2017 Master Code Practice Exam - 100 Question Answer Key

#	CORRECT ANSWER	ANSWER JUSTIFICATION OR CODE REFERENCE
1	D. all of the above	328.10
2	D. 175A	**Step 1: Lighting and Receptacles** Lighting = Table 220.12 = 3va x 1500 sq ft = 4500VA Small Appliance = 1500VA x 2 = 3000VA Laundry = 1500VA **Step 2: Table 220.42 - Lighting Demand** 4500VA + 3000VA + 1500VA = 9000VA First 3000VA @ 100%, Remainder @35% = 3000VA + 2100VA = 5100VA **Step 3: Cooking Appliances** 2 ovens @ 4000W each = 8000VA 1 cooktop = 5100VA Use Column C in Table 220.55 to find that 3 appliances between 3.5kW through 8.75kW can be totaled to 14kW. You could use Table A, instead, but for this calculation it was specified to use Column C. So total demand load for cooking appliances is 14,000 **Step 4: Air Conditioning** (6) 7A Window AC units = 6 x 7A = 42A 42A x 240V = 10,080VA **Step 5: Fixed Electric Space Heating** 220.51 requires the bathroom heater to be calculated at 100% of the total connected load. This is not considered a non-coincident load since this heater could be turned on at the same time AC is running. So this load is 1500VA **Step 6: Noncoincident Loads** None **Step 7: Appliances**

		Dryer = 5000W Water Heater = 4500W Dishwasher = 1200VA **Step 8: Add up all prior steps** 5100VA Lighting + 14,000VA Cooking + 10,080VA AC + 1500VA Heat + 5000W Dryer + 4500W Water Heater + 1200VA Dishwasher = 41,380VA 41,380VA / 240V = 172A Using Table 240.6(A) we find the next standard size breaker is 175A, therefore the service rating would need to be 175A.
3	D. Class I, Division 2	514.3(B)(3)(e)
4	B. 70%	630.31(A)(1)
5	B. grouped	424.19
6	D. Interactive	706.8(B)
7	A. Class I, Division 2	Table 511.3(D)
8	A. 8.8kW	1) Combine the Appliances NEC 220.55, Note 4: A counter-mounted cooking unit and up to two wall-mounted ovens (in the same room) can be added together and treated as one range. Nameplate ratings: Cooktop: 6 kW (2) Wall ovens: 4 kW each → 8 kW total Combined load: 6 kW + 8 kW = 14 kW 2) Apply Table 220.55 (Column C) For one range up to 12 kW, the demand is 8 kW. 3) Adjust for Over 12 kW (Note 1) The appliance is 2 kW above 12 kW → 2 increments of 5% = 10% Additional: 10% of 8 kW = 0.8 kW 4) Calculate Final Demand 8 kW (base) + 0.8 kW (overage) = 8.8 kW, so maximum demand load is roughly 8.8kW
9	D. 45,000VA	Choose the larger of 220.14(K)(1) or 220.14(K)(2) - in this case 220.14(K)(1) = 250 x 180VA = 45,000VA. 220.14(K)(2) = 25,000 x 1VA = 25,000VA.
10	C. 162,940VA	First, let's calculate the total connected load by adding up all the individual loads for both 120V and 208V systems.

		120-Volt Loads 60 duplex receptacles: As per 220.14(I), each duplex receptacle is calculated at 180 VA for commercial buildings. So, 60 receptacles amount to 60 × 180 VA =10,800 VA 100 ft multi-outlet assembly: Given in 220.14(H) of 180 VA per foot = 18,000 VA 1 broiler 5 kW = 5,000 VA 2 deep fryers 5.5 kW each = 2×5,500 VA=11,000 VA 1 freezer 3,400 VA 1 booster heater 1,500 VA 1 coffee service machine 3,500 VA 1 dishwasher 3,500 VA 208-Volt Loads 1 walk-in cooler 6,400 VA 1 water heater 4,800 VA 1 oven 20 kW = 20,000 VA 1 range 15 kW = 15,000 VA 2 convection ovens 8 kW each = 2×8,000 VA=16,000 VA 1 15kW electric heater = 15,000 VA 1 14 kW AC = 14,000 VA 3 208V exhaust fans 2.4A each = 3×2.4A×208V = 1500 VA 1 cooktop 10 kW = 10,000 VA 2 10 kW heating units = 2×10,000 VA=20,000 VA We'll sum these up to get the total connected load. Then we'll apply the demand factors from Table 220.88 to calculate the total demand load. The demand factor for all electric restaurants will be applied to the total connected load. Total 120V loads: 56,700 VA Total 208V loads: 122,700 VA Total Lighting and Sign: 50,000 VA Total Connected Load (Before Demand Factor): 65,700 VA + 122,700 VA + 50,000 VA = 229,400 VA First 200kVA calculated at 80% = 160kVA Remaining 29,400VA at 10% = 2,940VA Total Demand Load = 160,000VA + 2,940VA = 162,940VA
11	C. 225A primary /300A secondary	1. Calculate primary Full Load Amperage using: FLA_primary = (kVA x 1000) / (E x √3). For a 75 kVA transformer with a 480V primary voltage: FLA_primary = (75kVA x 1000) / (480 x √3) = 90.2A According to Table 450.3(B), for primary protection of a transformer with a current of 9 amperes or more, we can use up to 250% of the primary current rating if secondary protection is provided. Otherwise, if only primary protection is used, it can be 125%. Primary FLA = 90.2 x 2.50 = 225.5A This is the maximum ampere rating, so we cannot go up to 250A (note 1 only applies to 125% specifically, not 250%) Therefore we

<table>
<tr><td>12</td><td></td><td>would select a 225A OCPD for our primary protection.

2. Calculate secondary Full Load Amperage using:
FLA_secondary = (kVA x 1000) / (E x √3).

For a 75 kVA transformer with a 208V secondary voltage:
FLA_secondary = (75kVA x 1000) / (208 x √3) = 208.2A

Primary FLA = 208.2 x 1.25 = 260.25A

Per Note 1 of Table 450.3(B): 1. Where 125 percent of this current does not correspond to a standard rating of a fuse or nonadjustable circuit breaker, a higher rating that does not exceed the next higher standard rating shall be permitted.

Using Table 240.6(A) we see there is only 250A or 300A to choose from. Therefore we can upsize to a 300A breaker maximum for the secondary OCPD device for this transformer.

So your final answer should be 225A primary OCPD and 300A secondary OCPD.</td></tr>
<tr><td>12</td><td>B. 125A</td><td>455.7(A)</td></tr>
<tr><td>13</td><td>C. 45A</td><td>Table 430.72(B) Column C</td></tr>
<tr><td>14</td><td>C. 18 inches</td><td>513.10(C)(1)</td></tr>
<tr><td>15</td><td>A. a means to de-energize the cable conductors and power service delivery device</td><td>626.23(B)</td></tr>
<tr><td>16</td><td>C. 50A</td><td>Subtotal = 6,600VA
First 3000 VA at 100% = 3,000VA
Remainder (6600VA – 3000VA = 3600VA) × 35% = 1,260VA
Total = 4,260VA
Amperes per leg = 4620VA / 240V = 17.75A per leg

<table>
<tr><th>Leg A</th><th>Leg B</th></tr>
<tr><td>18 (lighting/appliances)</td><td>18 (lighting/appliances)</td></tr>
<tr><td>4 (Fan 200VA x 1.25 / 120V)</td><td>4 (Fan 200VA x 1.25 / 120V)</td></tr>
<tr><td>2 (Fan 200VA x 1.25 / 120V)</td><td>- (Fan 200VA x 1.25 / 120V)</td></tr>
<tr><td>- (Dishwasher 400VA / 120V)</td><td>3 (Dishwasher 400VA / 120V)</td></tr>
<tr><td>23 (Range 7000VA x 0.8 / 240V)</td><td>23 (Range 7000VA x 0.8 / 240V)</td></tr>
<tr><td>47A (Total amperes per leg)</td><td>48A (Total amperes per leg)</td></tr>
</table></td></tr>
</table>

		Step B: Total Load for Determining Power Supply Based on the higher current calculated for either leg, a minimum 50-A supply cord would be required.
17	B. listed antenna discharge unit	810.20(A)
18	D. All of these	750.20
19	A. 1/0 THWN Primary, 400 kcmil THWN Secondary	**1. Calculate primary Full Load Amperage using:** FLA_primary = (kVA x 1000) / (E x √3). For a 112.5kVA transformer with a 480V primary voltage: FLA_primary = (112.5kVA x 1000) / (480 x √3) = 135.3A **2. To size the primary conductors we refer to Table 310.15(B)(16) and find, under the 75ºC column 1/0 copper THWN will handle up to 150A.** **3. Calculate secondary Full Load Amperage using:** FLA_secondary = (kVA x 1000) / (E x √3). For a 112.5kVA transformer with a 208V secondary voltage: FLA_secondary = (112.5kVA x 1000) / (208 x √3) = 312.3A **4. To size the secondary conductors we refer to Table 310.15(B)(16) and find, under the 75ºC column 400 kcmil copper THWN will handle up to 335A.**
20	D. Class **I**, Division 1	Table 515.3
21	B. plus 125% of the FLA rating of all resistance heating loads	409.21(C)
22	C. helps to prevent unintentional signals on fire alarm circuit(s)	760.30
23	B. 2 feet	514.8 Exception 2
24	C. 12 inches	470.3
25	C. 2	518.4(A)
26	A. 150V or more than 5A	727.5
27	C. 167%	522.10(A)(2)
28	D. 135%	430.27 and 460.8(A)
29	D. 70A	Table 430.52 shows wound-rotor motors on non delay fuses can

		be calculated at a maximum of 150% of the motor's Full-Load Current. Table 430.250 shows a 15HP 230V motor has an FLC of 42A. Calculate: 42A x 1.5 = 63A Table 240.6(A) only has a 60 or 70A fuse, not 63 430.52 Exception 1 states: Where the values for branch-circuit short-circuit and ground-fault protective devices determined by Table 430.52 do not correspond to the standard sizes or ratings…a higher standard size shall be permitted. Therefore a 70A fuse is permitted.
30	D. ampere rating of largest motor, from the motor nameplate, or load	670.3(A)
31	A. copper	332.108
32	C. 194°F	410.11
33	A. 125%	675.11(B)
34	D. 125%	422.10(A)
35	B. is identified as a means of support	300.11(C)
36	C. orange	110.15
37	B. 20A	Table 400.5(A)(1)
38	D. dry and damp	Table 310.104(A)
39	A. Line-to-neutral loads	210.4(C)
40	C. supported by messenger wires	225.6 (B)
41	B. 10	240.21(B)(1) (2)
42	C. be permitted to be tapped, without overcurrent protection at the tap	240.21(B)(3)(3)
43	B. 22.5	Table 680.9(A)
44	A. 1/0 AWG and larger	310.10(H)(1)

45	C. 18	210.52(A)(3)
46	A. 6	Table 300.5
47	C. derived ungrounded	250.30(A)(2)
48	B. 83%	310.15(B)(7)
49	A. AC	320.40
50	B. 3-wire	220.82(A)
51	B. two	210.52(B)(3)
52	D. 200	630.12(B)
53	A. 10 ft	Table 680.9(B)
54	A. 3 feet	Table 110.26(A)(1)
55	D. 1.342 square inches	Ch.9 Table 1 shows percent of cross-sectional area for a conduit with two or more conductors shall be a maximum of 40%. Also Chapter 9 Table 4 EMT shows this same relationship in the 2" row, under the 40% column. Either method will yield the same result. 3.356 sq-in x 0.40 = 1.342 sq-in
56	B. 3 feet 6 inches	Table 110.26(A)(1)
57	C. 3/0	Table 250.102(C)(1)
58	A. Bare copper conductor not smaller than 4 AWG	250.52(A)(3)
59	B. Flexible metallic tubing	250.118(7)
60	D. without	240.30(B)
61	B. insulated	250.118(10)
62	C. ungrounded	250.4 (B)(4)
63	D. Both A and C	646.6(B)(2)
64	C. 25.2 kW	Refer to Table 220.55, Column B, for 8kW appliances, shows for 9 units the maximum demand factor is 35%. Maximum demand load = 8 kW×9×0.35=25.2 kW
65	B. 90A	430.6(A), 430.250 lists FLC rating for 25HP squirrel cage 460V motor is 34A . Table 430.52 shows AC polyphase motors can have a max rating of 250% of the motor's FLC. Therefore 34A x 2.5 = 85A.

		Looking at Table 250.6(A) we see 85A is not a standard breaker size so we need to either round up to 90A or round down to 80A. Back in Table 430.52 Exception 1 states: Where the values for branch-circuit short-circuit and ground-fault protective devices determined by Table 430.52 do not correspond to the standard sizes or ratings of fuses, nonadjustable circuit breakers, thermal protective devices, or possible settings of adjustable circuit breakers, a higher size, rating, or possible setting that does not exceed the next higher standard ampere rating shall be permitted. Thus we would round up to a 90A breaker for this instance.
66	A. 30	725.41(A)
67	C. 6	230.71(A)
68	C. vapor seal	368.234(A)
69	D. utilize a permanently attached power supply cable	626.23(A)
70	D. at least equal to	110.9
71	A. over 150V to ground	425.14
72	D. the same	701.10
73	A. 15-minute	708.20(F)(1)
74	B. 17 feet	Table 680.9(A)
75	C. 175 %	440.22(A)
76	B. abut, but not overlap	505.7(B)
77	A. five times	338.24
78	D. 6 AWG copper	Table 250.102(C)(1)
79	B. evaporative coolers	210.63 Exception
80	D. 300%	630.32(B)
81	B. have a distinctive color or marking so as to be readily identifiable	708.10(A)(2)
82	C. 30V AC	393.10(1)
83	D. 100°F	514.3(A)

84	C. 11 kVA	626.11(A)
85	C. two to six	230.40 Exception 2
86	A. nonconducting	480.9
87	B. eight times the metric designator (trade size) of the largest raceway.	380.23
88	D. critical branch	517.18(A)
89	B. 14 inches	Table 354.24(A)
90	D. 1/0 AWG	374.20
91	A. non-threaded fittings	440.9
92	C. The required conductor shall be secured within or under the perimeter surface 120 mm to 170 mm (6 in to 8 in) below the subgrade	680.26(B)(2)(b)
93	A. reclassified	506.7(C)
94	C. equipment grounding conductor	515.8(C)
95	B. 3A	Table 522.22
96	D. largest single	710.15(A)
97	D. 70% / 50%	630.31(A)
98	A. 6 feet	110.33(A)(1)
99	C. 5 ft / 6 ft	328.30
100	D. 8 AWG	547.10(B)