PRACTICE EXAM 8: CONSTRUCTION ELECTRICIAN SIMULATION (100 QUESTIONS)

1. When performing a lockout/tagout on a 600 V distribution panel before servicing, what is the correct sequence of actions?

A. Tag the disconnect, remove the fuses, lock the disconnect, then notify the supervisor

B. De-energize, lock the disconnect, tag it, then verify zero energy with a meter

C. Notify affected workers, de-energize, lock and tag the disconnect, then test for absence of voltage

D. Lock the disconnect, test for voltage, tag it, then notify affected workers

2. Which class of fire extinguisher is rated for use on energized electrical equipment?

A. Class C

B. Class A

C. Class B

D. Class K

3. A worker must access an attic space to install wiring. According to occupational health and safety guidelines, when is fall protection required when working from a height?

A. Only when working from scaffolding

B. Only when no guardrails are present at any height

C. Never required for residential interior work

D. When the working height exceeds 3 m (approximately 10 ft)

4. Which document on a job site provides the legally required hazard information for a chemical solvent being used to clean conduit?

A. The product purchase order

B. The Safety Data Sheet (SDS)

C. The manufacturer's warranty card

D. The site supervisor's logbook

5. When using a hydraulic bender to bend rigid conduit, what is the primary advantage over a hand bender?

A. It reduces operator effort and produces consistent bends in larger trade sizes

B. It eliminates the need to calculate the bend deduction

C. It removes the requirement for deburring the cut end

D. It allows conduit to be bent without measuring the offset

6. When organizing work for a multi-trade installation, which drawing should an electrician reference to coordinate raceway routing with ductwork?

A. The architectural elevation drawing

B. The single-line diagram

C. The panel schedule

D. The mechanical/HVAC coordination drawing

7. A unistrut support channel is being installed to carry a run of heavy cable tray. What is the most important factor when selecting the channel and its fasteners?

A. The colour of the channel finish

B. The manufacturer's brand name

C. The combined weight load and the anchoring substrate

D. The length of the threaded rod only

8. During commissioning of a newly installed lighting system, an electrician performs an insulation resistance test. What is the purpose of this test?

A. To verify the colour-coding of conductors

B. To confirm the insulation between conductors and ground is not compromised

C. To measure the wattage of the luminaires

D. To check the torque on the terminal screws

9. When mentoring a first-year apprentice, the most effective approach to teaching a new bending technique is to:

A. Demonstrate the task, then observe and provide feedback as the apprentice practices

B. Tell the apprentice to read the manual without demonstration

C. Complete the work yourself and explain it afterward

D. Have the apprentice watch a video and attempt it unsupervised

10. Before decommissioning an old motor circuit, what must be confirmed first?

A. The motor nameplate horsepower

B. The colour of the existing conductors

C. The price of replacement components

D. That the circuit is fully de-energized and isolated from all energy sources

11. A torque value for a terminal lug is specified in N·m. Why is using a calibrated torque tool important for terminations?

A. It speeds up the installation only

B. It improves the appearance of the panel

C. It ensures the connection is neither under-tightened nor over-tightened, preventing overheating

D. It is only required for aluminum conductors

12. A residential single-phase service is rated at 200 A. According to the Canadian Electrical Code, what is the minimum size of copper service conductor typically used for this rating?

A. No. 3/0 AWG

B. No. 2/0 AWG

C. No. 4/0 AWG

D. No. 1/0 AWG

13. What is the primary function of a kilowatt-hour meter at the consumer's service?

A. To record the quantity of energy consumed over time

B. To limit the maximum current drawn by the load

C. To convert AC to DC for the service

D. To protect against ground faults

14. A fuse is marked with an interrupting rating (IR). What does this rating represent?

A. The continuous current the fuse can carry

B. The voltage drop across the fuse

C. The time delay before the fuse opens

D. The maximum fault current the fuse can safely interrupt without rupturing

15. In a properly coordinated overcurrent protection scheme, which device should open first during a fault on a branch circuit?

A. The main service breaker

B. The branch-circuit breaker nearest the fault

C. The utility transformer fuse

D. The feeder breaker upstream

16. A three-phase, 4-wire distribution panel supplies a mix of single-phase and three-phase loads. To balance the system, the electrician should:

A. Connect all single-phase loads to phase A

B. Place the largest loads on the neutral

C. Distribute single-phase loads as evenly as possible across all three phases

D. Connect single-phase loads only between two phases

17. What is the principal purpose of a surge protective device (SPD) installed at a service entrance?

A. To divert transient overvoltages to ground and protect equipment

B. To correct the power factor of the load

C. To regulate the steady-state voltage of the service

D. To meter harmonic distortion

18. An uninterruptible power supply (UPS) of the online (double-conversion) type provides which key benefit over a standby UPS?

A. It is less expensive to install

B. It requires no battery maintenance

C. It uses less floor space

D. It supplies continuous conditioned power with no transfer time during an outage

19. When bonding the service equipment, the main bonding jumper connects the neutral bus to the:

A. Grounding electrode only

B. Enclosure/equipment grounding bus

C. Line side of the meter

D. Branch-circuit neutral terminals

20. A grounding electrode conductor connects the service to a driven ground rod. The primary reason for the grounding electrode system is to:

A. Carry normal load current back to the utility

B. Improve the power factor of the installation

C. Provide a low-impedance path to earth for lightning and stabilize voltage

D. Reduce the conductor size required for the service

21. Ground-fault protection of equipment (GFPE) on a large service is designed to operate on:

A. Low-level ground faults that may not trip the overcurrent device

B. Overload conditions on the neutral

C. Phase-to-phase short circuits only

D. Voltage sags on the incoming line

22. A standby diesel generator is connected to a building's emergency loads. Which device prevents the generator and the utility from being connected simultaneously?

A. A surge arrester

B. A current transformer

C. A power factor capacitor

D. A transfer switch with mechanical/electrical interlock

23. In a grid-tied photovoltaic (PV) system, the inverter's anti-islanding function is required to:

A. Increase the DC output of the array

B. Disconnect the PV system from the grid when utility power is lost

C. Store excess energy in the array

D. Step up the AC voltage to transmission levels

24. A battery energy storage system (BESS) using lithium-ion cells requires which special consideration during installation?

A. The batteries must be installed only outdoors

B. No ventilation is needed at any time

C. Thermal management and ventilation to prevent thermal runaway

D. The cells must be connected only in parallel

25. When working on a high-voltage system above 750 V, an electrician must ensure that approach distances are maintained. The minimum approach distance is determined primarily by:

A. The colour of the conductor insulation

B. The system voltage and applicable safety regulations

C. The ambient temperature only

D. The length of the feeder run

26. A delta-wye distribution transformer steps 4160 V down to 600/347 V. The wye secondary provides which advantage?

A. A neutral point for single-phase 347 V loads and a stable ground reference

B. Higher primary current

C. Elimination of all harmonics

D. A reduced number of secondary windings

27. A dry-type transformer is rated 75 kVA, 600 V primary, 208Y/120 V secondary. The approximate full-load secondary line current is closest to:

A. 72 A

B. 125 A

C. 360 A

D. 208 A

28. When energizing a new transformer for the first time, the recommended practice is to:

A. Apply full load immediately to confirm capacity

B. Short the secondary to check the windings

C. Energize from the primary with the secondary unloaded, then verify voltages before loading

D. Energize from the secondary side first

29. Two single-phase transformers are connected in an open-delta (V-V) configuration. Compared to a full delta bank, the open-delta arrangement delivers approximately what percentage of the three-transformer capacity?

A. 57.7%

B. 86.6%

C. 100%

D. 33.3%

30. Current transformers (CTs) used for metering must never have their secondary circuit open while the primary is energized because:

A. The CT will draw excessive primary current

B. Dangerous high voltage can develop across the open secondary terminals

C. The meter will read low

D. The CT ratio will reverse

31. A power conditioning system includes a line reactor ahead of a sensitive load. The line reactor primarily serves to:

A. Increase the available fault current

B. Step up the supply voltage

C. Convert single-phase to three-phase

D. Reduce harmonic distortion and limit inrush current

32. When servicing a metering installation, the electrician finds the meter socket jaws discoloured and pitted. This condition most likely indicates:

A. Normal aging requiring no action

B. A wiring colour-code error

C. A high-resistance connection causing heating

D. An undersized grounding electrode

33. A protection relay set for time-overcurrent (51) responds to:

A. Current magnitude over a time-delayed characteristic curve

B. Voltage above a fixed setpoint instantly

C. Frequency deviation only

D. Power factor below 0.8

34. When paralleling two generators, which parameters must match before closing the breaker?

A. Only the kVA ratings

B. Only the physical size of the units

C. Only the fuel type

D. Voltage, frequency, phase sequence, and phase angle

35. A grounding system at a high-voltage substation uses a ground grid. The step and touch potential calculations are performed to:

A. Determine the conductor colour code

B. Protect personnel from dangerous voltage gradients during a fault

C. Set the metering accuracy class

D. Size the primary fuse

36. A neutral grounding resistor (NGR) is installed on a generator's neutral. Its purpose is to:

A. Limit the ground-fault current to a safe level

B. Increase the available short-circuit current

C. Provide reactive power compensation

D. Step down the generator voltage

37. The secondary winding of a 600 V to 120 V control transformer is fused. The primary fuse is sized to protect against:

A. Secondary overloads only

B. Voltage transients on the secondary

C. Primary winding faults and inrush, per code

D. Low power factor

38. A renewable energy system feeds power back to the grid. The bidirectional revenue meter must be capable of:

A. Measuring only imported energy

B. Recording both imported and exported energy

C. Limiting the export to zero

D. Converting DC to AC

39. When servicing a 25 kV overhead distribution line, the most critical PPE and procedural requirement is:

A. Wearing standard work gloves only

B. Using a wooden ladder without testing

C. Working from a bucket truck without grounding

D. Verifying de-energization, applying grounds, and using rated insulating equipment

40. A run of EMT contains four No. 10 AWG TW conductors. When the number of current-carrying conductors in a raceway exceeds three, the ampacity must be:

A. Derated according to the code adjustment factors

B. Increased by 25%

C. Left unchanged

D. Doubled

41. What is the maximum number of 90° bends permitted in a single run of conduit between pull points according to the Canadian Electrical Code?

A. One

B. Two

C. Three

D. Four (equivalent to 360°)

42. When pulling conductors into a long conduit run, applying an approved cable-pulling lubricant primarily:

A. Increases the conductor ampacity

B. Reduces friction and the pulling tension on the conductors

C. Improves the insulation rating

D. Prevents corrosion of the conduit

43. A junction box must be sized for conductor fill. When determining box fill, each internal cable clamp counts as:

A. One conductor volume of the largest conductor present

B. Two conductor volumes

C. Zero — clamps are not counted

D. Half a conductor volume

44. Liquid-tight flexible metal conduit is most appropriate for connecting:

A. An underground service lateral

B. A panelboard to a structural beam

C. A motor where vibration and moisture are present

D. A run embedded in concrete

45. A 15 A, 125 V branch circuit serves general-purpose receptacles in a dwelling. Which protection is required for receptacles in a bedroom?

A. GFCI protection only

B. No special protection

C. Arc-fault circuit interrupter (AFCI) protection

D. Surge protection only

46. Receptacles installed within 1.5 m of a sink in a kitchen counter area must be:

A. Rated 20 A only

B. Protected by a GFCI

C. Mounted at 1 m above the floor

D. Connected to a dedicated neutral

47. When terminating an aluminum conductor at a device, the electrician must use:

A. Any standard copper-rated terminal

B. A soldered connection

C. A wire nut not rated for the conductor

D. A connector marked CO/ALR or AL-rated and an antioxidant compound where required

48. A baseboard electric heater rated 1500 W at 240 V draws approximately what current?

A. 6.25 A

B. 12.5 A

C. 3.1 A

D. 10 A

49. Electric heating cable installed in a ceiling must maintain clearance from:

A. The colour of the drywall

B. The room thermostat wiring only

C. Recessed luminaires and other heat-producing equipment per code

D. The exterior wall framing only

50. A heat recovery ventilator (HRV) is being wired in a residence. The HRV is part of which building system?

A. The fire alarm system

B. The HVAC (ventilation) system

C. The cathodic protection system

D. The emergency lighting system

51. Exit signs in a commercial building must remain illuminated during a power failure. This is accomplished by:

A. An integral battery or connection to an emergency power source

B. A standard switched circuit

C. A GFCI-protected receptacle

D. A photocell only

52. Emergency lighting in a means of egress must provide a minimum average illumination level to ensure safe evacuation. The unit batteries must be tested:

A. Only at the time of installation

B. Never, once commissioned

C. Only when the building is occupied

D. Periodically per code and maintenance requirements

53. A thermostat for an electric forced-air furnace is rated as a "line-voltage" type. This means it:

A. Operates on a 24 V control circuit

B. Switches the full supply voltage to the load directly

C. Requires a separate transformer

D. Can only be used with gas furnaces

54. Cathodic protection systems on underground metal structures use an impressed current or sacrificial anode to:

A. Increase the structure's conductivity for signaling

B. Provide lighting to the buried structure

C. Prevent corrosion by controlling the electrochemical reaction

D. Meter the soil resistivity

55. When installing a raceway through a fire-rated wall, the penetration must be:

A. Firestopped with an approved system to maintain the fire rating

B. Left open for ventilation

C. Filled with ordinary spray foam

D. Sealed only with electrical tape

56. A run of teck cable is supported horizontally. The maximum support spacing for the cable is governed by:

A. The colour of the cable jacket

B. The ambient humidity only

C. The number of conductors only

D. The Canadian Electrical Code support requirements for the cable type

57. A 120 V branch circuit feeds a string of recessed luminaires totaling 1440 W. On a 15 A circuit, this load represents what percentage of the breaker rating?

A. 50%

B. 60%

C. 80%

D. 100%

58. When wiring a 3-way switch arrangement to control a luminaire from two locations, the conductors running between the two 3-way switches are called:

A. Grounding conductors

B. Traveler conductors

C. Neutral conductors

D. Bonding conductors

59. A conductor's ampacity is affected by ambient temperature. When the ambient temperature rises above 30 °C, the conductor ampacity must be:

A. Corrected downward using the code temperature correction factors

B. Increased proportionally

C. Held constant

D. Replaced with a higher voltage rating

60. An HVAC rooftop unit requires a service receptacle within a specified distance. This receptacle must be:

A. Rated 600 V

B. Connected to the unit's control circuit

C. A twist-lock 50 A type

D. A 125 V GFCI-protected receptacle accessible for servicing

61. When sizing a raceway for conductor fill with three or more conductors, the maximum fill of the cross-sectional area permitted is approximately:

A. 53%

B. 40%

C. 31%

D. 25%

62. A pull box for conductors entering and leaving on opposite walls in a straight pull must have a length of at least:

A. The diameter of the largest conduit

B. Twice the diameter of the largest conduit

C. Four times the largest conduit

D. Eight times the trade diameter of the largest raceway

63. Knob-and-tube wiring discovered during a renovation should be:

A. Re-energized at higher voltage

B. Spliced with modern NMD90 freely

C. Evaluated and typically replaced, as it lacks a bonding conductor and modern protection

D. Wrapped with additional insulation and left in service indefinitely

64. A surface metal raceway is being installed in a finished office. Its primary advantage is:

A. Allowing wiring to be added without opening finished walls

B. Higher conductor ampacity than conduit

C. Eliminating the need for a bonding conductor

D. Providing fire-rated penetration automatically

65. Electric heating for a snow-melting system embedded in a concrete driveway must include:

A. No protection of any kind

B. Only a manual switch

C. A standard 15 A receptacle

D. Ground-fault protection of equipment (GFPE) and proper embedment depth

66. When making up conductors in a device box, the bonding/grounding conductors should be:

A. Left unconnected if the box is plastic and the device is self-grounding incorrectly

B. Joined together and bonded to the box (if metal) and the device

C. Connected only to the neutral bar

D. Taped off individually and capped

67. A communication cable and a 120 V power conductor share a common enclosure. The code requires:

A. Separation or a barrier between power and communication conductors

B. They be twisted together for shielding

C. The communication cable carry the neutral

D. Both share the same terminal block

68. Emergency lighting unit equipment installed in a stairwell must illuminate the path. The duration the emergency lighting must operate after a power failure is typically a minimum of:

A. 5 minutes

B. 15 minutes

C. 30 minutes

D. 8 hours

69. When an electrician installs ENT (electrical non-metallic tubing), a key limitation compared to EMT is that ENT:

A. Has a higher temperature rating

B. Can be used in all hazardous locations

C. Requires no support

D. Is not permitted to be left exposed in certain locations and has temperature/physical-protection limits

70. A magnetic motor starter uses a control relay coil and contacts. The "holding" or "seal-in" contact in a start/stop circuit serves to:

A. Reverse the motor rotation

B. Maintain the coil energized after the momentary start button is released

C. Provide overload protection

D. Reduce the starting current

71. Where are the overload relays placed for a motor that is not thermally protected internally?

A. In the motor starter, sized to the motor full-load current

B. At the distribution panel main

C. Inside the motor junction box only

D. In the emergency stop station

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

A. Increase the running speed

B. Improve the power factor at full load

C. Limit the inrush starting current and reduce mechanical stress

D. Eliminate the need for overload protection

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

A. Resistance in the rotor circuit

B. Frequency and voltage applied to the motor

C. Number of motor poles physically

D. DC field excitation

74. A VFD installation requires special cable and grounding practices mainly to:

A. Increase the motor torque

B. Reduce the cost of the conductors

C. Allow longer cable runs without limit

D. Mitigate electrical noise, reflected-wave voltage, and bearing currents

75. The full-load current of a three-phase, 10 hp, 600 V motor is taken from the code motor tables rather than calculated because:

A. The code FLA values include practical motor design factors for sizing conductors and protection

B. Calculation is not possible for three-phase motors

C. The nameplate is never reliable

D. Voltage does not affect motor current

76. A squirrel-cage induction motor runs slower than synchronous speed. The difference between synchronous and actual rotor speed is called:

A. Power factor

B. Torque ripple

C. Slip

D. Inrush

77. To reverse the direction of rotation of a three-phase induction motor, the electrician must:

A. Reverse the DC supply polarity

B. Add a starting capacitor

C. Increase the supply frequency

D. Interchange any two of the three line conductors

78. A motor control centre (MCC) provides:

A. A centralized assembly of motor starters, protection, and control in one structure

B. Only metering for the building service

C. Power factor correction exclusively

D. Emergency lighting backup

79. A programmable logic controller (PLC) reads field devices through its:

A. Power supply module only

B. Input modules

C. Output modules only

D. Communication port exclusively

80. In a PLC ladder-logic program, a normally open contact instruction examined for an "on" condition is true when the:

A. Output coil is forced off

B. Power supply is disconnected

C. Referenced input bit is in the on (1) state

D. Program is in stop mode

81. Overload relays protect a motor against:

A. Sustained currents above full-load that cause overheating over time

B. Instantaneous short-circuit faults only

C. Lightning surges

D. Low ambient temperature

82. A motor circuit's short-circuit and ground-fault protection (the branch-circuit breaker or fuse) is sized differently from the overload protection because it must:

A. Limit the running speed

B. Provide power factor correction

C. Allow motor starting inrush while still clearing faults quickly

D. Reduce the motor torque

83. A two-speed, single-winding (consequent-pole) motor changes speed by:

A. Adding external rotor resistance

B. Reconfiguring the stator winding connections to change the number of poles

C. Changing the supply voltage only

D. Inserting a capacitor in series

84. When commissioning a VFD-driven pump, the parameter that sets the lowest operating speed to avoid motor overheating from reduced cooling is the:

A. Maximum output frequency

B. Acceleration ramp time

C. Carrier (switching) frequency

D. Minimum frequency limit

85. A control circuit uses a normally closed (NC) stop pushbutton wired in series. This fail-safe design ensures that:

A. A broken wire or loss of continuity stops the motor

B. The motor restarts automatically after a fault

C. The stop button energizes the coil

D. The overloads are bypassed

86. An automated lighting control system uses an occupancy sensor (PIR). The PIR sensor detects:

A. Ambient sound levels

B. Carbon dioxide concentration

C. Infrared energy from a moving body (motion)

D. The supply voltage frequency

87. When a motor repeatedly trips its overload relay shortly after starting, the most likely cause to investigate first is:

A. The colour of the control wiring

B. The PLC firmware version

C. The ambient lighting level

D. Excessive load, low voltage, or a mechanical binding/locked rotor condition

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

A. Continuously varies the running speed of the motor

B. Controls only the voltage during start and run at line frequency

C. Converts AC to DC permanently

D. Provides full regenerative braking

89. In a forward/reverse magnetic starter, mechanical and electrical interlocks are provided to:

A. Prevent both contactors from closing at the same time and shorting the supply

B. Increase the motor horsepower

C. Reduce the control voltage

D. Provide overload protection

90. An automated building control system communicates between controllers using a network protocol. A common open protocol used for building automation is:

A. The motor nameplate standard

B. The conduit fill table

C. The CEC bonding rule

D. BACnet

91. A fire alarm system's initiating device circuit (IDC) is supervised. Supervision means the panel can:

A. Increase the horn volume automatically

B. Adjust the lighting in the building

C. Detect an open or fault in the circuit wiring and signal a trouble condition

D. Convert the signal to three-phase power

92. A door-chime/signaling transformer for a residential doorbell typically reduces 120 V to a low voltage of approximately:

A. 48 V

B. 16 V (low-voltage Class 2)

C. 120 V unchanged

D. 347 V

93. Category cable (e.g., Cat 6) for a structured data network must limit the amount of untwisting at terminations primarily to:

A. Increase the conductor ampacity

B. Reduce the cable weight

C. Allow higher voltage operation

D. Preserve performance and minimize crosstalk/signal degradation

94. A community antenna television (CATV) coaxial cable system uses a specific characteristic impedance of:

A. 75 ohms

B. 50 ohms

C. 120 ohms

D. 600 ohms

95. When installing fire alarm wiring, the conductors must be kept separate from power conductors and identified, and the cable used must be:

A. Any general-purpose communication cable

B. Standard NMD90 only

C. Rated and listed for fire alarm use (e.g., FAS/fire-rated cable)

D. Bare copper grounding wire

96. An integrated control system ties together HVAC, lighting, and security through a central interface. The main benefit of integration is:

A. Eliminating the need for any field wiring

B. Coordinated monitoring and control of multiple subsystems from one platform

C. Removing the requirement for overcurrent protection

D. Increasing the building service voltage

97. A nurse-call signaling system in a healthcare facility is classified as a life-safety signaling system, which means it must:

A. Be installed with reliability and supervision appropriate to its critical function

B. Use only 600 V conductors

C. Share conduit freely with power feeders

D. Operate only on battery with no AC source

98. When terminating fibre-optic cable for a communication backbone, the most critical factor affecting signal quality is:

A. The colour of the outer jacket

B. The ampacity of the strength member

C. The grounding of the glass core

D. A clean, properly polished/aligned connector end-face with minimal loss

99. A passive infrared (PIR) motion sensor used in a security system may produce false alarms if it is:

A. Wired with bonding conductors

B. Connected to a supervised loop

C. Aimed at a heat source such as an HVAC vent or sunlit window

D. Mounted at the recommended height

100. A signaling system's Class 2 circuit is limited in voltage and power so that it is:

A. Capable of carrying motor loads

B. Considered to present a low risk of fire ignition and electric shock, with relaxed wiring methods

C. Required to use the same conductors as the service

D. Always installed in rigid conduit only

Practice Exam 8: Answer Key and Explanations

1. C — The correct lockout sequence is: notify affected workers, de-energize, lock and tag the disconnect, then test for absence of voltage. Notification protects others, and verifying zero energy with a meter confirms the isolation before any work begins. Skipping the voltage test is the most common fatal error in lockout procedures.

2. A — Class C extinguishers are rated for energized electrical equipment because they use a non-conductive agent that won't create a shock path back to the operator. Using water or foam (Class A/B) on a live circuit can electrocute the user. Once power is removed, the underlying fire may reclassify as Class A.

3. D — Fall protection is required when the working height exceeds approximately 3 m (10 ft) under most Canadian OHS regulations. Above this threshold, an unprotected fall is likely to cause serious injury or death. The requirement applies regardless of interior or exterior work.

4. B — The Safety Data Sheet (SDS) is the legally required document providing hazard, handling, first-aid, and PPE information for a chemical product. It is mandated under WHMIS and must be accessible to workers using the product. This ensures workers can respond correctly to exposure or spills.

5. A — A hydraulic bender reduces operator effort and delivers consistent, repeatable bends in larger trade sizes that hand benders cannot manage. The electrician still must calculate deductions and deburr separately. Consistency matters for proper conductor fill and raceway alignment.

6. D — The mechanical/HVAC coordination drawing shows ductwork routing, allowing the electrician to plan raceways that avoid conflicts. Coordinating early prevents costly rework when trades compete for the same ceiling space. This is core to organizing multi-trade work.

7. C — Selecting support channel and fasteners depends on the combined load weight and the anchoring substrate (concrete, steel, wood). An undersized fastener or wrong anchor for the substrate can fail under load. Proper selection prevents collapse of energized cable tray.

8. B — An insulation resistance (megger) test confirms the insulation between conductors and ground is intact before energizing. Low readings reveal damaged insulation that could cause faults or shock. Commissioning catches these problems before the system goes live.

9. A — The most effective mentoring approach is to demonstrate the task, then observe and coach as the apprentice practices. Active practice with feedback builds competency far better than passive reading or watching. Supervised repetition reinforces safe technique.

10. D — Before decommissioning a motor circuit, the electrician must confirm it is fully de-energized and isolated from all energy sources. Stored energy or backfeed can injure the worker even when the main switch appears off. Verification is the foundation of safe decommissioning.

11. C — A calibrated torque tool ensures terminations are neither under- nor over-tightened, preventing loose, high-resistance connections that overheat. Loose lugs are a leading cause of panel fires; over-torquing can crack the lug or strand the conductor. Correct torque maintains a reliable, cool connection.

12. B — A 200 A residential service typically uses No. 2/0 AWG copper service conductors per CEC ampacity tables for the 75 °C/90 °C columns with applicable allowances. The conductor must safely carry the rated service current. Proper sizing prevents overheating of the service entrance.

13. A — A kilowatt-hour meter records the quantity of energy consumed over time, which is the basis for utility billing. It integrates power (kW) across time to yield energy (kWh). It does not limit current or provide protection.

14. D — The interrupting rating (IR) is the maximum fault current a fuse can safely interrupt without rupturing or exploding. If available fault current exceeds the IR, the device can fail catastrophically. Matching IR to available fault current is essential for equipment and personnel safety.

15. B — In a coordinated system, the branch-circuit breaker nearest the fault should open first, isolating only the faulted circuit. This selective coordination keeps the rest of the system energized. Proper coordination minimizes outage scope and aids troubleshooting.

16. C — Single-phase loads should be distributed as evenly as possible across all three phases to balance the system. Balanced loading minimizes neutral current and prevents one phase from overloading. This improves efficiency and equipment longevity.

17. A — A surge protective device diverts transient overvoltages (from lightning or switching) to ground, protecting downstream equipment. It clamps voltage spikes that would otherwise damage insulation and electronics. It does not regulate steady-state voltage or correct power factor.

18. D — An online double-conversion UPS continuously supplies conditioned power with zero transfer time during an outage because the load always runs from the inverter. There is no momentary gap as with a standby unit that must switch over. This is critical for sensitive equipment that cannot tolerate any interruption.

19. B — The main bonding jumper connects the neutral bus to the enclosure/equipment grounding bus at the service. This bond establishes the reference that allows overcurrent devices to clear ground faults. It is made only at the service, not downstream, to avoid objectionable neutral current on grounding paths.

20. C — The grounding electrode system provides a low-impedance path to earth for lightning and stabilizes the system voltage to ground. It is not intended to carry normal load current. This earth reference limits voltage rise during transient and fault events.

21. A — Ground-fault protection of equipment (GFPE) operates on low-level ground faults that may not draw enough current to trip the phase overcurrent device. Such arcing faults can cause severe burndown damage if undetected. GFPE catches them before they escalate.

22. D — A transfer switch with mechanical/electrical interlock prevents the generator and utility from being connected simultaneously. Paralleling an out-of-sync generator with the grid would be catastrophic and can back-feed the utility, endangering line workers. The interlock guarantees only one source feeds the load.

23. B — Anti-islanding disconnects the PV inverter from the grid when utility power is lost. This prevents the inverter from energizing a "dead" line and protects utility workers from unexpected backfeed. It is a mandatory safety function for grid-tied systems.

24. C — Lithium-ion BESS installations require thermal management and ventilation to prevent thermal runaway, a self-sustaining overheating reaction that can cause fire. Heat buildup must be dissipated and monitored. This is the principal safety concern unique to lithium chemistry.

25. B — Minimum approach distances for high-voltage work are determined by the system voltage and applicable safety regulations. Higher voltages require greater clearance to prevent flashover and arc contact. Maintaining these distances is fundamental to high-voltage safety.

26. A — A wye secondary provides a neutral point for single-phase 347 V loads and a stable ground reference for the 600/347 V system. The neutral allows both phase-to-phase (600 V) and phase-to-neutral (347 V) connections. This versatility is why wye is standard for distribution.

27. D — Secondary line current = VA ÷ (E_line × √3) = 75,000 ÷ (208 × 1.73) ≈ 208 A. The √3 factor accounts for the three-phase relationship between line and phase quantities. This calculation sizes the secondary conductors and protection.

28. C — A new transformer should be energized from the primary with the secondary unloaded, then have its voltages verified before loading. This confirms correct turns ratio and connections without stressing the windings. Loading only after verification prevents damaging a miswired transformer.

29. A — An open-delta (V-V) bank delivers approximately 57.7% of the capacity of a full three-transformer delta bank. The two transformers cannot fully utilize their combined kVA due to the phase relationship. This is the trade-off for running three-phase from only two transformers.

30. B — An open CT secondary on an energized primary can develop dangerous high voltage across the open terminals because the secondary loses its current path and the core saturates. This poses a lethal shock hazard and can destroy the CT. CTs must always be shorted before opening the secondary circuit.

31. D — A line reactor reduces harmonic distortion and limits inrush current to a sensitive load. The series inductance smooths current changes and buffers the load from disturbances. It is commonly added ahead of drives and electronic equipment.

32. C — Discoloured, pitted meter socket jaws indicate a high-resistance connection causing localized heating. Heat from a poor contact degrades the metal over time and can lead to failure or fire. This finding requires correction of the connection.

33. A — A time-overcurrent (51) relay responds to current magnitude over a time-delayed (inverse-time) characteristic curve. Higher fault currents trip faster while moderate overloads allow time delay. This curve enables coordination with downstream devices.

34. D — Before paralleling generators, voltage, frequency, phase sequence, and phase angle must all match. Closing the breaker with any mismatch produces large circulating currents and mechanical shock that can wreck the machines. Synchronizing equipment verifies these conditions.

35. B — Step and touch potential calculations protect personnel from dangerous voltage gradients across the ground during a fault. A ground grid limits the voltage a person could bridge between feet or hand-to-foot. These calculations are essential for substation safety design.

36. A — A neutral grounding resistor (NGR) limits ground-fault current to a safe level, reducing arc energy and equipment damage while still allowing fault detection. It prevents the destructive high currents of a solidly grounded system. This is common on generators and medium-voltage systems.

37. C — The primary fuse on a control transformer protects against primary winding faults and inrush, sized per code for the transformer rating. Primary protection guards the supply and the transformer itself. Secondary fusing separately protects the control circuit loads.

38. B — A bidirectional revenue meter records both imported and exported energy, which is required when a renewable system feeds power back to the grid. Net metering depends on measuring flow in both directions. A standard meter cannot account for exported generation.

39. D — Servicing a 25 kV line requires verifying de-energization, applying grounds, and using rated insulating equipment. Protective grounds discharge stored and induced energy and provide a path if the line is accidentally re-energized. These steps are non-negotiable for medium-voltage work.

40. A — When more than three current-carrying conductors share a raceway, ampacity must be derated using the code adjustment factors. Bundled conductors trap heat, reducing each conductor's safe current. Derating prevents insulation damage from accumulated heat.

41. D — The CEC permits a maximum total of 360° of bends (equivalent to four 90° bends) in a conduit run between pull points. Excessive bends increase pulling tension and can damage conductor insulation. Pull boxes break up runs that need more bends.

42. B — Approved cable-pulling lubricant reduces friction and the pulling tension on conductors during installation. Lower tension protects insulation and prevents conductor stretching. It does not affect ampacity or insulation rating.

43. A — For box fill, all internal cable clamps collectively count as one conductor volume based on the largest conductor present in the box. This accounts for the space the clamps occupy. Proper fill calculation prevents overcrowding that damages insulation.

44. C — Liquid-tight flexible metal conduit suits a motor connection where vibration and moisture are present. Its flexibility absorbs vibration while the liquid-tight jacket excludes moisture. Rigid raceway would transmit vibration and could crack.

45. C — Bedroom branch-circuit receptacles in a dwelling require arc-fault circuit interrupter (AFCI) protection. AFCIs detect dangerous arcing faults in wiring and cords that ordinary breakers miss. This protection targets a leading cause of residential electrical fires.

46. B — Receptacles within 1.5 m of a sink must be GFCI-protected because the proximity to water raises shock risk. A GFCI trips on small leakage currents before they become lethal. This is a core wet-location protection requirement.

47. D — Aluminum conductors must terminate on connectors marked CO/ALR or AL-rated, with antioxidant compound applied where required. Aluminum oxidizes and creeps, so improper terminals lead to loose, overheating connections. Correct rated connectors prevent failures and fires.

48. A — Current = Power ÷ Voltage = 1500 W ÷ 240 V = 6.25 A. This straightforward Ohm's-law power relationship determines the load current. Knowing the current sizes the conductor and overcurrent device for the heater.

49. C — Ceiling heating cable must maintain clearance from recessed luminaires and other heat-producing equipment per code. Trapped heat between the cable and a fixture can cause overheating and fire. Spacing rules protect both the cable and adjacent equipment.

50. B — An HRV is part of the HVAC (ventilation) system, exchanging stale indoor air with fresh outdoor air while recovering heat. It improves indoor air quality and energy efficiency. The electrician wires its motor and controls as an HVAC component.

51. A — Exit signs stay illuminated during a power failure via an integral battery or connection to an emergency power source. This ensures the egress path remains marked when normal power fails. Continuous illumination is a life-safety requirement.

52. D — Emergency lighting unit batteries must be tested periodically per code and maintenance requirements to confirm they will function in an outage. Batteries degrade over time and may fail silently. Scheduled testing verifies the system is ready when needed.

53. B — A line-voltage thermostat switches the full supply voltage to the heating load directly, without a low-voltage control circuit. It is common on baseboard and electric furnace applications. The contacts must be rated for the load current and voltage.

54. C — Cathodic protection prevents corrosion by controlling the electrochemical reaction on buried metal, using a sacrificial anode or impressed current to make the structure cathodic. This protects pipelines and tanks from electrolytic deterioration. The electrician installs and maintains the current source and connections.

55. A — A raceway penetrating a fire-rated wall must be firestopped with an approved system to maintain the wall's fire rating. The firestop restores the barrier the penetration breached, limiting fire and smoke spread. Ordinary foam or tape does not provide a rated seal.

56. D — Maximum support spacing for teck cable is governed by the CEC support requirements for that cable type. The code specifies intervals to prevent sag, strain on terminations, and mechanical damage. Following these spacings ensures a secure, durable installation.

57. C — 1440 W ÷ 120 V = 12 A, which on a 15 A circuit is 12 ÷ 15 = 80%. This matches the maximum continuous load allowance of 80% of the breaker rating. Sizing to this limit prevents nuisance tripping and overheating.

58. B — The conductors running between two 3-way switches are called traveler conductors. They provide the alternate paths that let either switch change the circuit state. Correct traveler wiring is essential for proper multi-location control.

59. A — When ambient temperature exceeds 30 °C, conductor ampacity must be corrected downward using the code temperature correction factors. Higher ambient heat reduces the conductor's ability to dissipate its own heat. Correction prevents insulation damage in hot environments.

60. D — An HVAC rooftop unit must have a 125 V GFCI-protected service receptacle accessible for servicing. The GFCI protects technicians using tools on a wet rooftop. The receptacle provides convenient, safe power at the equipment.

61. B — For three or more conductors, the maximum raceway fill is approximately 40% of the cross-sectional area. This limit allows heat dissipation and permits the conductors to be pulled without damage. Exceeding it risks insulation abrasion and overheating.

62. D — For a straight pull, the pull box length must be at least eight times the trade diameter of the largest raceway. Adequate length prevents sharp bending of conductors at the entry and exit. This protects insulation during the pull and afterward.

63. C — Knob-and-tube wiring should be evaluated and typically replaced because it lacks a bonding conductor and modern overcurrent/insulation protection. It is also easily damaged by added insulation. Replacement brings the installation up to current safety standards.

64. A — Surface metal raceway lets wiring be added in a finished space without opening walls. It mounts on the surface and routes conductors where concealed work would be impractical. This makes it ideal for retrofits and office additions.

65. D — An embedded snow-melting heating system requires ground-fault protection of equipment (GFPE) and proper embedment depth. GFPE protects against shock from a damaged heating element in a wet, walked-on surface. Correct depth protects the cable and ensures effective melting.

66. B — Bonding/grounding conductors in a device box must be joined together and bonded to the box (if metal) and the device. This maintains a continuous low-impedance fault path so overcurrent devices can clear ground faults. A broken bonding path leaves metal parts dangerously energized during a fault.

67. A — The code requires separation or a barrier between power and communication conductors sharing an enclosure. This prevents power-system voltage from coupling into or contacting the low-voltage communication wiring. Separation protects both the signal integrity and personnel.

68. C — Emergency lighting in a stairwell must typically operate for a minimum of 30 minutes after a power failure. This duration allows time for safe evacuation of the building. Code specifies the minimum based on egress needs.

69. D — ENT is not permitted to be left exposed in certain locations and carries temperature and physical-protection limitations compared to EMT. Being non-metallic, it is more vulnerable to physical and heat damage. The electrician must observe these restrictions when choosing ENT.

70. B — The seal-in (holding) contact maintains the starter coil energized after the momentary start button is released. It parallels the start button so the circuit stays latched. Releasing the stop button or an overload trip breaks the latch and stops the motor.

71. A — Overload relays for a non-thermally-protected motor are placed in the motor starter, sized to the motor's full-load current. Locating them there lets them sense and respond to sustained overcurrent. Proper sizing protects the windings from overheating.

72. C — A reduced-voltage starter limits inrush starting current and reduces mechanical stress on the motor and driven load. Lower inrush reduces voltage dip on the supply and wear on couplings and belts. It does not eliminate the need for overload protection.

73. B — A VFD controls AC induction motor speed by varying the frequency and voltage applied to the motor. Maintaining a proper volts-per-hertz ratio preserves torque across the speed range. This is the fundamental principle of variable-speed AC drives.

74. D — VFD installations need special cable and grounding to mitigate electrical noise, reflected-wave voltage, and bearing currents. High-frequency switching produces these effects, which can damage motor insulation and bearings. Proper cable and bonding protect the motor and reduce interference.

75. A — Motor full-load current is taken from code tables because those values include practical design factors used for sizing conductors and protection. The tabulated FLA standardizes circuit design across motor variations. Using table values rather than nameplate ensures code-compliant sizing.

76. C — The difference between synchronous speed and actual rotor speed in an induction motor is called slip. Slip is necessary to induce rotor current and produce torque. A motor at exactly synchronous speed would generate no torque.

77. D — To reverse a three-phase induction motor, interchange any two of the three line conductors. Swapping two phases reverses the rotating magnetic field direction. This simple change is the basis of forward/reverse starter wiring.

78. A — A motor control centre (MCC) is a centralized assembly of motor starters, protection, and control housed in one structure. It consolidates motor circuits for organized distribution and maintenance. This centralization is common in industrial facilities.

79. B — A PLC reads field devices (switches, sensors) through its input modules. The input modules convert field signals into logic the processor evaluates. Outputs then drive contactors, valves, or indicators based on the program.

80. C — A normally open contact instruction examined for an "on" condition is true when the referenced input bit is in the on (1) state. The instruction passes logic continuity only when its bit is set. This is the foundation of ladder-logic evaluation.

81. A — Overload relays protect a motor against sustained currents above full-load that cause gradual overheating. They allow brief starting inrush but trip on prolonged overcurrent. This protects the winding insulation from thermal damage over time.

82. C — Short-circuit and ground-fault protection is sized to allow motor starting inrush while still clearing faults quickly. It must not trip on the legitimate high inrush at start, yet must open fast on a true fault. This is why it is set higher than the overload protection.

83. B — A consequent-pole two-speed single-winding motor changes speed by reconfiguring the stator winding connections to change the number of poles. Pole count and synchronous speed are inversely related. This provides two distinct speeds from one winding.

84. D — The minimum frequency limit sets the lowest operating speed to prevent motor overheating from reduced self-cooling at low speeds. Many motor-mounted fans cool less effectively as speed drops. Setting this limit protects the motor during slow operation.

85. A — A normally closed stop pushbutton wired in series is fail-safe: a broken wire or loss of continuity stops the motor. The control circuit requires continuity to keep the coil energized. This design ensures faults stop rather than run the motor unexpectedly.

86. C — A PIR occupancy sensor detects infrared energy from a moving body (motion). It senses changes in radiated heat across its field of view. This triggers lighting control based on occupancy.

87. D — Repeated overload trips shortly after starting point first to excessive load, low voltage, or a mechanical binding/locked-rotor condition. These cause sustained high current the overload correctly senses. Investigating the mechanical and supply conditions identifies the root cause.

88. B — A soft starter controls only the voltage during start, then runs the motor at full line frequency. Unlike a VFD, it does not vary running speed. It reduces inrush during start but offers no continuous speed control.

89. A — Mechanical and electrical interlocks in a forward/reverse starter prevent both contactors from closing simultaneously, which would short the supply phase-to-phase. The interlock blocks the opposite contactor until the first releases. This protects the equipment and the supply.

90. D — BACnet is a common open protocol used for building automation communication between controllers. It enables interoperability among devices from different manufacturers. Open protocols simplify integration of HVAC, lighting, and other systems.

91. C — A supervised initiating device circuit lets the panel detect an open or fault in the circuit wiring and signal a trouble condition. Supervision ensures a broken wire is reported rather than silently disabling protection. This integrity monitoring is fundamental to life-safety systems.

92. B — A residential doorbell signaling transformer reduces 120 V to about 16 V, a Class 2 low voltage. The low voltage limits shock and fire risk for the chime wiring. Class 2 limits permit relaxed wiring methods.

93. D — Limiting untwist at Cat 6 terminations preserves performance and minimizes crosstalk and signal degradation. The twist rate provides noise cancellation that excessive untwisting destroys. Maintaining the twist is critical for high-speed data integrity.

94. A — CATV coaxial systems use a 75-ohm characteristic impedance. Matching this impedance throughout minimizes reflections and signal loss. Using 50-ohm cable instead would degrade the video signal.

95. C — Fire alarm wiring must use cable rated and listed for fire alarm use, kept separate from and identified apart from power conductors. Listed fire alarm cable meets reliability and survivability requirements. Proper cable and separation preserve system integrity in an emergency.

96. B — Integrated control systems provide coordinated monitoring and control of multiple subsystems from one platform. Tying HVAC, lighting, and security together improves efficiency and situational awareness. Integration does not remove field wiring or protection requirements.

97. A — A nurse-call life-safety signaling system must be installed with reliability and supervision appropriate to its critical function. Patients depend on it during emergencies, so dependable operation is mandatory. Supervision ensures faults are detected and reported.

98. D — The most critical factor in fibre termination is a clean, properly polished and aligned connector end-face with minimal loss. Contamination or poor alignment scatters light and increases attenuation. Quality terminations preserve the optical signal.

99. C — A PIR sensor aimed at a heat source such as an HVAC vent or sunlit window can produce false alarms. Rapid changes in radiated heat mimic a moving body. Proper aiming away from heat sources prevents nuisance triggers.

100. B — A Class 2 circuit is limited in voltage and power so it presents a low risk of fire ignition and electric shock, allowing relaxed wiring methods. The power limitation is the safety basis for these allowances. This is why low-voltage signaling uses simplified installation rules.