USSolarInstitute

Real. World. Training.

NABCEP's Solar PV Installer Exam is notoriously hard.
Here are 50 practice questions to help you pass.

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1. NEC section _____ shows the requirements for working spaces around live electrical equipment?

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1. Answer:

110.26

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2. What is the maximum latitude at which the sun can achieve a 90° altitude angle?

a. 30.45°

b. 23.45°

c. 18.45°

d. 40.45°

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2. Answer:

b. Approx. 23.45º north and south of the equator, but like magnetic declination, the latitude of the Tropics varies over time.

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3. If the open circuit voltage of a polycrystalline silicon PV module is 37.0V, the module Vmp is 29.9V, the inverter max voltage is 600VDC and its MPPT voltage range is 300 to 480VDC, and the minimum temperature is -24°C. What is the maximum number of modules per source circuit according to the NEC? List the NEC section where the answer is found.

a. 11
b. 14
c. 13
d. None of the above

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3. Answer C:

37V x 1.20 = 44.4V

600V max ÷ 44.4V = 13.4 ⟶ 13 modules

NEC Table 690.7 – 1.20 correction factor

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4. A PV array of Suniva 300 Watt modules consists of 3 rows and 10 columns of racked modules mounted in landscape and facing south at latitude 30°. The modules are tilted at 20°. The mounting posts are installed 3 ft. deep. How long must the posts be? Module dimensions are 77.6" x 38.7".

a. 94.05"
b. 62.54"
c. 75.7"
d. 39.7"

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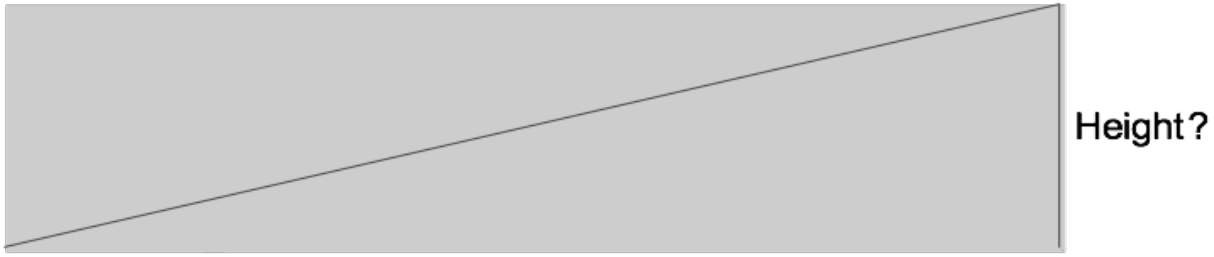
4. Answer



Answer: C

Sin(angle) = opposite ÷ hypotenuse

$\text{Sin}(20^0)$ = Height ÷ 38.7" x 3

Height = $\sin(20^0)$ x 116.1"

Height = 0.342 x 116.1" = 39.7 "

39.7" + 36" = 75.7"

for your test with Sea

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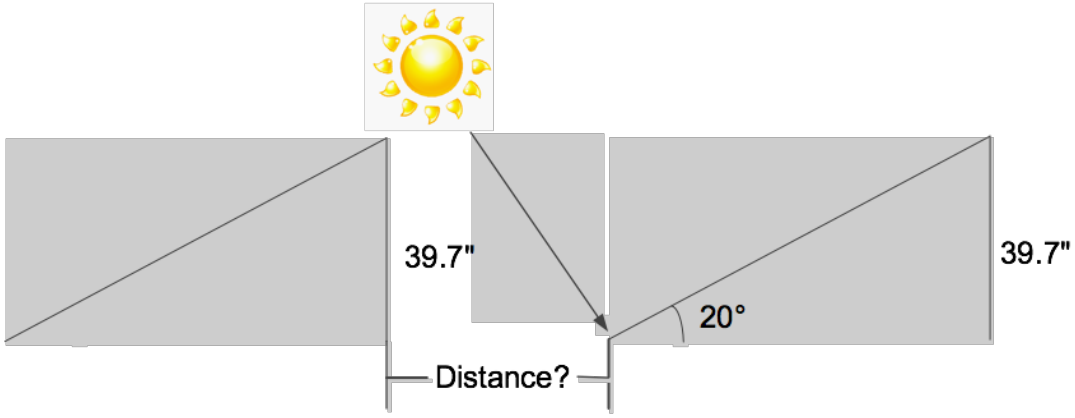
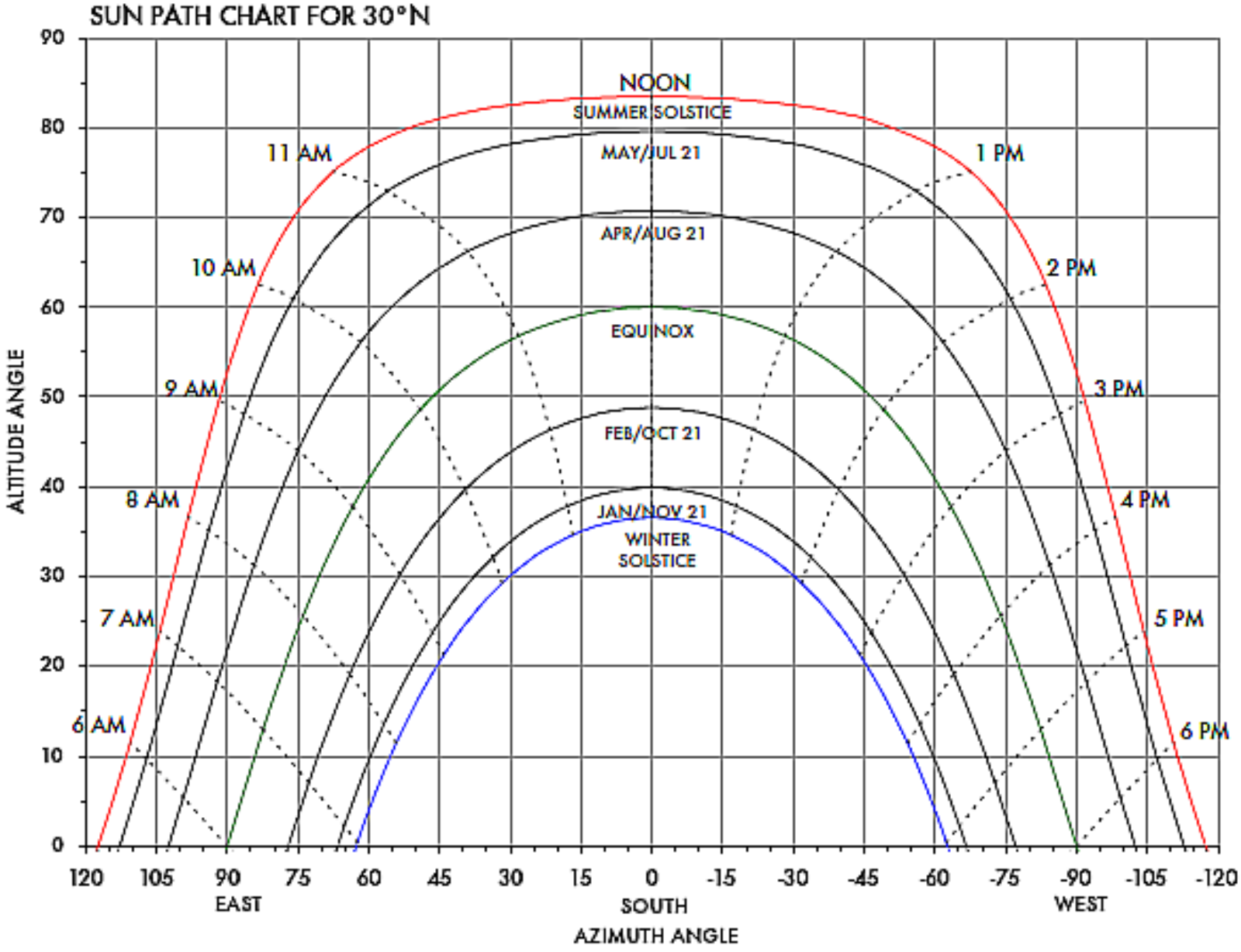
5. An array located at 30^{0}N latitude consists of two rows racked facing south. Both rows are on a level surface and the height from the ground to the highest point on the module is 39.7”. Calculate the minimum distance in feet needed between rows so the modules will not be shaded at 9AM on December 21. Use the sun chart provided.




SUN PATH CHART FOR 30°N
ALTITUDE ANGLE
AZIMUTH ANGLE
NOON
SUMMER SOLSTICE
MAY/JUL 21
APR/AUG 21
EQUINOX
FEB/OCT 21
JAN/NOV 21
WINTER SOLSTICE
11 AM
10 AM
9 AM
8 AM
7 AM
6 AM
1 PM
2 PM
3 PM
4 PM
5 PM
6 PM
90
80
70
60
50
40
30
20
10
0
120
105
90
75
60
45
30
15
0
-15
-30
-45
-60
-75
-90
-105
-120
EAST
SOUTH
WEST

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5. Answers:

a. 103.3”
b. 8.6’
c. 9’
d. 5.7’

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5. Answer: b

Tan(angle) = opposite ÷ adjacent where opposite is array height and adjacent is row-to-row spacing

Tan(21°) = 39.7“ ÷ Row-to-row
Row-to-row = 39.7" ÷ 0.384
Row-to-row = 103.4“ or 8.6’

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6. At 43^0 North latitude on the winter solstice, the solar altitude angle at noon is_____.

a. 43^0
b. 23.45^0
c. 90^0
d. 70.45^0

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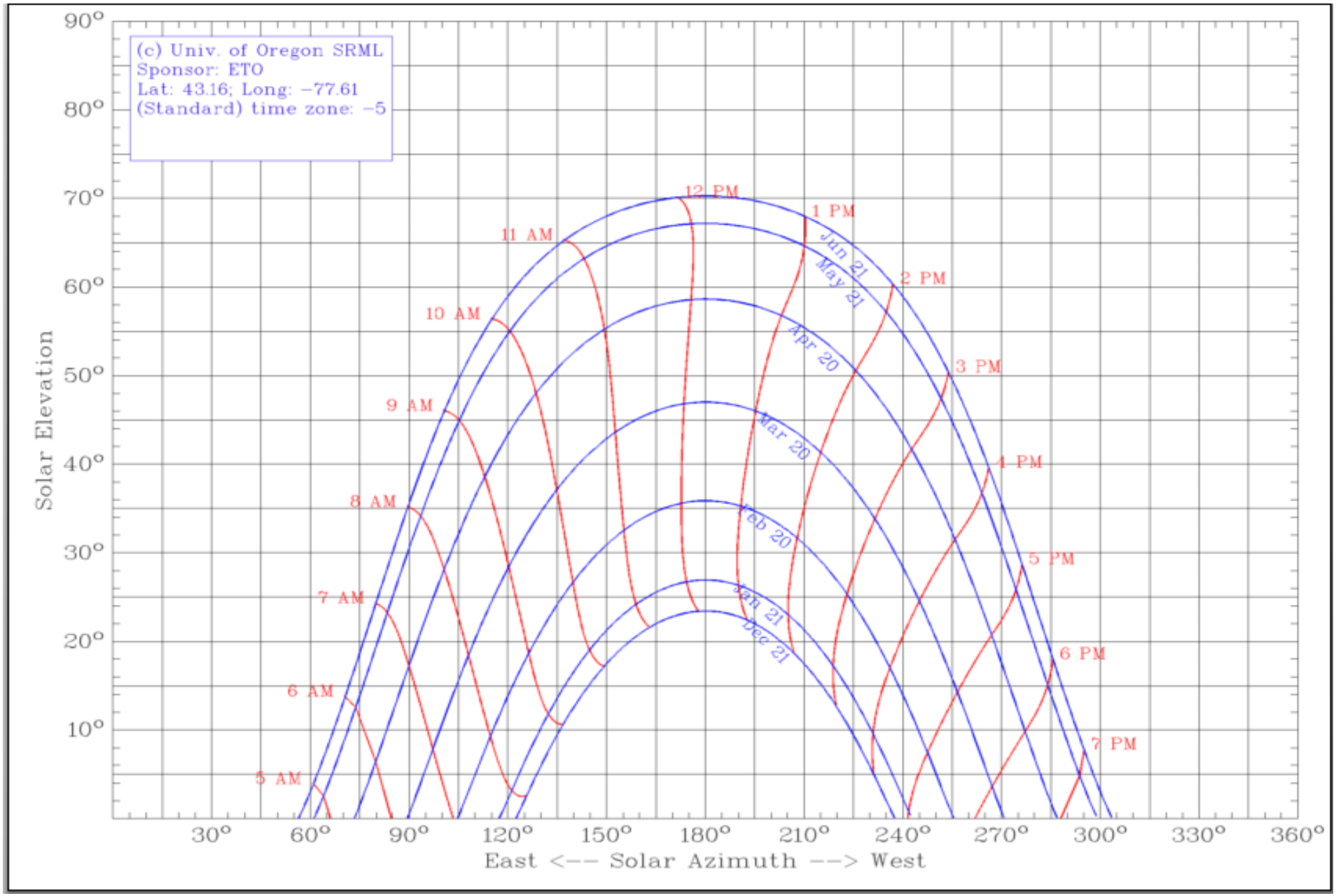
6. Answer:
d. 23.55^0

90° - 43° (latitude) + (-23.45°) = 23.55°

For the Summer Solstice, the third number is +23.45°C, resulting in 70.45°.

For either equinox, the last number is zero.


(c) Univ. of Oregon SRML
Sponsor: ETO
Lat: 43.16; Long: -77.61
(Standard) time zone: -5
Solar Elevation
East <-- Solar Azimuth --> West
90°
80°
70°
60°
50°
40°
30°
20°
10°
30°
60°
90°
120°
150°
180°
210°
240°
270°
300°
330°
360°
12 PM
1 PM
11 AM
Jun 21
May 21
2 PM
10 AM
Apr 20
3 PM
9 AM
Mar 20
4 PM
8 AM
Feb 20
5 PM
7 AM
Jan 21
Dec 21
6 PM
6 AM
7 PM
5 AM

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7. An array is comprised of 22 modules. Each module is 64.5” x 38.7” and weighs 44.1 lbs. The site will experience 50 psf. of uplift force. What is the approximate total uplift on the array?

a. 48,000 lbs.
b. 19,000 lbs.
c. 13,000 lbs.
d. 16,000 lbs.

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7. Answer:
a. 19,000 lbs.

64.5” x 38.7” ÷ 144 sq. in/sq. ft. = 17.33 sq. ft.
17.33 sq. ft. x 22 modules x 50 psf = 19063 lbs.

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8. What is the temperature correction factor if the module correction factor is -0.335 %/^{0}C and the cell temperature is 54^{0}C?

a. 0.903
b. 1.181
c. 1.097
d. 0.819

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8. Answer:

a. 0.903

$1 + (-0.00335 \times (54 - 25)) = 0.903$

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9. A module has dimensions of 64.5” x 38.7” and is in a landscape orientation on a flat roof. The position of the sun at 9am on Dec 21 is 11° elevation and 130° azimuth. What is the maximum tilt angle the modules can have so that there is no inter-row shading. A 2 foot walkway is required between adjacent rows?

a. 10°
b. 15°
c. 20°
d. 25°

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9. Answer:
a. 10° is the closest to 10.8°

Module width x SIN(tilt angle) = module height

Module height x COS(azimuth angle) ÷ TAN(elevation angle) = minimum row spacing

The azimuth angle is 180 – 130 = 50°
The height is 24” x TAN(11) ÷ COS (50) = 7.26”
SIN^{-1}(7.26” ÷ 38.7”) = 10.8° tilt angle

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10. Where no overcurrent protection is provided for the PV dc circuit, an assumed overcurrent device rated at the PV circuit Isc is used to size the equipment grounding conductor in accordance with NEC _____.

a. Article 250.122
b. Article 250.66
c. Table 250.122
d. Table 250.66

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10. Answer:

c. Table 250.122

NEC Article 690.45(A) refers to Table 250.122

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11. There are to be two critical loads on a PV system. Your analysis shows that one uses 1900 Wh/day and operates for 6 hrs. per day and the other uses 1200 Wh/day and operates for 3.5 hrs. What is the weighted average operating time?

a. 4.9 hrs./day
b. 5 hrs./day
c. 9.5 hrs./day
d. 5.3 hrs./day

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11. Answer: b. 5 hrs./day

$$\frac{(1900\ \text{Wh/day} \times 6\ \text{hrs.}) + (1200\ \text{Wh/day} \times 3.5\ \text{hrs.})}{(1900\ \text{Wh/day} + 1200\ \text{Wh/day})} = 5\ \text{hrs.}$$

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12. What is the combined effect in wattage of the 2 loads in the previous question?

a. 3500 Watts
b. 620 Watts
c. 140 Watts
d. 1.9 Watts

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12. Answer: b 620 Watts

$$\frac{(1900\ \text{Wh/day} + 1200\ \text{Wh/day})}{5.0\ \text{hrs.}} = 620\text{W}$$

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13. The critical design month is the worst case scenario where the load and the _____ are used to design the PV system.

a. Peak demand
b. Total power demand
c. Duty cycle
d. Insolation data

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13. Answer: d. Insolation data

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14. Active means of charge control is required by the NEC unless the maximum array charge current for 1 hour is less than _____ % of the rated battery capacity measured in amp/hours.

a. 1
b. 3
c. 5
d. 10

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14. Answer: b. 3%

See NEC 690.72

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15. When battery temperature is high, temperature compensation _____ the VR set point to minimize the excessive over charging and reduce electrolyte losses.

a. lowers
b. raises
c. does not change
d. none of the above

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15. Answer: a Lowers

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16. A 48 volt battery bank is used to provide power for critical loads requiring 7458 Wh/day. Three days of autonomy are required. What is the required capacity of the battery bank?

a. 155.4 Ah
b. 466 Ah
c. 604 Ah
d. None of the above

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16. Answer: b. 466 Ah

7458 Wh ÷ 48V = 155.4 Ah/day

155.4 Ah/day x 3 days autonomy = 466 Ah

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17. Critical loads operate for 12 hours. Three days of autonomy are required and the preferred depth of discharge of 50%. What is the average discharge rate?

a. C/180
b. C/72
c. C/36
d. C/24

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17. Answer: b. C/72

12 hrs./day x 3 days autonomy = 36 hrs
36 hrs. ÷ 0.5 DOD = 72 hrs. → C/72

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18. A battery bank of 500 Ah is required. The depth of discharge is 50%, the minimum operating temperature is -10°C and the average discharge rate is C/128. According to the manufacturer's specs. this yields a temperature and discharge rate derating factor of approximately 73%. What is the required battery bank capacity?

a. 250 Ah
b. 1370 Ah
c. 684 Ah
d. 1000 Ah

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18. Answer: b. 1370Ah

Given 50% DOD, the battery bank must be:
500 Ah ÷ 0.5 = 1000 Ah

Because 27% of the capacity is lost due to cold temperatures per the manufacturer:

1000 Ah ÷ 0.73 = 1369.9 Ah → 1370Ah

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19. A battery bank must supply 1200 Ah and will operate at 48V. The battery selected is an 800 Ah battery. How many 6V batteries will be required in this battery bank?

a. 8
b. 16
c. 24
d. None of the above

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19. Answer: b. 16

48V bank ÷ 6V battery = 16 batteries in series to achieve voltage

1200 Ah ÷ 800Ah = 1.5 → 2 parallel strings of batteries

8 x 2 = 16

Nothing was mentioned about DOD.

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20. A PV system needs to supply 5834 Wh per day. The daily average insolation is 4.8 peak sun hours. The battery system charging efficiency is 0.9. The nominal voltage is 48V. What is the required array current not including any additional deration factors?

a. 27.9A
b. 28.1A
c. 64.8A
d. 25.3A

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20. Answer: b. 28.1A

5834 Wh/day ÷ 4.8 Peak Sun Hours = 1215.4W

1215.4W ÷ 0.9 charging efficiency = 1350.5W

1350.5W ÷ 48V = 28.1A

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21. You are an installer called to move a residential two-axis tracker system from Yuma, AZ to Duluth, MN. Before reinstalling the system what should you check?

a) The system open circuit voltage
b) The new house branch circuit amperage
c) The breaker size of the main panel
d) The insolation difference

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21. Answer: a. Check the Voc.

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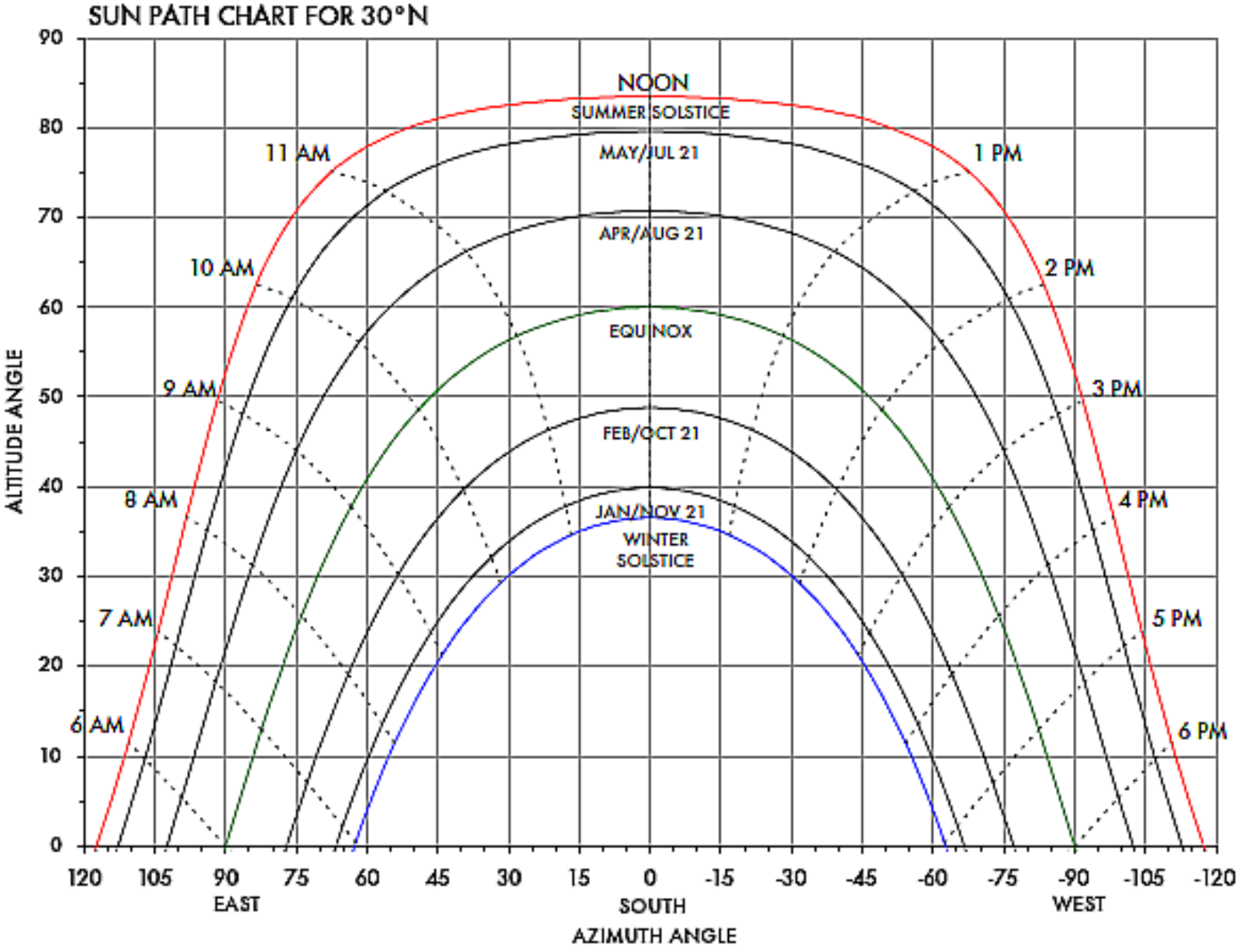
22. For a PV array to directly face the sun at 11 AM solar time on June 21st at 30^{0}N latitude, at what tilt and azimuth angles should the modules be mounted? Use the sun-path chart provided.


SUN PATH CHART FOR 30°N
ALTITUDE ANGLE
AZIMUTH ANGLE
NOON
SUMMER SOLSTICE
MAY/JUL 21
APR/AUG 21
EQUINOX
FEB/OCT 21
JAN/NOV 21
WINTER SOLSTICE
11 AM
10 AM
9 AM
8 AM
7 AM
6 AM
1 PM
2 PM
3 PM
4 PM
5 PM
6 PM
90
80
70
60
50
40
30
20
10
0
120
105
90
75
60
45
30
15
0
-15
-30
-45
-60
-75
-90
-105
-120
EAST
SOUTH
WEST

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22. Answer:

Approximately 14^0 elevation and 63^0E azimuth

Elevation = $90^0 - 76^0 = 14^0$

Note: The sum of all angles in any triangle = 180^0

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23. The purpose of a linear current booster is to:

a. Keep its output voltage the same as its input voltage and boost the output current to a value larger than the input current.

b. Convert a high input voltage and low input current to a lower output voltage and a higher output current.

c. Convert a low input voltage and high input current to a higher input voltage and a lower input current.

d. Keep its output current the same as its input current and boost the output voltage to a value larger than the input voltage.

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23. Answer: b. Convert a high input voltage and low input current to a lower output voltage and a higher output current

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24. Where the removal of the utility-interactive inverter or other equipment disconnects the bonding connection between the grounding electrode conductor and the photovoltaic source and/or the photovoltaic output circuit grounded conductor, a_____ shall be installed to maintain the system grounding while the inverter or other equipment is removed.

a. Grounding-electrode conductor
b. Fuse
c. Bonding jumper
d. Overcurrent device

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24. Answer:
c. Bonding jumper

NEC Article 690.49

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25. In addition to NEC Article 690. where else in the NEC are over-current devices are addressed?

a. Article 250
b. Article 300
c. Article 100
d. Article 240

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25. Answer:
d. Article 240

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26. You are inspecting a PV system in Oregon. The array is facing south on a 6/12 pitch roof and the PV equipment is on the east side of the house 60 feet from the combiner. You see an SMA inverter with a #6 GEC run to the ground rod. To the right, is a 30A disconnect with EMT extending to the roof. Inside the disconnect you see two black PV conductors landed onto the terminals. Your inspection of the combiner box on the roof shows two black PV wires. Each one is terminated on a fuse holder and the ground wire is terminated on the ground bus. What type of PV system are you inspecting?

a. Positive ground system
b. Bi-polar
c. Ungrounded
d. Negative ground system

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26. Answer:

c. Ungrounded

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27. USE-2 wire must be strapped and secured between modules at intervals no more than:

a. 6’
b. 3’
c. 4.5’
d. 10’

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27. Answer:

c. 4.5’

Installation methods for exterior USE–2 conductors, commonly used in PV arrays, are stated in NEC 338.10(B)(4). This section refers to Article 334.30 for support methods. Article 334 is entitled Non-Metallic Sheathed Cable (often referred to by the trade name Romex).

The requirements for fastening NM cable are well understood by AHJ. (Field Inspection Guidelines by Bill Brooks)

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28. If the uplift force on a system is 1,200 pounds with a safety factor of 1.5, what is the uplift force with a safety factor of 2?

a. 800 lbs
b. 1200 lbs
c. 1400 lbs
d. 1600 lbs

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28. Answer:

d. 1600 lbs

1200 lbs ÷ 1.5 = 800 lbs

800 lbs x 2 = 1600 lbs

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29. When GFP is used on an inverter, the grounded and grounding conductors should be:

a. Grounded: Isolated, grounding: Isolated from case
b. Grounding: Isolated, grounded: Connected to case
c. Both: Connected to case
d. Grounding: Connected to case, Grounded: Bonded to grounding

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29. Answer:

d. Grounding: Connected to case, Grounded: Bonded to grounding

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30. A customer in New Mexico has a 6000W grid-tied PV system. Every day around noon during the summer, the 25A solar breaker trips. The inverter is on the south side of the house. The conduit run from the inverter to the transition box is 200 ft. The array is facing true south at latitude. What should be done to prevent the breaker from tripping?

a. Move the inverter out of the sun to lower its internal temperature
b. Increase the breaker size
c. Increase the wire size between the transition box and the inverter to compensate for voltage drop
d. Decrease the tilt of the array to lower production

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30. Answer:

b. Increase the breaker size.

6000W ÷ 1.2 = 5000W inverter
5000W ÷ 240V = 20.8A
20.8A x 1.25 = 26.04A

A 30 amp breaker was needed for this system

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31. You are on a roof in December to check system production compared with the expected production. You know there will be some shading around 3 p.m. In addition to a multi-meter, what tools will you need?

a. Pathfinder and Temp. gauge
b. Pathfinder and Irradiance meter
c. Irradiance meter and temp. gauge
d. Temp. gauge and inclinometer

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31. Answer:

c. Irradiance meter and temp. gauge

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32. When checking short-circuit current on a string of modules, what do you do first?

a. Measure short circuit current
b. Inspect for shading
c. Measure voltage
d. Measure operating current

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32. Answer:

d. Measure operating current

You must verify that the circuit is in the open position before you loosen any terminals to which the conductor is attached.

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33. When troubleshooting modules, what do you do?

a. Disconnect all loads to prevent module arcing when unplugged
b. Open DC disconnect on the inverter
c. Open AC disconnect
d. Pull fuses in combiner box

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33. Answer:

a. Disconnect all loads to prevent module arcing when unplugged

All are correct: 1. Open the AC disconnects. 2. Open the DC disconnects. 3. Pull fuses in the combiner box.

Taking all these steps ensures that all loads are disconnected. Then it is safe to work on modules.

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34. If an inverter is being used in sell mode, the PV charge controller bulk and float voltages and the inverter bulk and float voltages should be set as follows:

a. Charge controller bulk and float should be higher than bulk and float of inverter

b. Charge controller bulk and float should be lower the bulk and float of inverter

c. Bulk should be higher than float on the inverter

d. Float should be higher than float on the inverter

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34. Answer:

a. Charge controller bulk and float should be higher than bulk and float of inverter

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35. At 75^{0}C which wire would be used?

a. THW-2, XHHW, RHH
b. THHN, THW, USE
c. THW, XHHW, THWN
d. USE-2, RHW-2, THW

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35. Answer:

c. THW, XHHW, THWN

NEC 310.15(B)(16)

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36. What should be done if USE-2 wires are found to resting against a roof?

a. Lift them and strap at 3’ distances.
b. Lift them and strap them at 5’ distances.
c. Put them in EMT conduit.
d. Put them in liquid-tight conduit.

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36. Answer:

a. Lift them and strap at 3’ distances

NEC 338.10(B) (4).

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37. A potential customer wants a PV system. His average monthly usage is 450kWh. He has a southeast facing roof that is 15 degrees off true south with a 30 degree tilt. He receives 4.9 peak sun hours on average per day. He has a 240V split-phase panel with a 200A breaker. What is the maximum inverter output that can be connected to his electrical panel?

a. 25A

b. 30A

c. 32A

d. 35A

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37. Answer:

c. 32A

200A bus bar X 120% = 240A
(NEC 705.12(D)(2)

240A – 200A main breaker = 40A max solar breaker

40A ÷ 125% = 32A

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38. You are installing a ground wire to the rebar on a pole mount. What size rebar must be used?

a. #2

b. #4

c. #6

d. #8

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38. Answer:

b. #4

NEC 250.52(A)(3)(1)

Rebar comes in 1/8 in. increments. Rebar is required to be no smaller than ½ in.

1/8 = 0.125

0.5 ÷ 0.125 = 4

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39. A 55 foot tree will grow 25 feet during the life of the PV system. How far away does a ground mount system need to be? The system is located at 40 degrees latitude, the sun's lowest altitude angle is 14 degrees and the azimuth angle is 41 degrees.

a. 263'

b. 280'

c. 240'

d. 330'

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39. Answer:

d. 330’

$$\frac{55' + 25' \text{ (tree height at leading edge)}}{\text{Tan}(14^{0})} = 320.8'$$

I did not multiply by the COS (41) because the question does not say that the array is due north of the tree.

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40. A weather vane falls onto an array and there is broken glass. The system is still working. What is the main safety concern and how do you handle it?

a. No concern. Open AC disconnect, remove vane, unplug broken modules and replace them.
b. Little concern. Open AC disconnect, put on gloves for broken glass, remove vane and unplug modules to be replaced.
c. Medium concern. Open DC disconnect, remove vane and unplug modules to be replaced.

d. Vane has high potential. Open DC disconnect, unplug all modules and remove vane with voltage rated gloves.

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40. Answer:

d. Vane has high potential. Open DC disconnect, unplug all modules and remove vane with voltage rated gloves.

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41. What is the most important consideration for construction of a ground mount array in a heavy snow area?

a. Tilt angle

b. Distance from ground to bottom of array

c. Row-to-row shading

d. All of the above

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41. Answer:

b. Distance from ground to bottom of array

Incorrect answers:

a, Tilt angle. Typically on a ground-mount the array will be at latitude. Even at latitude -15^0 in areas where there is lots of snow this angle will allow snow shedding.

b. Row-to-row shading. The question did not mention multiple rows.

c. Could be correct but not the most accurate choice.

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42. System drawings call for #10 wire. The system calls for a 50 amp breaker. What size should the wire be?

a. #10

b. #8

c. #12

d. #6

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42. Answer:

b. #8

NEC 240.4(D) (7) Copper #10 limited to a 30A overcurrent device.

NEC Table 310.15(B)(16) in either 75 or 90 degree column shows #8 good for a 50A breaker

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43. At what depth should a 1/0 ground wire be buried?

a. 12”

b. 18”

c. 30”

d. It shouldn’t be buried

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43. Answer:

c. 30”

A 1/0 ground wire is actually a ground ring, per Article 250.52 (A) (4)

Article 250.53 (F) states that a 30” minimum burial depth for a ground ring is required.

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44. An inverter is on the north side of a house and the array is on the south. Where should the DC and AC disconnects be?
a. The DC disconnect should be close to the array and the AC disconnect should be next to the inverter.

b. Both the DC and AC disconnects should be close to the main service.

c. The AC disconnect should be close to the array and the DC next to the inverter.

d.The DC and AC disconnects should be on either side of the inverter.

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44. Answer:

d. The DC and AC disconnects should be on either side of the inverter.

NEC 690.17

Incorrect answers:

a. and c. Neither of these satisfy the "readily accessible" requirement.

b. Since we don't know from the question that the main service is in an accessible location, stipulating that the disconnects go close to the main service does not by itself satisfy 690.17.

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45. At what distance from the junction box must USE-2 wire be secured?

a. 10”

b. 12”

c. 18”

d. 36”

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45. Answer:

b. 12”

NEC 334.30

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46. The power loss due to temperature for a silicon module is listed as -0.5%/^{0}C in the manufacturer's specifications. The manufacturer recommends two array mounting options; one with a ¾" air gap between the module and the roof and one with a 3" air gap. The closer mounting system causes the array to operate 10^{0}C hotter on average throughout the year. Which mounting system will produce the most energy? How much?

a. ¾" gap by 5%
b. 3" gap by 5%
c. 3" gap by 10%
d. Both will produce the same

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46. Answer: b. 3" gap by 5%

NEC Section: Technically none, but Table 310.15(B)(3)(c) serves as a guide.

Solution:

It should be intuitive based on the Table that a 3" gap will be cooler than a ¾" gap. So answers "a" and "d" can be eliminated. Since the temperature change is 10^0C, the larger gap will produce 5% more power:

0.5%/^{0}C x 10^0C = 5%

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47. A 7kW PV system using 3 utility interactive inverters listed to UL 1741 is planned for the roof of a duplex. The inverters may be installed on the roof near the PV array if which of the following conditions are met?

a. All inverters are mounted in a readily accessible location. DC disconnects are at the inverters. AC disconnects are at the point of interconnection with the service equipment. An array wiring plaque is installed at the inverter location.

b. Although the inverters are not mounted in a readily accessible location, there is an additional readily accessible AC disconnect for the system. AC and DC disconnects for all 3 inverters are mounted in or near the inverters. A power rating plaque is mounted on each inverter.

c. All inverters are mounted where they can be serviced from a service platform. AC and DC disconnects for all 3 inverters are mounted in or near the inverters. There is an additional readily accessible AC disconnect for the system. A power rating plaque is mounted on each inverter.

d. Although none of the inverters are mounted in a readily accessible location, there is an additional readily accessible AC disconnect for the system at the service entrance equipment. AC and DC disconnects for each inverter are mounted in or near the inverters. Plaques with a system description showing all power sources are mounted at the inverters and the service equipment.

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47. Answer: d. Although none of the inverters are mounted in a readily accessible location, there is an additional readily accessible AC disconnect for the system at the service entrance equipment. AC and DC disconnects for each inverter are mounted in or near the inverters. Plaques with a system description showing all power sources are mounted at the inverters and the service equipment.

Solution

NEC 2011 Article 690.14 (D) (1-4) Utility-interactive inverters mounted in not-readily – accessible-locations.

NEC 2011 Article 690.14 (C)(1) Requirements and location for Disconnecting Means

NEC 2011 Article 705.10 Permanent plaque or directory.

a. Does not meet 690.14 D 2, 4.

b. Meets 690.14 D 1- 2, does not meet 4.

c. Meets 690.14 D 1-2, does not meet 4.

d. Meets all definitions provided by 690.14(D)(1-4) and 705.70

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Use the following system specifications to answer questions 23 and 24.

PV array size: 9kW
Modules: 200W, 39 lbs each
Location: flat roof of a two-story commercial structure
Mounting: 9' x 5', 43 lb aluminum frames holding 3 modules each
Total weight required: 925 lbs per mounting frame
Ballast: 8'"x8"x16" concrete blocks, 27 lbs each

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48. What is the total number of concrete blocks required to ballast the system?

a. 765
b. 29
c. 435
d. 514

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48. Answer: c. 435

Solution

Number of modules:

9000 (System Watts) ÷ 200 (Watts/module) = 45 modules

45 modules ÷ 3 modules/frame = 15 frames for the system

43 lbs./frame + (3 x 39 lbs./module) = 160 lbs. (frame & modules)

925 lbs. (required weight per frame) – 160 lbs. = 765 lbs. of ballast

765 lbs. ÷ 27 lbs. (block weight) = 28.3 → 29 blocks per frame

15 (frames required) x 29 (blocks) = 435 blocks to ballast the system

Note: The early answer "b. 29" is included to catch test takers who are rushing or not fully understanding what has actually been asked.

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49. What is the approximate dead load within the system footprint that the roof must withstand?

a. 7 lbs./sq. ft.
b. 21 lbs./sq. ft.
c. 42 lbs./sq. ft.
d. 63 lbs./sq. ft.

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49. Answer: b. 21 lbs./sq. ft.

925 lbs. ÷ (9 ft. x 5 ft.) = 20.56 lbs./sq. ft.

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50. A utility interactive PV system is installed on a commercial building. The array is roof mounted and operates at 372Vmp with an operating current of 8.56A. When inspecting the source circuit combiner box located next to the array, you observe the following: the ungrounded PV source circuit conductor is black USE-2/RHW-2, the frame grounding conductor is #6 solid Cu, the box is a NEMA4 rated metal box, the PV output conductors leave the (+) and (–) terminal busses and pass into a male EMT adapter secured with a locknut. What is required to bring the combiner box into compliance with the NEC?

a. A 600VDC 15A fuse with touch-safe fuse holder must be installed on the ungrounded source circuit conductor.
b. A grounding bushing must be installed on the EMT adapter.
c. The frame grounding conductor must be changed to #8 stranded Cu.
d. None of the above.

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50. Answer: d. None of the above

Solution

250.97 states that, *for circuits of over 250V to ground, the electrical continuity of metal raceways … shall be ensured by one or more of the methods specified for services in 250.92(B)*

250.92(B)(1-4)

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50. Notes Part 1:

a. Could be correct, but the presence or lack thereof of an OCPD was not specifically mentioned and the language reads *the* ungrounded not one of the ungrounded, etc.

Plus, not all single string circuits need OCP to satisfy Code- see J Wiles *To Fuse or Not to Fuse.*

b. To provide a reliable bonding connection, a bonding bushing would be required only if the box had concentric knockouts which are not encountered in NEMA4 boxes unless listed.

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50. Notes Part 2:

c. This choice is a trap. There are instances where the frame ground would need to be increased from #8 to #6, i.e. if it was subject to physical damage. This is meant as a trick for people who think they are positive about the Code but don't bother checking.

This question is important because this issue is seen quite regularly from both novice PV installers and licensed electricians unfamiliar with the Code.