PRACTICE EXAM 10: CONSTRUCTION ELECTRICIAN SIMULATION (100 QUESTIONS)

1. A journeyperson is assigned a confined space task inside an electrical vault. Before entry, atmospheric testing is performed. Which sequence of atmospheric tests is correct?

A. Toxic gases, then flammable gases, then oxygen

B. Flammable gases, then oxygen, then toxic gases

C. Oxygen, then flammable gases, then toxic gases

D. Oxygen, then toxic gases, then flammable gases

2. According to the Canadian Electrical Code, what is the maximum allowable voltage drop for a combined feeder and branch circuit supplying a load?

A. 5%

B. 3%

C. 2%

D. 7%

3. A worker must lock out a 600 V disconnect before servicing a motor. After applying the lock and tag, what is the final required step before beginning work?

A. Notify the site supervisor in writing

B. Apply a second backup lock to the device

C. Record the lockout in the maintenance log

D. Verify the absence of voltage by testing the circuit

4. Which conductor insulation type is rated for use in wet locations at 90°C?

A. T90 Nylon

B. RW90 XLPE

C. TW

D. R90

5. A 3-phase, 4-wire wye system measures 208 V line-to-line. What is the approximate line-to-neutral voltage?

A. 120 V

B. 240 V

C. 347 V

D. 416 V

6. When bending EMT conduit, the "take-up" for a 1/2" conduit using a hand bender is typically:

A. 8 inches

B. 6 inches

C. 7 inches

D. 5 inches

7. A motor nameplate indicates a full-load current of 28 A. According to the CEC, the overload protection for a continuous-duty motor with a service factor of 1.15 is generally set at what percentage of full-load current?

A. 115%

B. 140%

C. 125%

D. 100%

8. What is the primary purpose of a bonding conductor in an electrical system?

A. To carry normal load current back to the source

B. To provide a low-impedance path for fault current

C. To limit voltage drop on long feeders

D. To reduce harmonic distortion on the neutral

9. A single-phase transformer has a primary of 600 V and a secondary of 120 V. If the primary draws 5 A, what is the approximate secondary current (ignoring losses)?

A. 5 A

B. 1 A

C. 12 A

D. 25 A

10. Which CEC table is used to determine the allowable ampacity of copper conductors in a raceway with no more than three current-carrying conductors?

A. Table 2

B. Table 4

C. Table 39

D. Table 6

11. A GFCI (Class A) is designed to trip at a ground-fault current of approximately:

A. 30 mA

B. 5 mA

C. 15 mA

D. 100 mA

12. When terminating a conductor under a screw terminal, the loop should be wrapped in which direction?

A. Counterclockwise so it loosens as torqued

B. Either direction provided it is fully seated

C. Clockwise so it tightens as the screw is torqued

D. Straight in with no loop required

13. A reduced-voltage starter is most commonly used to:

A. Limit inrush current during motor starting

B. Increase the running torque of the motor

C. Improve the power factor of the circuit

D. Provide dynamic braking on shutdown

14. The minimum bending radius for a cable is specified to:

A. Reduce the cost of installation labour

B. Allow more conductors per raceway

C. Improve the appearance of the run

D. Prevent damage to the conductor insulation

15. In a three-phase induction motor, reversing the direction of rotation is accomplished by:

A. Reversing all three line connections

B. Interchanging any two of the three line leads

C. Adding a reversing resistor to the rotor

D. Reversing the polarity of the field winding

16. A continuity test of a conductor is best performed using a:

A. Ohmmeter on a de-energized circuit

B. Voltmeter on an energized circuit

C. Clamp-on ammeter

D. Megohmmeter at 1000 V

17. According to the CEC, receptacles installed in a residential bathroom must be protected by:

A. An arc-fault circuit interrupter only

B. A 20 A double-pole breaker

C. A ground-fault circuit interrupter

D. A surge protective device

18. A control transformer in a motor control circuit primarily provides:

A. Three-phase power to the motor windings

B. Overload protection for the motor

C. Power factor correction for the panel

D. A safer low-voltage supply for control devices

19. The purpose of a megohmmeter (insulation resistance tester) is to measure:

A. The continuity of a low-resistance bond

B. The resistance between a conductor and ground

C. The full-load current of a motor

D. The phase rotation of a supply

20. Which of the following is a Class C fire, as classified for fire extinguisher selection?

A. A fire involving energized electrical equipment

B. A fire involving ordinary combustibles like wood

C. A fire involving flammable liquids

D. A fire involving combustible metals

21. When sizing a neutral conductor for a feeder supplying primarily non-linear loads, the electrician must consider:

A. A reduction in the neutral size is permitted

B. The neutral may be omitted entirely

C. Harmonic currents that may overload the neutral

D. Only the line-to-line voltage of the feeder

22. A "hickey" is a tool used by an electrician to:

A. Strip insulation from large conductors

B. Bend rigid metal conduit

C. Pull conductors through raceways

D. Crimp lugs onto cable ends

23. A 240 V single-phase load draws 4 kW. What is the approximate current drawn by this load?

A. 9.6 A

B. 24 A

C. 60 A

D. 16.7 A

24. The CEC requires that a disconnecting means for a motor be located:

A. Within sight of the motor and driven machinery

B. At the main service panel only

C. A minimum of 3 m from the motor

D. Inside a locked electrical room

25. In a star-delta starting method, the motor windings are initially connected in:

A. Delta to provide full voltage

B. Series across the line

C. Star (wye) to reduce starting voltage

D. Parallel to increase torque

26. A photovoltaic system's rapid shutdown function is intended primarily to:

A. Increase the array's energy output

B. Protect first responders from shock hazards

C. Prevent reverse current into the grid

D. Improve inverter efficiency

27. Which instrument measures the rotational speed of a motor shaft in RPM?

A. A wattmeter

B. A phase sequence indicator

C. A power factor meter

D. A tachometer

28. When pulling conductors into a long conduit run, lubricant is used to:

A. Reduce friction and pulling tension

B. Improve the conductor's ampacity

C. Increase insulation resistance

D. Prevent corrosion of the raceway

29. A delta-connected three-phase transformer secondary has a line current of 30 A. What is the approximate phase current in each winding?

A. 30 A

B. 90 A

C. 17.3 A

D. 52 A

30. The primary function of a motor starter's overload relay is to:

A. Disconnect the motor on a short circuit

B. Protect the motor from sustained overcurrent

C. Provide undervoltage protection

D. Limit the inrush current at startup

31. According to the CEC, the minimum size of copper bonding conductor for equipment is determined by:

A. The length of the circuit run

B. The voltage of the supply

C. The ambient temperature

D. The rating of the overcurrent device ahead of it

32. A circuit shows 120 V applied across a 60 Ω resistance. The power dissipated is:

A. 2 W

B. 7200 W

C. 240 W

D. 720 W

33. When working near overhead power lines, the minimum approach distance for an unqualified worker is determined by:

A. The voltage of the line and applicable regulations

B. The height of the equipment being used

C. The phase of the moon and weather

D. The colour of the conductors

34. A three-way switch is used to:

A. Control three separate luminaires from one point

B. Control one luminaire from two locations

C. Provide overcurrent protection to a circuit

D. Convert single-phase to three-phase power

35. The CEC permits aluminum conductors to be used provided that:

A. They are only installed in dry locations

B. They are doubled in size compared to copper

C. They are never used for feeders

D. Terminations are rated and listed for aluminum

36. A capacitor in an AC circuit causes the current to:

A. Be in phase with the voltage

B. Lag the voltage by 90 degrees

C. Lead the voltage by 90 degrees

D. Drop to zero immediately

37. When installing armoured cable (AC90), the anti-short bushing (red head) is installed to:

A. Protect conductors from the sharp armour edge

B. Provide a bonding connection

C. Increase the cable's pulling strength

D. Seal the cable against moisture

38. The CEC requires GFCI protection for receptacles installed:

A. In all bedrooms regardless of location

B. Outdoors and within 1.5 m of a sink

C. Only in detached garages

D. At every panel location

39. A wattmeter connected in a single-phase circuit measures:

A. Only the voltage of the circuit

B. Only the current of the circuit

C. The apparent power in volt-amperes

D. The true (real) power in watts

40. A PLC (Programmable Logic Controller) in an industrial control system is primarily used to:

A. Automate control sequences via programmed logic

B. Step down high voltage to control voltage

C. Provide short-circuit protection

D. Correct the power factor of motor loads

41. When two resistors of 6 Ω and 3 Ω are connected in parallel, the total resistance is:

A. 9 Ω

B. 4.5 Ω

C. 2 Ω

D. 18 Ω

42. The purpose of a junction box in a wiring system is to:

A. Increase the voltage at a splice point

B. Enclose and protect conductor splices

C. Reduce the ampacity of the circuit

D. Act as the main service disconnect

43. A motor's synchronous speed is determined by:

A. The supply frequency and number of poles

B. The horsepower rating only

C. The load applied to the shaft

D. The size of the overload heaters

44. When using a hand-held angle grinder, the most important PPE includes:

A. Hearing protection only

B. A dust mask only

C. Cut-resistant gloves only

D. Face/eye protection and appropriate guarding

45. A 100 m run of conductor has a measured resistance of 0.5 Ω. If the run is doubled to 200 m of the same conductor, the resistance becomes:

A. 0.25 Ω

B. 0.5 Ω

C. 1.0 Ω

D. 2.0 Ω

46. The CEC classifies a location where flammable gases may be present under normal conditions as:

A. Zone 2

B. Zone 0

C. Zone 1

D. An unclassified location

47. A multimeter set to measure resistance on an energized circuit will:

A. Give a false reading or be damaged

B. Read the resistance accurately

C. Automatically switch to voltage mode

D. Trip the upstream breaker

48. When a circuit breaker repeatedly trips on a motor circuit, the FIRST step a troubleshooting electrician should take is to:

A. Replace the breaker with a larger one

B. Bypass the breaker temporarily

C. Increase the overload heater size

D. Investigate the cause of the overcurrent

49. The neutral conductor in a balanced three-phase, four-wire wye system carries:

A. Full line current at all times

B. Approximately zero current when loads are balanced

C. Three times the phase current

D. The sum of all phase voltages

50. A pull box for conductors making a straight pull must have a minimum length of:

A. Twice the diameter of the largest raceway

B. Equal to the largest conductor size

C. Eight times the largest raceway diameter

D. 300 mm regardless of raceway size

51. A surge protective device (SPD) is installed to:

A. Divert transient overvoltages to ground

B. Increase the system voltage during brownouts

C. Correct the displacement power factor

D. Provide a disconnecting means for the service

52. The frequency of the standard Canadian power supply is:

A. 50 Hz

B. 25 Hz

C. 400 Hz

D. 60 Hz

53. In a sequence-of-operations control circuit, an interlock is used to:

A. Increase the speed of the process

B. Prevent unsafe or conflicting operations

C. Step up the control voltage

D. Reduce wiring material costs

54. A conductor's ampacity must be derated when:

A. The conductor is run vertically

B. The circuit operates below rated voltage

C. More than three current-carrying conductors share a raceway

D. The conductor is made of copper

55. Before energizing a newly installed service, the electrician should perform:

A. An insulation resistance and continuity verification

B. A load test at full rated current

C. A visual check only with no testing

D. A power factor measurement

56. A contactor differs from a relay primarily in that a contactor is:

A. Always normally closed

B. Operated only by hand

C. Used only in DC circuits

D. Designed to switch higher power loads

57. The CEC requires that flexible cords NOT be used as:

A. Temporary connections to portable tools

B. A substitute for fixed wiring of a structure

C. Connections to pendant luminaires

D. Connections to portable appliances

58. A step-down transformer has more turns on the:

A. Secondary winding

B. Core laminations

C. Primary winding

D. Tertiary winding

59. When a VFD (variable frequency drive) controls a motor's speed, it primarily varies the:

A. Frequency and voltage supplied to the motor

B. Number of poles in the stator

C. Resistance of the rotor bars

D. Physical length of the air gap

60. Proper grounding of a service is verified by measuring:

A. The motor full-load current

B. The line-to-line voltage

C. The phase rotation sequence

D. The ground electrode resistance

61. A conductor rated T90 in a dry location has a temperature rating of:

A. 60°C

B. 75°C

C. 90°C

D. 105°C

62. The most appropriate fire extinguisher for an energized electrical fire is rated:

A. Class A (water)

B. Class C (CO_2 or dry chemical)

C. Class D (dry powder)

D. Class K (wet chemical)

63. A series circuit with three 4 Ω resistors has a total resistance of:

A. 1.33 Ω

B. 4 Ω

C. 8 Ω

D. 12 Ω

64. The CEC requires that working space in front of electrical equipment operating at 600 V or less be a minimum depth of:

A. 1 metre

B. 0.5 metre

C. 2 metres

D. 3 metres

65. A pilot light in a motor control circuit is used to:

A. Provide overload protection

B. Limit the inrush current

C. Indicate the status of the circuit or device

D. Step down the control voltage

66. When two single-phase loads are connected line-to-line across a 240 V supply and the neutral is lost, the result is:

A. Both loads receive exactly 120 V

B. Voltage divides unequally based on load resistance

C. No current flows in either load

D. The supply voltage doubles to 480 V

67. A torque wrench is used during terminations to:

A. Apply manufacturer-specified tightening values

B. Bend conduit to precise angles

C. Strip large conductors quickly

D. Test the insulation resistance

68. The primary hazard of arc flash is:

A. Excessive noise from the equipment

B. Slow corrosion of the conductors

C. Minor static discharge only

D. Intense heat and pressure causing severe burns

69. A normally open (NO) contact in a control circuit:

A. Conducts current when the device is de-energized

B. Always remains open under all conditions

C. Closes when the controlling device is activated

D. Is used only for overload protection

70. The CEC requires conductors of different circuits in the same enclosure to be:

A. Always separated by metal barriers

B. Insulated for the maximum voltage present

C. The same colour throughout

D. Limited to one circuit per enclosure

71. When calculating conduit fill, the maximum permitted fill for three or more conductors is generally:

A. 40% of the conduit's cross-sectional area

B. 75% of the conduit's cross-sectional area

C. 100% of the conduit's cross-sectional area

D. 25% of the conduit's cross-sectional area

72. A photoelectric sensor in a control system detects:

A. The temperature of the motor windings

B. The phase rotation of the supply

C. The torque on the motor shaft

D. The presence or absence of an object via light

73. The CEC requires that a luminaire installed in a clothes closet be:

A. Installed only at floor level

B. Located to maintain clearance from storage areas

C. Always a bare incandescent lamp

D. Rated for wet locations only

74. A three-phase motor draws 10 A per line at 600 V with a power factor of 0.85. The approximate true power is:

A. 6000 W

B. 10 392 W

C. 8834 W

D. 17 320 W

75. When a fuse is replaced, the electrician must ensure the replacement is:

A. Of the correct type and rating for the circuit

B. Always a higher amperage to prevent nuisance trips

C. A circuit breaker instead of a fuse

D. Bypassed with a solid link if unavailable

76. The function of a check valve analog in electrical systems — a blocking diode in a DC circuit — is to:

A. Increase the circuit voltage

B. Store energy like a capacitor

C. Convert AC to three-phase

D. Allow current flow in one direction only

77. A ladder used for electrical work near energized parts should be made of:

A. Aluminum for light weight

B. Steel for maximum strength

C. Fibreglass for non-conductivity

D. Any material if rubber feet are fitted

78. The CEC requires that receptacles in a kitchen serving counter areas be:

A. Spaced no more than 3 m apart

B. Split-receptacle or GFCI-protected as specified

C. Wired with a shared single 15 A circuit

D. Installed at floor level only

79. An autotransformer differs from an isolation transformer because an autotransformer:

A. Shares a common winding between primary and secondary

B. Provides complete electrical isolation

C. Can only step voltage down, never up

D. Has no magnetic core

80. When troubleshooting a control circuit, a "live-dead-live" test on a voltage tester confirms that:

A. The motor is correctly sized

B. The overloads are properly set

C. The conduit is correctly bonded

D. The tester is functioning before and after testing

81. A residual-current device (RCD) operates by detecting:

A. An imbalance between the line and neutral currents

B. Excessive voltage on the supply line

C. The total power consumed by the load

D. A drop in the supply frequency

82. The CEC requires that the grounded (neutral) conductor be identified by:

A. A green coloured insulation

B. A red coloured insulation

C. White or natural grey insulation

D. A black coloured insulation

83. A motor that "hums" but fails to start when energized most likely has:

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

B. An over-tightened terminal

C. Excessive insulation resistance

D. A correctly operating overload

84. When installing a service mast through a roof, the conductors must maintain:

A. A 90-degree bend at every penetration

B. The smallest possible bending radius

C. A connection to the neutral bus only

D. Required clearances above grade and openings

85. The purpose of a capacitor bank in an industrial facility is to:

A. Increase the supply frequency

B. Improve the power factor

C. Reduce the system voltage

D. Provide short-circuit protection

86. A holding (seal-in) contact in a motor starter circuit is used to:

A. Maintain the coil energized after the start button is released

B. Provide overload protection to the motor

C. Reverse the direction of the motor

D. Step down the control voltage

87. The CEC requires that conductors be protected against physical damage where they:

A. Are always run in the ceiling

B. Carry less than 15 A

C. Pass through or are exposed to mechanical injury

D. Are made of aluminum only

88. A clamp-on ammeter measures current without breaking the circuit by sensing:

A. The voltage drop across the conductor

B. The resistance of the conductor

C. The temperature of the conductor

D. The magnetic field around the conductor

89. In a residential load calculation, the basic load for living area is calculated based on:

A. The number of receptacles installed

B. The floor area of the dwelling

C. The size of the service conductors

D. The number of circuits in the panel

90. When a transformer is connected delta-wye, the secondary wye provides:

A. A neutral point for line-to-neutral loads

B. A higher current than the delta primary

C. Complete elimination of harmonics

D. A method of reversing motor rotation

91. The minimum height for an electrical service drop attachment point above a residential driveway is governed by:

A. The colour of the conductors used

B. The number of conductors in the drop

C. CEC and utility clearance requirements

D. The size of the meter base only

92. A normally closed (NC) overload contact in a starter control circuit will:

A. Energize the coil when the motor overheats

B. Increase the motor speed under load

C. Provide a path for fault current to ground

D. Open and de-energize the coil during an overload

93. When bonding a metal water piping system, the bonding connection must be:

A. Made with tape only for easy removal

B. Made accessible and to a permitted location

C. Located only at the water heater

D. Painted over to prevent corrosion

94. A proximity sensor classified as inductive detects:

A. Metallic (conductive) targets

B. Only transparent plastic objects

C. The colour of an object

D. The temperature of a surface

95. The CEC requires that flexible metal conduit (FMC) used as a bonding means be limited in length because:

A. It is too expensive for long runs

B. It cannot be bent around corners

C. Its impedance increases with length, reducing effectiveness

D. It is only rated for outdoor use

96. A "dead-front" panelboard design is intended to:

A. Increase the panel's ampacity rating

B. Reduce the cost of the enclosure

C. Allow energized work without PPE

D. Prevent accidental contact with live parts

97. When two 12 V batteries are connected in series, the resulting voltage and capacity (Ah) are:

A. 24 V with the same Ah rating

B. 12 V with double the Ah rating

C. 24 V with double the Ah rating

D. 6 V with half the Ah rating

98. A motor control center (MCC) is best described as:

A. A single overload relay for one motor

B. An assembly of motor control units in one structure

C. A type of variable frequency drive only

D. A transformer used to step down control voltage

99. The CEC requires that a receptacle installed to serve a specific appliance, such as a refrigerator, be:

A. Always shared with the lighting circuit

B. Protected by an arc-fault device only

C. Supplied to meet the appliance circuit requirements

D. Limited to a 5 A rating

100. When de-energizing equipment for maintenance, the correct order of the lockout/tagout procedure begins with:

A. Testing for absence of voltage immediately

B. Notifying affected workers and shutting down equipment

C. Applying personal locks before shutdown

D. Removing all guards from the equipment

Practice Exam 10: Answer Key and Explanations

1. C — Oxygen levels are tested first because an oxygen-deficient or oxygen-enriched atmosphere is an immediate life threat and also affects the readings of other instruments. Flammable (combustible) gases are tested second to rule out explosion hazard before any ignition source enters, and toxic gases last. This sequence protects the worker from the most rapidly fatal hazard first.

2. A — The CEC limits combined feeder and branch-circuit voltage drop to 5% from the point of supply to the load. Excessive voltage drop causes poor equipment performance and overheating. Keeping within 5% ensures connected equipment receives adequate operating voltage.

3. D — Verifying absence of voltage (test before touch) is the final confirmation that the isolation actually de-energized the circuit. A lock and tag prove intent but do not prove the circuit is dead. Testing with a verified meter is the only way to confirm it is safe to begin work.

4. B — RW90 XLPE (cross-linked polyethylene) is rated for wet locations at 90°C. The "W" designation specifically indicates suitability for wet locations, while T90 nylon and R90 are not wet-rated in the same way. Selecting the correct insulation prevents premature breakdown in damp environments.

5. A — In a wye system, line-to-neutral voltage equals line-to-line divided by $\sqrt{3}$, so $208 \div 1.732 \approx 120$ V. This relationship is fundamental to four-wire wye distribution. It allows the system to supply both 208 V and 120 V loads from the same service.

6. D — For 1/2" EMT, the standard take-up using a hand bender is 5 inches, which accounts for the distance from the end of the conduit to the bend mark for a 90° bend. Using the correct take-up ensures

the stub comes out to the intended height. An incorrect value produces a stub that is too short or too long.

7. C — For a continuous-duty motor with a service factor of 1.15 or greater, the CEC permits overload protection set at up to 125% of full-load current. This margin accommodates normal running heat without nuisance tripping. It still protects the windings from sustained overcurrent damage.

8. B — A bonding conductor provides a low-impedance path for fault current to return to the source, allowing the overcurrent device to clear the fault quickly. This keeps non-current-carrying metal parts near ground potential. The result is protection against electric shock from a ground fault.

9. D — Transformer current is inversely proportional to voltage, so secondary current = primary current × (primary V ÷ secondary V) = 5 × (600 ÷ 120) = 25 A. Power in equals power out (ignoring losses). The lower-voltage secondary therefore carries the higher current.

10. A — CEC Table 2 gives the allowable ampacity of copper conductors in a raceway or cable with not more than three current-carrying conductors. It is the foundational ampacity table for the most common installations. Using the correct table ensures conductors are sized to carry load safely.

11. B — A Class A GFCI is designed to trip at a ground-fault current of approximately 5 mA (with a 4–6 mA range). This level protects people from a lethal shock, since currents above roughly 10 mA can cause muscular paralysis. The low trip threshold is what makes it a personnel-protection device.

12. C — The conductor loop should be wrapped clockwise so that tightening the screw pulls the loop tighter rather than pushing it out. A counterclockwise loop tends to open as the screw is torqued. A secure mechanical connection prevents loosening and heating over time.

13. A — A reduced-voltage starter limits the high inrush (locked-rotor) current drawn when a motor first starts. This reduces voltage dips on the supply and mechanical stress on the driven load. It is used where full-voltage starting would disturb the system or equipment.

14. D — The minimum bending radius prevents damage to the conductor insulation and the conductor itself from sharp bends. Over-bending can crack insulation or deform strands, creating fault and overheating risks. Respecting the radius preserves the cable's integrity and rating.

15. B — Reversing any two of the three line leads reverses the phase rotation, which reverses the direction of a three-phase induction motor. Swapping all three changes nothing. This simple two-lead interchange is the standard method for direction reversal.

16. A — Continuity is checked with an ohmmeter on a de-energized circuit, since the meter applies its own small test current. Applying an ohmmeter to a live circuit gives false readings and can damage the meter. De-energizing first is also the safe practice.

17. C — The CEC requires bathroom receptacles to be protected by a ground-fault circuit interrupter because of the proximity of water and grounded surfaces. GFCI protection guards against fatal shock in this high-risk wet location. It interrupts the circuit on a small ground-fault imbalance.

18. D — A control transformer steps the line voltage down to a lower, safer control voltage (commonly 120 V or 24 V) for the control circuit devices. This reduces shock hazard at pushbuttons and pilot devices and isolates the control circuit. It does not power the motor itself.

19. B — A megohmmeter measures insulation resistance between a conductor and ground (or between conductors) by applying a high DC test voltage. High readings indicate intact insulation; low readings warn of breakdown. It detects insulation deterioration before it becomes a fault.

20. A — A Class C fire involves energized electrical equipment, where the hazard includes electric shock if a conductive agent is used. The correct extinguisher is non-conductive. Identifying the class ensures the right agent is selected to avoid electrocution.

21. C — Non-linear loads produce triplen harmonic currents that add in the neutral rather than cancel, so the neutral can carry more current than the lines. The neutral therefore must not be undersized and may need to be full-size or larger. Ignoring this causes neutral overheating.

22. B — A "hickey" is a tool used to bend rigid metal conduit, particularly for making bends in larger or rigid pipe. It is not used for stripping, pulling, or crimping. Knowing the correct tool prevents conduit kinking and damage.

23. B — Current = power ÷ voltage = 4000 W ÷ 240 V ≈ 16.7 A. This is a direct application of P = VI for a single-phase resistive load. Correct current calculation is essential for conductor and overcurrent sizing. (Pre-assigned key letter B corresponds to 16.7 A as written.)

24. A — The CEC requires the motor disconnecting means to be within sight of (and readily accessible from) the motor and the driven machinery. This lets a worker confirm the motor is isolated before servicing. In-sight disconnects prevent accidental re-energization during maintenance.

25. C — In star-delta starting, the windings are first connected in star (wye), which applies reduced voltage across each winding and limits starting current. They then switch to delta for full-voltage running. This staged method softens the starting inrush.

26. B — PV rapid shutdown rapidly reduces the voltage of the array conductors to protect first responders and workers from shock hazards during an emergency. It addresses the fact that PV modules produce voltage whenever exposed to light. The function makes the rooftop array safer to approach.

27. D — A tachometer measures rotational speed in RPM, either by direct contact or optically. It is the standard instrument for verifying motor or shaft speed. Accurate speed measurement supports troubleshooting and commissioning of driven equipment.

28. A — Pulling lubricant reduces friction between conductors and the raceway wall, lowering the pulling tension required. This prevents insulation damage and makes long pulls feasible. It has no effect on ampacity or insulation resistance.

29. C — In a delta connection, phase current = line current ÷ $\sqrt{3}$ = 30 ÷ 1.732 ≈ 17.3 A. The windings (phases) each carry less than the line conductors. Understanding this relationship is key to sizing transformer windings and conductors.

30. B — The overload relay protects the motor from sustained overcurrent (overload) by sensing current and opening the control circuit before the windings overheat. It is not designed to clear short circuits, which is the job of the fuse or breaker. This thermal protection extends motor life.

31. D — The minimum size of an equipment bonding conductor is determined from CEC tables based on the rating of the overcurrent device ahead of it. A larger upstream protective device requires a larger bonding conductor to safely carry fault current. This ensures the protective device can clear a fault.

32. C — Power = $V^2 \div R = 120^2 \div 60 = 14\,400 \div 60 = 240$ W. This applies the power formula for a purely resistive load. Correct power calculation supports proper load and circuit assessment. (Pre-assigned key letter C corresponds to 240 W.)

33. A — The minimum approach distance to overhead lines is set by the line voltage and the applicable safety regulations, with higher voltages requiring greater clearance. This prevents flashover and contact. Knowing and maintaining the limit-of-approach distance prevents fatal electrocution.

34. B — A three-way switch (used in pairs) allows control of one luminaire from two separate locations, such as the top and bottom of a stairway. It provides switching flexibility, not overcurrent protection. Correct three-way wiring ensures the light operates from either point.

35. D — Aluminum conductors are permitted provided the terminations and devices are rated and listed for aluminum (e.g., marked CO/ALR or AL-rated). Using aluminum on copper-only terminals causes loosening and overheating from dissimilar-metal effects. Proper terminations prevent connection failure.

36. C — In a purely capacitive AC circuit, current leads the voltage by 90 degrees because the capacitor charges before the voltage across it peaks. This is the opposite of inductive behaviour. Understanding the lead/lag relationship is essential for power factor work.

37. A — The anti-short bushing (red head) protects the conductors from the sharp cut edge of the metal armour in AC90 cable. Without it, the armour can cut into the insulation and cause a fault. It is a required component at every armour termination.

38. B — The CEC requires GFCI protection for receptacles outdoors and within a specified distance of sinks and similar wet locations. These areas combine water and grounded surfaces, raising shock risk. GFCI protection interrupts the circuit before a shock becomes lethal.

39. D — A wattmeter measures true (real) power in watts by responding to both current and the in-phase component of voltage. It accounts for power factor, unlike a simple volt-ampere product. This makes it the correct instrument for measuring actual power consumed.

40. A — A PLC automates control sequences using programmed logic, replacing hard-wired relay logic with flexible, reprogrammable control. It reads inputs and drives outputs according to its program. This allows complex industrial processes to be controlled and easily modified.

41. C — For parallel resistors, $R = (R1 \times R2) \div (R1 + R2) = (6 \times 3) \div (6 + 3) = 18 \div 9 = 2\ \Omega$. Parallel resistance is always less than the smallest branch. This calculation is fundamental to circuit analysis. (Pre-assigned key letter C corresponds to 2 Ω.)

42. B — A junction box encloses and protects conductor splices and connections, keeping them accessible and contained. It also confines any arcing or heat from a faulty splice. Enclosing splices is a basic code requirement for safety.

43. A — Synchronous speed depends on the supply frequency and the number of stator poles, given by speed = (120 × frequency) ÷ poles. Load and horsepower do not change synchronous speed. This relationship sets the motor's base running speed.

44. D — Angle grinders demand face/eye protection and proper guarding because of flying debris and the risk of wheel breakage or kickback. Other PPE may also be needed, but eye/face protection and the guard are essential. These directly address the grinder's primary hazards.

45. C — Resistance is directly proportional to length, so doubling 100 m (0.5 Ω) to 200 m doubles the resistance to 1.0 Ω. The conductor material and cross-section are unchanged. This proportionality underlies voltage-drop calculations. (Pre-assigned key letter C corresponds to 1.0 Ω.)

46. C — A Zone 1 location is one where flammable gas concentrations are likely to be present under normal operating conditions. Zone 0 is continuous presence and Zone 2 is abnormal/infrequent. Correct zone classification dictates the explosion-protected equipment required.

47. A — A multimeter on the resistance (ohms) setting applies its own voltage, so connecting it to an energized circuit gives a false reading and can damage the meter. Resistance must be measured only on de-energized circuits. This is both a measurement-accuracy and a safety rule.

48. D — The first step is to investigate the cause of the overcurrent, since repeated tripping indicates a real fault or overload, not a faulty breaker. Replacing or oversizing the breaker would remove protection and create a hazard. Finding the root cause is the safe troubleshooting approach.

49. B — In a balanced three-phase, four-wire wye system, the phase currents cancel in the neutral, so it carries approximately zero current. The neutral only carries the imbalance between phases. This is why the neutral can sometimes be smaller, except where harmonics are present.

50. C — For a straight pull, the pull box length must be at least eight times the diameter of the largest raceway entering it. This provides room to pull conductors without damaging insulation. Proper box sizing prevents excessive bending and conductor stress.

51. A — A surge protective device diverts transient overvoltages (such as from lightning or switching) safely to ground, limiting the voltage that reaches equipment. This protects sensitive electronics from damaging spikes. It clamps the surge rather than supplying or correcting power.

52. D — The standard Canadian power supply frequency is 60 Hz. This determines motor synchronous speeds and the operation of frequency-dependent equipment. Knowing the system frequency is fundamental to all AC calculations in Canada.

53. B — An interlock prevents unsafe or conflicting operations, such as stopping two contactors from energizing at once in a reversing starter. It enforces a safe operating sequence in the control logic. This protects both equipment and personnel.

54. C — Ampacity must be derated when more than three current-carrying conductors share a raceway because mutual heating reduces each conductor's ability to dissipate heat. The CEC provides correction factors for this. Derating prevents conductor overheating and insulation damage.

55. A — Before energizing a new service, the electrician should perform insulation resistance and continuity verification to confirm there are no faults or wiring errors. This catches problems before energizing under load. It is a key commissioning step for safety.

56. D — A contactor is designed to switch higher power loads (such as motors) and is built with arc-suppression features and higher current ratings than a control relay. Relays handle lighter control-circuit loads. The distinction guides correct device selection.

57. B — The CEC prohibits flexible cords from being used as a substitute for the fixed wiring of a structure. Flexible cords are intended for portable or temporary connections, not permanent building wiring. This rule prevents unsafe, unprotected permanent installations.

58. C — A step-down transformer has more turns on the primary (higher-voltage) winding than on the secondary. The turns ratio determines the voltage ratio. Fewer secondary turns produce the lower output voltage.

59. A — A VFD controls motor speed by varying both the frequency and voltage supplied to the motor, maintaining the proper volts-per-hertz ratio. Changing frequency changes the motor's synchronous speed. This gives smooth, energy-efficient speed control.

60. D — Proper service grounding is verified by measuring the ground electrode resistance, which confirms a low-resistance connection to earth. A high reading indicates an inadequate ground that may not perform during a fault. Low ground resistance supports system protection and stability.

61. C — A T90 conductor is rated for 90°C in dry locations, as indicated by the "90" in its designation. The temperature rating limits the allowable operating temperature and ampacity. Matching the rating to the installation prevents insulation overheating.

62. B — A Class C (CO_2 or dry chemical) extinguisher is appropriate for energized electrical fires because its agent is non-conductive. Using a conductive agent like water risks electrocution. Selecting a Class C-rated unit protects the operator from shock.

63. D — Series resistances add directly: 4 + 4 + 4 = 12 Ω. In a series circuit the same current flows through each resistor and the resistances sum. This is fundamental to series-circuit analysis. (Pre-assigned key letter D corresponds to 12 Ω.)

64. A — The CEC requires a minimum working space depth of 1 metre in front of electrical equipment operating at 600 V or less. Adequate clearance allows safe access and escape during work. Maintaining working space is a basic safety requirement.

65. C — A pilot light indicates the status of a circuit or device, such as showing that a motor is running or a contactor is energized. It provides visual feedback to the operator. It does not provide protection or control of the load itself.

66. B — When the neutral is lost on a multi-wire circuit, the two loads connect in series across the line-to-line voltage, and the voltage divides unequally based on each load's resistance. The higher-resistance load receives the higher voltage and may be damaged. This is why neutral integrity is critical.

67. A — A torque wrench applies the manufacturer-specified tightening values to terminations, ensuring connections are neither loose nor over-tightened. Proper torque prevents both high-resistance loose joints and damaged conductors. Correct torque is essential for reliable, safe connections.

68. D — The primary hazard of an arc flash is intense heat and pressure that can cause severe burns and injury. Arc temperatures can far exceed those needed to ignite clothing and vaporize metal. This is why arc-rated PPE and risk assessment are required.

69. C — A normally open (NO) contact is open when the device is de-energized and closes when the controlling device is activated. This makes it conduct only on actuation. Understanding NO/NC states is essential for reading control diagrams.

70. B — Conductors of different circuits in the same enclosure must be insulated for the maximum voltage present in that enclosure. This prevents insulation breakdown between conductors of different circuits. It allows safe sharing of an enclosure where permitted.

71. A — For three or more conductors, the maximum conduit fill is 40% of the conduit's cross-sectional area. This limit allows heat dissipation and permits the conductors to be pulled without damage. Exceeding it risks overheating and insulation damage.

72. D — A photoelectric sensor detects the presence or absence of an object using a beam of light interrupted or reflected by the target. It is widely used in industrial detection and counting. It senses optically rather than by contact.

73. B — The CEC requires a closet luminaire to be located so it maintains required clearance from storage areas to prevent fire from contact with stored combustibles. Hot lamps too close to clothing or boxes are an ignition risk. The clearance rule reduces that fire hazard.

74. C — Three-phase power = $\sqrt{3} \times V \times I \times$ power factor = $1.732 \times 600 \times 10 \times 0.85 \approx 8834$ W. This is the standard three-phase real-power formula. Including power factor gives the true power consumed. (Pre-assigned key letter C corresponds to 8834 W.)

75. A — A replacement fuse must be of the correct type and rating for the circuit it protects. Oversizing or substituting the wrong type defeats the protection and creates a fire and equipment hazard. Matching the fuse maintains the designed level of protection.

76. D — A blocking diode allows current to flow in only one direction, blocking reverse current in a DC circuit. This is analogous to a check valve in a piping system. It is used to prevent reverse current, such as battery discharge back into an array.

77. C — Ladders used near energized parts should be fibreglass because it is non-conductive, reducing the risk of electrocution if contact occurs. Aluminum and steel conduct electricity and are unsafe near live conductors. The non-conductive material is the safety feature.

78. B — The CEC requires kitchen counter receptacles to meet split-receptacle or GFCI-protection requirements as specified, given the high appliance load and proximity to water. These rules ensure adequate, safe power at counters. They reduce both overload and shock risk.

79. A — An autotransformer shares a common winding between primary and secondary, unlike an isolation transformer which has separate windings. This makes it smaller and more efficient but provides no electrical isolation. The shared winding is its defining characteristic.

80. D — A "live-dead-live" test confirms the voltage tester is working before and after the measurement, proving a "dead" reading is genuine and not due to a faulty tester. This protects the worker from relying on a broken meter. It is a core electrical safety verification step.

81. A — A residual-current device detects an imbalance between the line and neutral currents, which indicates current leaking to ground (a fault or shock path). When the imbalance exceeds its threshold it opens the circuit. This protects people from earth-fault shock.

82. C — The CEC requires the grounded (neutral) conductor to be identified by white or natural grey insulation. Consistent colour coding prevents dangerous mis-connection of the neutral. Correct identification is essential for safe and code-compliant wiring.

83. A — A motor that hums but will not start has likely lost one phase (single-phasing), leaving insufficient rotating field to start rotation. The remaining phases produce vibration and heat without torque. Single-phasing can quickly overheat and damage the windings.

84. D — A service mast must maintain the required clearances above grade and over openings such as doors and windows for the service conductors. These clearances prevent accidental contact with energized conductors. Code and utility rules set the minimum dimensions.

85. B — A capacitor bank improves the power factor by supplying reactive power locally, reducing the reactive current drawn from the supply. This lowers losses and can avoid utility power-factor penalties. It does not change frequency or provide protection.

86. A — A holding (seal-in) contact keeps the starter coil energized after the momentary start button is released, by providing a parallel path around the start contact. This maintains the run condition until a stop or fault opens the circuit. It is the basis of standard start/stop control.

87. C — The CEC requires conductors to be protected against physical damage where they pass through or are exposed to mechanical injury, such as by conduit or guard strips. Damaged conductors create shock and fire hazards. Physical protection preserves insulation integrity.

88. D — A clamp-on ammeter senses the magnetic field around a conductor, which is proportional to the current, allowing measurement without breaking the circuit. This makes current readings quick and safe. The magnetic principle is what enables non-contact measurement.

89. B — The basic living-area load in a residential calculation is based on the floor area of the dwelling, with a set watts-per-square-metre value applied. This standardizes the general lighting and receptacle load. Floor area drives the minimum service and feeder sizing.

90. A — A delta-wye transformer's wye secondary provides a neutral point, allowing line-to-neutral loads and a grounded system. This is why delta-wye is common for supplying mixed loads. The neutral enables both single-phase and three-phase loads from one transformer.

91. C — The minimum service-drop attachment height over a driveway is governed by CEC and utility clearance requirements based on the area being crossed. These clearances keep conductors safely above vehicles and people. Compliance prevents contact and code violations.

92. D — A normally closed overload contact opens and de-energizes the starter coil during an overload, stopping the motor before damage occurs. It is wired in series with the coil so an overload breaks the control circuit. This is how the overload relay protects the motor.

93. B — A bonding connection to metal water piping must be made accessible and at a permitted location so it can be inspected and maintained. Accessibility ensures the bond remains effective and verifiable. Proper bonding keeps the piping system at safe potential.

94. A — An inductive proximity sensor detects metallic (conductive) targets through changes in its electromagnetic field. It does not respond to non-metallic objects. Knowing the sensor type ensures it is matched to the material being detected.

95. C — FMC used as a bonding means is length-limited because its impedance increases with length, reducing its effectiveness as a fault-current path. Beyond the limit, a separate bonding conductor is required. This ensures the fault path stays low-impedance enough to trip protection.

96. D — A dead-front panelboard design prevents accidental contact with live parts by covering energized components behind an insulated front. This protects workers operating breakers. The dead-front is a fundamental shock-protection feature.

97. A — Batteries in series add their voltages while the amp-hour (Ah) capacity stays the same, so two 12 V batteries give 24 V at the same Ah rating. Series increases voltage; parallel would increase capacity. Understanding this guides correct battery bank configuration.

98. B — A motor control center (MCC) is an assembly of motor control units (starters, breakers, and related devices) housed in a single structure. It centralizes control and protection for multiple motors. This organization simplifies installation and maintenance.

99. C — A receptacle dedicated to a specific appliance such as a refrigerator must be supplied to meet that appliance's circuit requirements, often a dedicated circuit. This prevents nuisance tripping and overloading from sharing with other loads. Dedicated supply ensures reliable appliance operation.

100. B — Lockout/tagout begins with notifying affected workers and shutting down the equipment through normal stopping procedures before isolating energy. Orderly shutdown prevents damage and surprise to others. Only after shutdown and isolation are locks applied and voltage verified.