cannot energize the line. This is a fundamental line-worker safety requirement for grid-tied systems.

40. C — Rigid PVC conduit expands and contracts significantly with temperature, so an expansion coupling must be installed to absorb the movement. Without it, thermal stress can crack fittings or pull conductors. Upsizing the conduit or adding supports does not address linear expansion.

41. D — For three current-carrying conductors in a single conduit, the maximum fill is 40% of the conduit's cross-sectional area. The 40% figure applies to runs of more than two conductors, balancing fill against heat dissipation and pulling friction. One conductor allows 53% and two allow 31%.

42. D — Power and signal cables in a shared tray should be separated by a barrier or adequate spacing to prevent electromagnetic interference. Power conductors induce noise into low-level signal circuits when run together. Physical separation maintains signal integrity.

43. B — A receptacle (or other device on a strap/yoke) counts as two conductor volumes based on the largest conductor connected to it. This box-fill rule reserves space for the device's wiring and heat dissipation. Conductors, clamps, and devices each have defined volume allowances.

44. A — EMT must be secured within 1 m of each box and supported at intervals not exceeding 1.5 m along the run. This spacing keeps the raceway rigid and prevents sagging or strain on connections. Supporting only at boxes would leave unsupported spans.

45. C — Receptacles serving kitchen counter areas in a dwelling require GFCI protection because of the proximity of water and grounded appliances. GFCI detects small ground-fault currents and opens before a lethal shock can occur. This is a long-standing life-safety requirement near sinks.

46. C — AFCI protection detects dangerous arcing conditions (series or parallel arcs) in branch-circuit wiring that ordinary breakers do not sense. Arcing faults can ignite fires without drawing enough current to trip on overcurrent. AFCIs interrupt these conditions to prevent electrical fires.

47. A — A continuous load must not exceed 80% of the overcurrent device rating; equivalently, the device must be rated at 125% of the continuous load. This margin prevents nuisance tripping and overheating from sustained current. The 80% rule is fundamental to branch-circuit loading.

48. B — The disconnecting means for HVAC equipment such as a rooftop unit must be within sight of and readily accessible to the equipment. This lets a servicer positively de-energize the unit before working on it. "Within sight" generally means visible and not more than the code-specified distance.

49. D — Embedded electric heating cable must not be cut or shortened in the field, because its length is matched to its rated resistance and wattage. Cutting it changes the resistance, causing overheating and failure. The cable is installed as a complete factory-rated assembly.

50. D — Current = Power ÷ Voltage = 1500 ÷ 240 = 6.25 A. This determines the conductor and breaker sizing for the heater circuit. Ohm's-law power relationships govern resistive heating loads.

51. C — Emergency and exit lighting must remain operational for a minimum of 30 minutes during a power failure under typical code requirements. This duration allows occupants enough illuminated time to evacuate safely. The backup source must sustain the required light level for the full period.

52. A — A self-contained emergency lighting unit includes a trickle charger that keeps the battery at full charge during normal operation. This ensures the battery is ready to deliver full runtime the moment utility power fails. The lamps illuminate automatically on power loss.

53. B — Cathodic protection makes the protected metal structure the cathode of an electrochemical cell, so corrosion occurs at a sacrificial anode instead. By forcing the structure to receive (not give up) electrons, metal loss is shifted away from it. This protects buried pipes and tanks from corrosion.

54. C — In a high ambient temperature location, conductor ampacity must be reduced using the appropriate temperature correction factor. Higher surrounding temperature reduces the conductor's ability to dissipate heat, lowering its safe current. Ignoring derating risks insulation damage.

55. A — The two ungrounded conductors of a multi-wire branch circuit must be connected to opposite phases so the shared neutral carries only the unbalanced (difference) current. If connected to the same

phase, the neutral would carry the sum of both currents and could overload. Opposite-phase connection keeps neutral current safe.

56. D — Maximum pulling tension is limited to prevent mechanical damage to the conductor and its insulation during the pull. Excessive tension can stretch, neck, or strip the conductor, compromising its integrity. Lubricant and proper technique keep tension within limits.

57. B — A junction box must remain accessible without removing any part of the building structure or finish. This ensures future inspection, splicing, and maintenance are possible. Burying a box behind permanent construction is prohibited.

58. D — Electrical non-metallic tubing is intended for concealed installation within walls, floors, and ceilings in suitable dry/protected locations. It is not rated for direct sunlight exposure, hazardous locations, or use as a service mast. Its flexibility suits concealed work.

59. A — The airflow interlock prevents the duct heater from energizing unless air is moving across the elements. Without airflow, the elements would overheat and create a fire hazard. The interlock ties heater operation to proven fan operation.

60. C — Antioxidant (joint) compound inhibits the oxidation of aluminum, which would otherwise form a high-resistance film at the connection. Aluminum oxide builds up rapidly and causes overheating at terminations. The compound keeps the connection low-resistance and reliable.

61. B — The conductors running between two 3-way switches are called travellers, carrying the switched signal between the switch pair. The light is controlled from either location by changing which traveller is energized. Travellers are the defining feature of 3-way switching.

62. C — Flat conductor cable systems are limited to branch circuits in accessible interior floor areas, typically under carpet squares. They are not permitted in wet, outdoor, or hazardous locations, nor for service conductors. The accessibility allows replacement and inspection.

63. C — A line-voltage thermostat switches the full load current of the heater directly, with no control transformer required. Its contacts are rated for the heater's voltage and current. Low-voltage thermostats instead switch a small control signal through a transformer or relay.

64. A — In a commercial occupancy, the CEC allows each general-purpose receptacle to be assigned a load of 1 A for circuit-loading calculations. This determines how many receptacles a 15 A circuit can serve while reserving capacity. The allowance reflects typical diversified usage.

65. D — A raceway crossing between heated and cold spaces can form condensation, so the installer must provide a means to drain or seal the raceway against moisture. Trapped moisture corrodes equipment and degrades insulation. Drainage or sealing fittings address the temperature-driven condensation.

66. B — Exit signs must be continuously illuminated and supplied from an emergency power source so they remain visible during a utility outage. Occupants must be able to locate exits even when normal power fails. Connecting them to a switched circuit would defeat their life-safety purpose.

67. D — The "90" in RW90 designates the conductor's maximum continuous operating temperature of 90 °C. This rating affects allowable ampacity and termination compatibility. Higher temperature ratings permit higher ampacities when terminations are rated to match.

68. A — The anti-short bushing ("red head") protects the conductors from the sharp cut edge of the armour where the cable enters the connector. Without it, the metal edge could abrade and cut through the insulation, causing a fault. It is a required part of an AC90 termination.

69. A — For a continuous load, the conductor and breaker must be sized at 125% of the load: 12 A × 1.25 = 15 A. This margin prevents overheating from sustained current draw. The 125% factor is the continuous-load complement of the 80% rule.

70. C — The holding (seal-in) contact maintains the starter coil circuit after the momentary start button is released, keeping the motor running. It parallels the start button so the coil stays energized. Releasing the start button without a seal-in would immediately drop out the motor.

71. B — Overload relays protect the motor from sustained currents above its rated full-load current, such as those from mechanical overload. They trip on a time-current curve that mimics motor heating. Short circuits and ground faults are handled by the separate overcurrent device.

72. B — A three-phase induction motor is reversed by interchanging any two of the three line leads, which reverses the rotating magnetic field direction. This is the standard reversing method for three-phase motors. Swapping overload connections or adding capacitors does not reverse rotation.

73. D — A VFD controls motor speed by varying both the frequency and the voltage supplied to the motor, maintaining a constant volts-per-hertz ratio. Frequency sets the synchronous speed while matching voltage preserves torque and avoids saturation. This is the core operating principle of variable-frequency drives.

74. C — Long motor leads from a VFD cause reflected-wave voltage spikes; installing an output (load) reactor or dV/dt filter slows the voltage rise and protects the motor insulation. The filter limits the peak voltage reaching the motor terminals. This is a common mitigation on long cable runs.

75. A — A reduced-voltage starter limits the high inrush current and the mechanical shock of across-the-line starting on large motors. Lower starting voltage means lower starting current and gentler acceleration. This protects both the supply system and the driven equipment.

76. D — Branch-circuit conductors for a single continuous-duty motor must be rated at 125% of the full-load current: 28 A × 1.25 = 35 A. The 25% margin accounts for continuous motor operation and heating. This is the standard CEC motor-conductor sizing rule.

77. C — Pressing the normally closed stop button opens the control circuit, de-energizing the coil and dropping out the starter (and the seal-in contact). The motor stops because the holding circuit is broken. The NC stop button must open to interrupt the latch.

78. A — A key advantage of a PLC is that its control logic is defined in software and can be modified by reprogramming, without rewiring hardwired relays. This makes process changes fast and flexible. The same hardware can serve many different control schemes.

79. B — A discrete (digital) input module receives on/off signals from field devices such as limit switches, pushbuttons, and proximity sensors. Each input represents a simple two-state condition. Analog signals like 4–20 mA require an analog input module instead.

80. D — A wye-delta starter first connects the windings in wye to reduce starting voltage and current, then switches to delta for normal running. The wye connection applies about 58% of line voltage to each winding at start, cutting inrush. This reduces stress during acceleration.

81. A — 10 hp × 746 W/hp = 7460 W of output power. The conversion factor of 746 watts per horsepower is standard for electric motors. This output figure is before accounting for motor efficiency losses.

82. D — A motor that hums but will not start is classically caused by single-phasing — the loss of one of the three supply phases. With only two phases present, the motor cannot develop a rotating field and stalls while drawing heavy current. This is a common and damaging fault condition.

83. B — A soft starter controls only the voltage ramp during starting and stopping; it does not regulate speed during normal running like a VFD. Once at full voltage it simply runs the motor across the line. This makes it cheaper but less versatile than a drive.

84. B — An MCC "bucket" is a removable, self-contained unit housing the starter and protection for a single motor, plugged into the MCC's common bus. Buckets allow individual motor circuits to be serviced or replaced without de-energizing the whole centre. This modularity is the defining feature of an MCC.

85. A — Dynamic braking of a DC motor disconnects the armature from the supply and connects it across a resistor, so the motor acts as a generator dissipating its rotational energy as heat. This rapidly slows the motor without mechanical friction. The resistor value sets the braking rate.

86. C — A pressure switch opens or closes the control circuit based on system pressure, providing automatic control of pumps and compressors. When pressure reaches a setpoint, the switch changes state to start or stop the motor. It is a process-sensing control device, not a protective device.

87. C — The motor disconnecting means must be within sight of the motor, or be capable of being locked in the open position, so a servicer can ensure the motor stays de-energized. This protects workers from unexpected startup during maintenance. Lockable disconnects satisfy the requirement when out of sight.

88. D — An analog output module produces a variable signal such as 0–10 V, ideal for sending a speed reference to a VFD. It provides a continuously variable value rather than a simple on/off state. Discrete devices like lamps and solenoids use digital outputs.

89. A — Bumping (jogging) the motor briefly to observe shaft direction is the safe, standard way to confirm rotation before coupling it to a pump. A momentary energization reveals direction without risk to the driven load. If reversed, two line leads are swapped before final coupling.

90. B — An ambient-compensated overload relay trips based on motor current regardless of the surrounding air temperature. This prevents nuisance trips when the relay and motor are in different ambient conditions. It keeps protection accurate when controller and motor temperatures differ.

91. D — An end-of-line resistor allows the fire alarm panel to supervise the initiating device circuit, monitoring it for open (and short) faults. A break in the wiring changes the monitored current, signalling a trouble condition. Supervision ensures the wiring is intact and ready to operate.

92. C — A Cat 6 structured-cabling channel has a maximum recommended length of 100 m, including patch cords. Beyond this, signal attenuation and timing degrade network performance. The 100 m limit is the standard for balanced twisted-pair horizontal cabling.

93. C — Untwisting of the pairs at a termination must be minimized to preserve performance and reduce crosstalk. The twist provides noise cancellation, so excess untwisting degrades high-frequency signal quality. Higher categories tolerate even less untwist.

94. A — A passive infrared sensor detects changes in infrared (heat) energy caused by a moving body crossing its field of view. The human body emits infrared that contrasts with the background, triggering the sensor. It is "passive" because it emits nothing and only senses thermal change.

95. D — An addressable fire alarm device reports its specific identity and location to the panel, so the exact device in alarm or trouble is known. This greatly speeds response and maintenance compared with conventional zoned systems. Each device has a unique address on the loop.

96. B — Class 2 low-voltage signalling circuits are limited to safe, low power and current levels by their power source. This inherent limitation reduces shock and fire risk, allowing relaxed wiring methods. The restriction is on energy, not on the type of equipment connected.

97. D — BACnet is a widely used open communication protocol for integrating building automation systems such as HVAC, lighting, and security. Being vendor-neutral, it allows equipment from different manufacturers to interoperate. This open standard is the common backbone of integrated building control.

98. B — CATV and most video coaxial systems use a characteristic impedance of 75 ohms, which must be matched at connectors and equipment. Impedance mismatch causes signal reflections and loss. (Data/RF coax such as older Ethernet used 50 ohms; video uses 75.)

99. A — A notification appliance circuit supplies power to the audible and visible signalling devices such as horns and strobes. These alert occupants to evacuate during an alarm. Initiating devices (detectors) are on separate initiating circuits.

100. C — Communication cabling installed in a plenum air-handling space must be plenum-rated, using low-smoke, flame-resistant jacketing as required by code. In a fire, ordinary cable jackets release toxic smoke that the plenum would circulate. Plenum rating limits smoke and flame spread in these air spaces.