Units 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 19, 20, 25, 26 Electrical Wiring
Residential Fourth Edition
Unit 5

1. What is an outlet? Point on a wiring system where current is taken to supply utilization equipment

2. How are lines from switches to the outlets they control distinguished from invisible edge lines? Curved

3. When light fixtures have not been purchased at the time of rough-in, what is typically done? Outlet provided

4. What type of outlet box is typically used with a plaster ring? 4x4 square

5. What does the CEC require when installing junction boxes in a residence? Must be accessible without removing any part of the building

6. What requirement must be met when nonmetallic boxes are used with armoured cables? Continuity of bonding for all metal raceways

7. What is the size of a standard device box? 3 x 2 x 2 ½”

8. What are the standard depths for device boxes? 1 ½” – 3 ½”

9. What is the maximum distance from the finished surface for outlet boxes mounted in noncombustible materials? 6 mm

10. What is represented by a circle with a triangle inside on an electrical plan? Special-purpose outlet

11. What requirement must be met when changing from one wiring method to another? Fitting where the change is made must be accessible after installation

12. What are some examples of special purpose outlets? Central vacuum, weatherproof receptacle, dedicated receptacle, air conditioning, and clock receptacle

13. How many wires must be deducted when calculating box fill with one fixture stud and one hickey? 2

14. How many conductors are deducted for a plug and switch mounted on a single strap when calculating the number of conductors permitted in a box? 2

15. Do raised plaster rings add capacity to outlet boxes when calculating the number of wires permitted? Yes, if marked with dimensions
16. Is it possible to use a smaller box for a given application with EMT than with cable? Yes (Because of conductors passing through without joint or splice in EMT)

17. What is the proper orientation for mounting a plug horizontally when a metal plate is to be used? Ground on top if vertical and neutral on top if horizontal

18. What practice will ensure an electrical system will “fail-safe”? Bonding

Unit 6

1. What is a feeder? Circuit conductors between the service equipment and the final branch circuit overcurrent device

2. What is the situation where it is permissible to have conductors with an ampacity rating less than the overcurrent device? Motor branch circuit

3. When is a three-way switch set up required for lights on stairs in a residence? Four or more steps

4. What is the maximum distance away from a washbasin when installing a receptacle in a bathroom? 1 m (26-712)

5. Does the CEC allow for more than 12 outlets on a 15 amp circuit under any circumstances? Yes when the load is known and is 12A or less

6. How is the distance between kitchen counter plugs measured? Along the wall line

7. Are receptacles installed in the side of a counter for persons with disabilities required to be on a separate circuit? No

Unit 7

1. What is the minimum conductor size that is generally stranded? No.8 AWG

2. What does the “M” stand for in “MCM” the older term for conductor size? Roman numeral for 1000

3. How does the voltage drop in an aluminum conductor compare to copper? Voltage drop is greater in aluminum

4. How do crimp connectors for aluminum conductors compare to copper? Longer with more contact area and have an inhibitor paste inside
5. How are terminals and connectors for aluminum and copper conductors marked? AL for aluminum and CU for copper and copper-clad aluminum

6. What is a “thermoset” material? What are some types of thermoset insulation? Insulation material that will not soften and deform. R90XLPE, RW90XLPE

7. How many more amps can No.0 R90 copper conductors carry than No.0 TW in free air? 50 A

8. What are some effects of voltage drop? Lights dim, television picture shrinks, motors run hot, electric heating devices are less efficient, appliances operate improperly

9. What are some causes of voltage drop? Wire too small, circuit too long, poor connection, conductors operating at high temperature

10. What is the maximum voltage drop the CEC will allow in a branch circuit? 3%

11. What happens to the resistance of a conductor as the CMA doubles? Half

12. What size conductor is required for a 3% voltage drop (on 120 V) when a load requires 8 amps and is 12 m away? (Use table D3) No.16 AWG

13. What size conductor is required for a 2% voltage drop (on 120 V) when a load requires 8 amps and is 12 m away? (Use table D3) No.14 AWG

14. What size conductor is required for a 1% voltage drop (on 120 V) when a load requires 8 amps and is 12 m away? (Use table D3) No.12 AWG

15. What size conductor is required for a 3% voltage drop (on 240 V) when a load requires 16 amps and is 30 m away? (Use table D3) No. 12 AWG

16. What size conductor is required for a 2% voltage drop (on 240 V) when a load requires 16 amps and is 30 m away? (Use table D3) No.10 AWG

17. What size conductor is required for a 1% voltage drop (on 240 V) when a load requires 16 amps and is 30 m away? (Use table D3) No.8 AWG

18. What are the two most common applications for NMWU cable? Wet and direct burial locations

19. Does the CEC permit non-metallic sheathed cable to be embedded in concrete? No

20. What is the distance above finished floor below which non-metallic sheathed cable must be protected? 1.5 m
21. Which table is used for derating factors when cables are bundled together for long distances? Table 5C

22. What is the distance that must be maintained between NMSC and a masonry chimney? 50 mm

23. What is the maximum distance cables may be bundled without applying correction factors? 600 mm

24. What requirements must be met for type AC90 cable to be embedded in plaster? Used for extension of existing outlets and must be No.10 AWG or smaller

25. What two types of armoured cable are permitted to be used in underground installations? ACWU90 and TECK90

26. What is the maximum vertical distance in an attic where non-metallic sheathed cable may be run across the surface of the joists? 1 m

27. Does the CEC permit NMSC to be run through cold air return joist and stud spaces? Yes, if run perpendicular to the long dimensions

28. Does the CEC permit more than one cable in a connector? Only if approved for use with more than one cable

29. What type of building construction typically requires the electrical installation be in a conduit? Concrete or cement block (Non-combustible)

30. How often must 1” rigid metal conduit be supported? 2 m (Rule 12-1010)

31. When fitting a piece of PVC conduit, what is the four step process? Cut, ream, clean, and glue

32. What is the minimum bending radius for PVC conduit? Table 7 (5-6 times diameter)

33. Where is the table for the coefficient of linear expansion for PVC conduit located? Appendix B (Rule 12-1118)

34. What are the three types of flexible conduit? Flexible metal, liquid-tight flexible metal, and liquid-tight non-metallic

35. What is the maximum length for trade size 12 (3/8”) flexible metal conduit? 1.5 m (12-1004)
36. Does the CEC permit liquid-tight conduit to be used as a general purpose raceway? Find rule! 12-1302 (3) (b) No

37. Is the metal armor of liquid-tight flexible metal conduit suitable for a bonding means? No (12-1306)

Unit 8

1. What three colors are not permitted for the ungrounded conductor in a circuit? White, grey, and green

2. At what point is a grounded conductor called the neutral conductor? When it is part of a multi-wire branch circuit and carries only the unbalanced load

3. Does a two-wire circuit have a neutral conductor? No. It is the identified or grounded conductor

4. Which conductor of a switch leg using non-metallic sheathed cable should be used for the white conductor? Feed and not the return

5. Why do tungsten lamps require special switches? High inrush current

6. What is the difference in mounting for Category 3 switches? Mounting holes are further apart to prevent using a regular switch (120V)

7. How does a three-way switch operate between the terminals? (How is the switching done?) From a common to one traveler terminal then from the common to the other traveler terminal

8. How does a four-way switch operate between the terminals? (How is the switching done?) Straight through or cross corner (figure 8-13)

9. How is a two pole switch different from a four-way switch? Has an on and off position which makes and breaks two sets of contacts

10. Which plug slot is connected to the ungrounded conductor? Narrow slot

11. Is a separate grounding jumper required from the bonding screw on a receptacle to the back of the outlet box? Yes (10-906)

12. What is the proper method for replacing an existing two wire receptacle when no means is available to obtain a ground connection? GFCI receptacle
13. How is induction heating kept to a minimum when using armored cable or raceway? Make sure the same amount of current flows in each direction in a raceway or cable

Unit 9

1. What is the most important consideration in any electrical installation? It does not kill anyone

2. Outdoor receptacles must have GFCI protection if they are located less than what distance above grade? 2.5 m

3. Which device may not be connected to a GFCI protected circuit? Smoke Detector

4. What are the two most common types of GFCI protection? Receptacles and breakers

5. How much current will trip a GFCI receptacle or breaker? .006 Amps (6 milliamps) Other materials say 5 milliamps. Let’s not argue over a milliamp

6. What is the current withstand rating for GFCI receptacles? 5000A

7. What is the purpose of using plastic staples for GFCI circuits? Reduce nuisance tripping

8. Does a GFCI provide shock protection? No it limits the time of the shock

9. What is the main problem with putting 12 outlets on a single GFCI? Difficult to isolate a ground problem

10. How often should a GFCI be tested? Monthly

11. Does the CEC permit replacement of a nongrounding-type receptacle without installing additional wiring? Yes, if there is no equipment bonding conductor run with the cables

12. Which areas in a residence require arc fault circuit interrupters? (AFCI) Bedrooms or sleeping facilities

13. What types of problems are sensed by an AFCI faster than by a standard thermal-magnetic breaker? Arcing (fluctuations in voltage and current)

14. What is the minimum resistance reading between conductors when doing an insulation test? (Good conductors) 1 megohm or greater
15. What types of equipment would benefit from a TVSS receptacle? **Electronic** (computers, tv, stereo, microwave)

16. How long does it take for a MOV in a Surge Suppressor outlet to clamp a transient? **Less than one nanosecond** (One billionth of a second)

17. Where is the insulated green conductor connected for an isolated ground receptacle? (Both ends) **Green hexagon screw on the receptacle connected to the ground bus on the nearest distribution panel**

18. How is an isolated ground receptacle identified? **Green triangle**

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Unit 11

1. What is a “branch circuit”? **The wiring from the last overcurrent device in the system to the point of utilization**

2. What are the four groupings for residential lighting? **General, accent, task, and security**

3. What are some “inductive” loads that may be connected to branch circuits? **Transformers, motors, ballasts, etc.**

4. What is the power factor of a resistive load? **100% or 1**

5. What is the minimum number of circuits required for 90 general outlets? (lighting and receptacle) **8**

6. What is the minimum number of receptacles required in a room measuring 4.5 m x 5.5 m? (Usable Space) **6 (20 m / 3.6 m) (Rule 26-712)**

7. What is the minimum number of receptacles in a living room measuring 7.6 m x 5.5 m? (Usable Space) **8 (26.2 / 3.6) (Rule 26-712)**

8. What is the minimum number of receptacles in a bedroom measuring 2.75 m x 2.75 m? (Usable Space) **4 (11 / 3.6) (Rule 26-712)**

9. How many wires are permitted under a standard screw-type terminal? **1**

10. What is a split-switched receptacle? **Half of the receptacle (one outlet) is switched while the other half is live all the time**

11. How many wires are required between split-switched receptacles? **3**

12. Receptacles installed outside higher than 2.5 m above grade do not require a weather proof cover. **True or False?**
13. Are pigtails counted when calculating the maximum number of wires in an outlet box? No (12-3036 (1) ©)

14. Which half of a split-switched receptacle is mounted on top? Unswitched outlet

15. What precaution must be taken when installing receptacles and baseboard heaters or radiators in the same areas? Cords plugged into outlets should not pass over heat generating sources

16. What types of fixtures can be installed in a clothes closet? With globe (No bare bulb or pendant type)

17. What are the two acceptable mounting positions for the light in a closet? Ceiling or front wall over the door

18. What is the disadvantage of having multiple split-switched outlets in a room? Loss of unswitched receptacles

19. What precautions must be taken when mounting ceiling fans? Weight, twisting force and vibration must be factored in

20. What is the maximum weight permitted to be supported by the screws of an outlet box? 23 kg Ceiling

21. What is the typical amperage for a ceiling fan? .4-.8 A

Unit 12

1. Wall spaces in living rooms and bedrooms require a receptacle if they are more than what length? 900 mm

2. What is the main advantage of track lighting? Lampholder can be moved and relocated as required

3. What is a pendant kit for track lighting? Kit that allows the fixture to hang below a beam or ceiling

4. How often must track lighting be supported? Two supports and one more for every 1.5 m of extension

5. Why are dimmer controls not recommended for controlling a receptacle? Could overload the dimmer or damage equipment installed in the outlet

6. What type of box is typically used for 1000 watt dimmer controls? 2 gang deep
7. What problem may result when a tungsten filament lamp is controlled by a dimmer control? **High and prolonged inrush currents**

8. How long should fluorescent fixtures operate (age) before dimming? **100 hours**

9. What fixtures are permitted in wet locations? **Must be marked and approved for location (Suitable for wet locations)**

10. What designation is given by the CEC for areas under roofs, canopies, and open porches? **Damp locations**

11. What is a doorjamb switch and where is it used? Switch cut into the door jamb and operated by the opening and closing of the door. Typically used in closets

   **Unit 13**

1. Is an outlet box typically required for a medicine cabinet with a light built in? **No**

2. What is the restriction for switches mounted in a washroom controlling lights? **Must not be within reach of a person in a shower or tub**

3. Which fluorescent lamps types give the best flesh tones? **Warm white or warm white deluxe**

4. What is the standard type (color) of fluorescent bulb? **Cool white**

5. What is the maximum distance from a receptacle for any point in a hallway? How is it measured? **4.5 m (shortest path a supply cord would follow without going through a doorway)**

6. What is a polarized receptacle? **One blade wider than the other to prevent cross connection (Neutral and hot)**

7. What does the letters “IC” indicate on a combination bathroom heater, fan, light? **Suitable for Insulated Ceiling**

8. Where is the on/off device for a hydromassage tub to be located? **Behind a barrier or not less than 1 m from the tub (Unless ……)**

9. How is a circuit for a hydromassage tub protected? **GFCI circuit**

   **Unit 14**
1. What are the two main advantages of fluorescent lighting? Use less energy and bulbs last many times longer

2. What are the two basic installation types for kitchen fans? Exhaust or recirculate

3. What rating is typically on a fan in addition to electrical properties? Sound (sone)

4. Is there a standard outlet box for a clock outlet? Deep outlet box

5. What other method is permitted to supply counter plugs besides split 15 amp receptacles? 20 Amp 2-wire

6. Does the CEC permit connecting lighting outlets to the counter plug circuit? No

7. Are appliances plugged into counter plugs included in the basic load for service calculations? Yes

8. Why is a neutral conductor that carries on through an outlet box not permitted to be connected to the second terminal on a receptacle or light fixture? In the case of 3-wire circuits, there can be current on the neutral when one circuit has been shut off. The neutral must be continuous with a pigtail off to the receptacle

9. Why is this sometimes permitted on split receptacles? (question 9) Two pole breaker is installed on the multi-wire circuit

Unit 15

1. What is the maximum length of tap conductors from a larger conductor? 7.5 m

2. If there are no temperature markings on a junction box for connection to an appliance, what is assumed? 60°C

3. What is an infinite-position heat control? Full range of control (Not in steps like high, medium, and low)

4. Are self-cleaning ovens connected different from standard ovens? Yes. Higher temperatures are available and they are lined with high-temperature materials

5. When sizing conductors for a range, what is the demand wattage for a range that is rated 11kW? 8 kW

6. When sizing conductors for a range, what is the demand wattage for a range that is rated 14kW? 8.8 kW
7. What is used as the disconnecting means for a freestanding range rated 50 amps or less? Cord and plug (Rule 26-744)

8. What is the proper orientation for 14-50R receptacle? Ground to either side

9. Does the CEC allow the waste disposal to be connected to the split counter plugs? No, it requires a separate circuit

10. What are the advantages of a cord connection for a garbage disposals, trash compactors, etc? Easier to disconnect, replace, service and reduced vibration

11. What is the purpose of a flow switch connected to a garbage disposal? Prevent operation unless the water is running

12. Is a 15 amp circuit typically sufficient for a residential dishwasher? Yes

13. What does the term “hard wired” mean? Wired direct (No cord and receptacle)

Unit 16

1. Is a disconnecting means required for a dryer in a residence? Why? No. Dryers incorporate an attachment cord and receptacle that acts as a disconnecting means

2. What size box is used with a dryer outlet? 4 11/16” square box (119 x 54 mm square)

3. What is the proper orientation for mounting a dryer receptacle? So the cord hangs down (Range is with U ground to either side) (26-744(5))

4. What is the purpose of the thermal protection on the motor of a dryer? Prevent the motor from reaching dangerous temperatures from overload or failure to start

5. What must be added to any exhaust fan ducting run through attics? Insulated

6. Are prefabricated roof trusses permitted to be drilled for cables to pass through? No in most cases

7. What is the purpose of an attic exhaust fan? Remove hot, stagnant, or damp air from the attic to help keep it cooler

8. What is a direct-drive motor? Fan blade is connected directly to the shaft of the motor (No belt or gear box)
9. What are some of the methods of controlling fans in a residence? On-off switch, speed control, timer switch, humidity control switch, automatic temperature control, high-temperature shut off, and combination controls

10. What does overload protection for a motor protect against? Burnout due to a stall or rotor lock

11. What is a comfortable humidity level for a residence? 50%

12. How is a humidistat typically connected to an exhaust fan? Extra-low-voltage wiring and relay or line-voltage with or without a relay

13. Is a humidistat (10% to 90% adjustable) considered to be a disconnecting device for a fan? No. It does not have a definite “off” position

Unit 19

1. What are fixture drops? 1-2 m of AC90 or NMD90 from an outlet box to a fixture

2. What additional support is required for suspended fluorescent fixtures? Independent of the ceiling (Chains)

3. What precaution must be taken when installing armoured cable into recessed lighting fixtures? Wiring must meet minimum temperature requirements of fixture

4. What are the minimum and maximum lengths for raceways containing tap conductors to a recessed fixture from a junction box? 450 mm – 2 m (30-910 (3))

5. Is there more voltage drop in a three-wire 120/240 volt circuit or two two-wire 120 volt circuits? More in the two two-wire circuits

6. Make sure the two ungrounded conductors in a three-wire circuit connect to different phases! (This is not a question!)

7. What is the result of connecting the two ungrounded conductors in a three-wire circuit to the same phase? The neutral conductor can be overloaded as it will carry the return current from both ungrounded conductors

8. What is likely to happen to electronic equipment when there is a break in the neutral of a three-wire circuit? Can be damaged

9. If available, what is the recommended method of grounding the neutral wire of a consumer’s service? Water piping system (street side of meter)

Unit 20
1. Does the CEC permit flexible cord to be used for a fixture drop? No. It is not for permanent wiring.

2. What is the wattage of a fluorescent fixture with 2-34W lamps? 68 W.

3. How many receptacles are required in the unfinished basement area? 1.

4. What is the reason for drilling every second joist from one direction and then come back and drill the rest from the other direction? Make it easier to pull cable through.

5. Where a number of appliances may be used simultaneously on a multi-outlet Assembly how many outlets would be counted for 900 mm? 3.

6. What is listed in Table 13? Rating or setting of overcurrent devices protecting conductors.

7. What loads are typically considered continuous? Persist for more than 1 hour in any 2 hour period or is more than 225 A (8-104 (3)).


9. What portion of a multi-outlet assembly is considered to be one outlet? Each 300 mm.

10. Why are empty conduits installed from the basement to the attic in this residence? Is this a good practice? Future circuits can be installed easily. Yes.

11. What is the best voltage for a 1HP motor? (120 or 240).

12. What size overcurrent protection is required for a motor with a FLA (Full Load Amps) rating of 21 amps if non-time-delay fuses are used? 60 A.

13. What size overcurrent protection is required for a motor with a FLA (Full Load Amps) rating of 21 amps if time-delay fuses are used? 35 A.

14. What size overcurrent protection is required for a motor with a FLA (Full Load Amps) rating of 21 amps if a circuit breaker is used? 50 A.

15. What is the percentage of FLA used for overload protection for a motor if the service factor is 1.10? 115%.
16. What is the percentage of FLA used for overload protection for a motor if the service factor is 1.15? 125%

17. What is the maximum overload amperage rating for a motor with a FLA of 18 amps and a service factor of 1.10? 20.7 A

18. What is the maximum overload amperage rating for a motor with a FLA of 18 amps and a service factor of 1.15? 22.5 A

19. Does the CEC permit the well casing for a drilled well to be used as the grounding electrode? Not that I can find

20. What is the temperature rating for the high-temperature cutoff on electric water heaters? 96°C

21. What is the purpose of the anodes in an electric water heater? Reduce corrosion

22. Voltage to heating elements should be kept within what percentage of the rated voltage? 5%

23. Why is magnesium-oxide used in heating elements? Insulates and conducts heat very well

24. What is a “flat rate” connection for a water heater? When the supply authority turns off the water heater during peak demand times and you pay a flat rate depending on the size of the water heater

25. How does a cold water tank operate with regard to which elements operate and when? When it is first turned on (cold) the top element comes on and heats the top portion then the bottom one comes on and heats the bottom. Typically the bottom element will maintain unless there is a great demand

26. What does a “disconnecting means of the indicating type” mean? Clearly shows on and off

27. What is the result of operating a heating element below the rated voltage? Decreased output and likely longer life

28. What happens to the wattage of an element if the voltage is cut in half? Current is also cut in half so the wattage will be 25%

Unit 25

1. Where are lights typically mounted in a residential garage? (side to side and back to front) On each side of automobiles (eliminate shadows) and a bit to the front (where it is needed more)
2. Does the CEC permit the use of NMWU cable in dry locations? Yes

3. What is considered sufficient support for a conduit body? Two or more conduits tightly threaded into the conduit body

4. What is a vehicular area with regard to table 53? Alleys, driveways, parking lots, streets, and highways

5. What requirement will allow a reduction in the depth of cover of table 53 by 150 mm? Approved mechanical protection

6. Is polyethylene well pipe considered suitable mechanical protection for reducing the minimum cover requirements of Table 53? Yes (Appendix B)

7. Is a bonding conductor required in an underground installation with rigid metal conduit? Yes

8. What are two requirements for installing a bare bonding conductor in rigid metal conduit? 15 m or less in length and no more than 2 quarter bends

9. What is the minimum depth of sand that must surround direct burial cables? 75 mm

10. How is a split-phase motor reversed? Change the direction of current in either the start or run winding (Not both)

11. Why can a relatively small motor lift a heavy garage door? Using counter balance and a gear box

12. How far in from the center of the door should the plug be mounted for the garage door opener? 3.2 m back from center of door opening

13. Overload protection for a motor is what percentage of the FLA? (Full load amps) 125%

14. Is a separate circuit required for a central vacuum system? Yes (26-720 {e})