



How to Use the NEC - Answer Key - Based on 2020 NEC

EduCode 2020

Hunter Technical Services



Pre-Quiz

This is a quiz for you to do on your own. It will allow you a measurement of your current skills related to the subject matter of this course.

You are allowed 15 to 20 minutes to complete this quiz.



Pre - Quiz

I. How many Chapters are in the NEC?

Answer: 9

II. How many Parts are in Article 410?

Answer: 16

III. Are Sections always numbered sequentially?

B. No

IV. Are Notes to Tables considered part of enforceable text?

A. Yes

Post - Quiz

V. What phrase means that an action is allowed, but not required?

Answer: Shall be permitted

VI. What Article primarily covers load calculations?

Answer: 220

VII. The title of Chapter 9 is:

Answer: Tables

VIII. Do Chapters 1 through 4 normally apply to Communications Systems?

Answer: No

Navigating the NEC Quiz

I. Use the Table of Contents to locate information about Equipment Grounding Conductors.

Answer: Page 129, Article 250, Part VI

II. Use the Index to locate information about Fixture Wires.

Answer: Article 402, 9 other references

III. Use either the Table of Contents or the Index, or both, to find information about Luminaires.

Answer: Article 410, page 277, 16 Parts

Navigating the NEC Quiz

IV. Use either the Table of Contents or the Index, or both, to find information about service disconnects.

Answer: Article 230, page 93, 8 parts

V. What does a “.“ in the margin indicate?

Answer: B Deleted text

Article 90

Article 90 Quiz

Please take 20 minutes to complete this quiz.



Article 90 - Quiz

I. Is an electrical substation owned by a manufacturing facility covered by the NEC?

Answer: A. Yes, 90.2 Scope

II. Information that is found in brackets is?

Answer: C. Informative, 90.5(C) Explanatory Material

III. The purpose of the NEC is to safeguard

Answer: C. Both, 90.1(A) Practical Safeguarding

IV. Electrical equipment found underground in a mine is subject to the NEC.

Answer: B. False, 90.2(B)(2) Not Covered

Chapter 1

Exercise:

What is the first definition in the Article?

Accessible (as applied to equipment)



Chapter 1

Exercise:

Find the Definition for a wet location.

What page is it found on?

Page 38



Article 110

Exercise:

What Section in Article 110 contains rules for electrical connections?

Section 110.14 Electrical Connections.



Chapter 1

Exercise:

What Table in the Code has the cmil equivalencies for AWG?

Chapter 9, Table 8 Conductor Properties



Chapter 1

Exercise:

What are the two options for Series Combination Systems?

1) Engineered

2) Tested



Chapter 1

Exercise:

Using Table 110.26(A)(1), find the required minimum depth of working space for a 480Y/277 V panelboard in Condition 2.

Answer: 1.0 m (3 ft. 6 in)



Chapter 1 - Quiz

I. What is the definition for *approved*?

Answer: Acceptable to the AHJ, found in Article 100

II. How many Conditions are listed under Table 110.26(A)(1)?

Answer: 3

III. High-leg marking requires marking the higher voltage conductor or busbar by

Answer: C. Both, Orange or other effective means

Chapter 1 - Quiz

IV. Connections of dissimilar metal conductors are permitted to be intermixed in any copper connector.

Answer: B. False; What section, 110.14.

V. Live parts operating at 480 volts are permitted to be protected from accidental contact by elevating them above the floor at least

Answer: C. 8' 6"; What section, 110.27(A)(4)(b).

Chapter 2

Exercise:

Using the Titles at the top of each page find Article 220. On what page does it begin?

Page 73



Article 220

To illustrate how to use Article 220, let's do a basic load calculation:

Load Calculation Exercise

Calculate the feeder size for a new 1000 sq. ft apartment that has the following loads:

- 1) Dishwasher @ 12.0 amperes, 120 volts
- 2) Clothes washer @ 10.0 amperes, 120 volts
- 3) Electric clothes dryer @ unknown
- 4) Electric water heater @ 4500 watts
- 5) Garbage disposal @ 6.3 amperes, 120 volts



Building 1000 sq. ft @ 3 VA per sq ft	3000 va	References: 220.14(J) 210.11(C)(3) and (4) 220.42 220.54 220.14(A), (B), (C) 220.50
Small appliance circuits (2 req) 2x1500 VA each	3000 VA	
Laundry circuit @ 1500 VA	<u>1500 VA</u>	
Total General lighting	<u>7500 VA</u>	
1st 3000 VA @ 100%	3000 VA	
Remainder VA @ 35%	<u>1575 VA</u>	
General Lighting Load	<u>4575 VA</u>	
Total general lighting load	4575 VA	
Dryer circuit @ 5000 VA (minimum)	5000 VA	
Dishwasher (12 amperes x 120 V = 1440 VA)	1440 VA	
Electric water heater	4500 VA	
Garbage Disposal (6.3 amperes x 120 V = 756 VA)	0756 VA	
25% of largest motor load (25% of 756 VA = 189 VA)	<u>0189 VA</u>	
Total Load for this Apartment	<u>16460 VA</u>	

Service size 16460 VA / 240 V = 69 amperes

Minimum size service rating is 70 amperes per 230.79(D) and 240.6(A).

Article 220

Building 1000 sq. ft @ 3 VA per foot	3000 VA	
Small appliance circuits (2 req) 2 1500 VA each	3000 VA	
Laundry circuit @ 1500 VA	<u>1500 VA</u>	
Total General lighting	7500 VA	
1st 3000 VA @ 100%	3000 VA	
Remainder VA @ 35%	<u>1575 VA</u>	
General Lighting Load	4575 VA	
Total general lighting load		4575 VA
Dryer circuit @ 5000 VA (minimum)		5000 VA
Dishwasher (12 amperes x 120 V = 1440 VA)		1440 VA
Electric water heater		4500 VA
Garbage Disposal (6.3 amperes x 120 V = 756 VA)		0756 VA
25% of largest motor load (25% of 756 VA = 189 VA)		<u>0189 VA</u>
Total Load for this Apartment		<u>16460 VA</u>
Service size: $16460 \text{ VA} / 240 \text{ V} = 69 \text{ amperes}$		
Minimum size service rating is 70 amperes per 230.79(D) and 240.6(A)..		



Article 250

Grounding and Bonding Exercise

Grounding Electrode Conductors. Table 250.66

250 kcmil would require a 2 AWG cu conductor

Main Bonding Jumpers. Table 250.102(C)(1)

500 kcmil would require 1/0 AWG cu or 3/0 AWG al

Equipment Grounding Conductors. Table 250.122

1200 ampere device would require 3/0 AWG cu or 250 kcmil al



Chapter 2

Final Exercise

As a final exercise, use Chapter 2 to find the answers to the following questions. Write down what resources you used to locate the answers (ToC, index, etc.) and in what Section the answer is found in the Code.



Chapter 2

Exercise:

- 1) For a branch circuit overcurrent protective device, what is the maximum rating of the device protecting a 10 AWG copper conductor (unless specifically permitted elsewhere in the Code)?

**Article 240.4(D) Small Conductors, (7) 10 AWG copper
30 Amperes**



Chapter 2

Exercise:

2) Are arc-fault circuit interrupters (AFCI) required for dwelling unit hallway branch circuits?

Article 210.12(A) Dwelling Units

Yes



Article 310

Conductor Ampacity Exercise:

A circuit with four 500 kcmil copper THHN/THWN-2 insulated current-carrying conductors is installed in an ambient temperature of 102° F. What is the final ampacity of the conductor, without regard to load or terminations?



Article 310

Conductor Ampacity Exercise:

Table 310.16, 500 kcmil copper THHN/THWN-2 is good for 430 amperes Table 310.15(C)(1) more than 3 current carrying conductors, 80% adjustment factor; Table 310.15(B)(1) 102° F requires .91 factor

$$\underline{430 \times 80\% = 344,}$$

$$\underline{344 \times .91 = 313.04}$$

313 Amperes



Chapter 3

Wiring Methods Exercise:

Installing Type MC cable requires a minimum bend radius for each type of armor or sheath. What is the minimum bending radius for each of the following cables:

- 1) Interlocked armor that has an external diameter of 2”:**
- 2) Smooth sheath that has an external diameter of 1”:**
- 3) Corrugated sheath that has an external diameter of 1.5”:** Accessible (as applied to equipment)

1) 14”; 2) 12”; 3) 10.5”



Chapter 3

Wiring Methods Exercise - continued:

I) Where do you measure the radius of the bend?

A. Inner curve

B. Outer curve

C. Midpoint of the cable

A. Inner edge of any bend



Chapter 3

Wiring Methods Exercise - continued:

II. Where would you normally find information about the external diameter of a cable, if you are not physically measuring it?

Manufacturer's specifications



Chapter 3

Wiring Methods Exercise - continued:

III. What is the purpose of the minimum bend radius requirement?

To prevent physical damage to the cable assembly



Article 410

Luminaire Exercise:

What is the minimum clearance between a luminaire and the nearest point of clothes storage for the following luminaires in a clothes closet:

- 1) surface-mounted incandescent _____**
- 2) recessed fluorescent _____**
- 3) recessed LED _____**

1) 12"; 2) 6"; 3) 6"



Article 410

Luminaire Exercise continued:

Are there any luminaires that are permitted to be installed within the clothes closet storage space? If so, what is the condition that must be met?

Yes, surface mounted fluorescent or LED fixtures where identified for the use.



Article 430

Motor Exercise:

A 2 hp, single-phase, 230 volt motor requires a minimum of what size branch-circuit short-circuit and ground-fault protection using a dual-element time-delay fuse (using no exceptions)? (List all code references used to find the answer.)

Table 430.248, 12 amperes FLC

Table 430.52 dual-element time delay fuses - 175%

$12 \times 175\% = 21$ amperes (20 ampere fuse) per 430.52(C)(1)



Chapters 5, 6 and 7

Temporary Installations Exercise:

I. Find the Article for Temporary Installations. What is the Article number?

Article 590

II. Find the Section within that Article for Feeders. What is the Section number?

Section 590.4(B)



Chapters 5, 6 and 7

Temporary Installations Exercise continued:

III. Within that Section, what wiring method is specifically permitted in an underground raceway that is otherwise prohibited to be installed underground?

Type SE cable, 590.4(B)(2)

IV. Within that Section, what wiring method is permitted to be used for emergencies and tests that would otherwise be prohibited?

Single insulated conductors for the purposes specified in 590.3(C). Found in 590.4(B) Exception.



Chapters 5, 6 and 7

Temporary Installations Exercise continued:

V. For the answer in question IV, the wiring method must be _____ only to qualified persons.

accessible



Chapter 9

Can I round up when I calculate the number of conductors in a raceway?

Yes, if the decimal is greater than or equal to 0.8; Note (7)

How do I determine the area of an elliptical cable?

The major diameter of the elliptical; Note (9)



Chapter 9

Can I use the actual dimensions of a conductor, or do I have to use the values given in the NEC?

Yes; Note (10)

Am I limited to 40% fill if I have a short piece of conduit?

No, 60% fill for lengths not to exceed 24"; Note (4)



Chapter 9

Chapter 9 Tables Quiz

Please take 20 minutes to complete this quiz.



Chapter 9 Tables Quiz

I. Using Table 1, answer the following questions:

A. What minimum percentage fill is permitted for four conductors in a conduit?

Answer: 40%; Table 1

B. Are cables in raceway subject to the conduit fill percentage limitations?

Answer: Yes; Note (9)

C. What is the range of conductor outer diameter to raceway inner diameter ratios that can result in jamming?

Answer: 2.8 to 3.2 ratio; Informational Note No. 2

II. Using Table 4, find the minimum size for an FMC conduit that has four conductors with a total area of .951 sq. in.

Answer: Trade Size 2

Chapter 9 Tables Quiz

III. What note in Notes to Tables sends you to Table 8 for bare conductors dimensions?

Answer: Note (8)

IV. In Table 10, how many strands does a Class C 750 kcmil conductor have?

Answer: 91 strands

Informative Annexes

Annex C Exercise:

I. Using the Table of Contents on the first page of Annex C, how many tables are contained within the annex?

Answer: 33 separate tables

II. What is the significance of the letter (A) following the table number?

Answer: Tables with (A) are for compact stranded conductors



Informative Annexes

Annex C Exercise:

What is the maximum number of compact stranded 1/0 AWG THHN conductors that can be pulled into a Trade size 2 Intermediate Metal Conduit?

- A. 7**
- B. 8**
- C. 9**
- D. 11**

Answer: C. 9



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