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Continuing Education Course #122
Solar Basics
Radiation Data Online

1. The latitude and longitude of any of the 239 stations used to prepare the publication, Solar Radiation Data Manual for Flat-Plate and Concentrating Collectors, can be found in that publication.
- a. true
- b. false

2. All of the 239 stations in the NREL 1961-1990 data set had solar radiation measurements at their site.
- a. true
- b. false

3. All of the 239 stations in the NREL 1961-1990 data set are National Weather Service stations and had meteorological data collected.
- a. true
- b. false

4. To optimize the performance of a flat-plate collector for maximum annual incident solar radiation, its tilt from the horizontal should be approximately which of the following?
- a. 90 degrees (vertical)
- b. 15 degrees more than the latitude of the site
- c. the latitude of the site
- d. 15 degrees less than the latitude of the site

5. To obtain maximum summertime solar radiation with a flat-plate solar collector, its tilt angle from the horizontal should be approximately which of the following?
- a. 90 degrees (vertical)
- b. 15 degrees more than the latitude of the site
- c. the latitude of the site
- d. 15 degrees less than the latitude of the site

NOTE: For Questions 6-8, the publication, Solar Radiation Data Manual for Flat-Plate and Concentrating Collectors, should be used as the source for data. The pages for Colorado Springs, CO and for Des Moines, IA are copied in the course document. (pages 7 and 35)

6. The average number of cooling degree days (base 18.3 degrees C) in Des Moines, IA, in August is:
- a. 200
- b. 159
- c. 70
- d. 41

7. What is the average rate of direct beam solar radiation (in kWhr/sq m/day), striking a one-axis concentrating collector with E-W horizontal axis in Colorado Springs, CO, in December?

○ a. 2.7
○ b. 3.8
○ c. 3.9
○ d. 4.3

8. What flat-plate collector tilt angle (from the horizontal) should be used to obtain the maximum wintertime solar radiation in Des Moines, Iowa?
○ a. 15 degrees
○ b. 42 degrees
○ c. 57 degrees
○ d. 90 degrees

9. The flat-plate collector configuration that will have the greatest average rate of incident solar radiation in Colorado Springs, CO, in December is which of the following?
○ a. flat-plate with fixed tilt of latitude plus 15 degrees
○ b. 1-axis tracking with tilt angle = latitude plus 15 degrees
○ c. vertical
○ d. 2-axis tracking

10. Parabolic trough concentrating collectors can use only the direct beam component of solar radiation.
○ a. true
○ b. false

11. If the average temperature for a given day at a given location is less than a specified base temperature, then the difference between the two is designated cooling degree days.
○ a. true
○ b. false

12. Incident global solar radiation includes both diffuse radiation and direct beam radiation.
○ a. true
○ b. false

13. Direct beam solar radiation is the sum of ground reflected radiation and sky radiation.
○ a. true
○ b. false

14. The illuminance data in the publication, Solar Radiation Data Manual for Buildings, is for the hour following the time given in the table heading.
○ a. true
○ b. false

NOTE: For Questions 15-20, the publication, Solar Radiation Data Manual for Buildings, should be used as the source for data. The pages for Colorado Springs, CO and for Des Moines, IA are copied in the course document. (pages 23 and 36)

15. What is the average number of heating degree days in Colorado Springs, CO in January, relative to a base temperature of 65 degrees Fahrenheit?
○ a. 1122
○ b. 924
○ c. 6115
○ d. 419

16. What would be the average rate of global solar radiation (in Btu/sq ft/day) striking a south facing vertical window in Des Moines, IA, in December?

- a. 1230
- b. 1020
- c. 1010
- d. 930

17. What will be the average daily amount of solar radiation (in Btu/day) transmitted through an unshaded, 18" by 24" south-facing window in Des Moines, Iowa, in December? (Assume the standard window construction specified in the NREL Solar Radiation Data Manual for Buildings.)

- a. 700
- b. 1400
- c. 2100
- d. 2800

18. What is the average rate of diffuse solar radiation in Btu/sq ft/day, striking a west-facing window in Colorado Springs, CO in March?

- a. 1250
- b. 870
- c. 440
- d. 330

19. What is the average incident illuminance (klux-hr) for mostly clear conditions on a south-facing window in Colorado Springs, CO, between 10:00 and 11:00 a.m. in March?

- a. 45
- b. 56
- c. 76
- d. 84

20. What would be the horizontal distance that a roof overhang should extend beyond the wall, in order to provide no shading at solar noon on 11/17 and 1/25 but will be completely shaded at solar noon on 5/12 and 8/2, for a window that is 24" in vertical height in Des Moines, IA? Assume that the vertical distance of the window below the roof overhang is correct.

- a. 0.326 ft
- b. 0.500 ft
- c. 0.578 ft
- d. 1.156 ft

21. Which of the following is the sign convention for latitude and longitude that should be used for the NASA Power website discussed in this course.

- a. North latitude is positive, West longitude is positive
- b. South latitude is positive, East longitude is positive
- c. North latitude is positive, East longitude is positive
- d. South latitude is positive, West longitude is positive

NOTE: For Questions 22-25, the NASA Power website at https://power.larc.nasa.gov/ should be used as the source for data. Data from the pages for Colorado Springs, CO; Melbourne, Australia; and Des Moines, IA are given in the course document. (pages 28, 30, and 37)

22. Based on the NASA Power 22 year solar radiation database, what is the monthly average insolation incident on a horizontal surface (in kWh/sq m/day) in Colorado Springs, CO, in January?

- a. 2.6
- b. 3.50
- c. 4.63
- d. 5.61

23. What is the elevation of Melbourne, Australia in meters, based on data from the NASA Power data set used in this course:

- a. 145
- b. 350
- c. 485
- d. 675

24. Based on the NASA Power 22 year solar radiation database, what is the monthly average diffuse radiation incident on a horizontal surface (in kWh/sq m/day) in Des Moines, Iowa, in January?

- a. 1.91
- b. 1.49
- c. 1.05
- d. 0.74

25. Based on the NASA Power 22 year solar radiation database, what is the monthly average number of cooling degree days above 18.3 degrees Centigrade in Des Moines, Iowa, in June?

- a. 38
- b. 61
- c. 102.5
- d. 196