QUESTIONS FOR REVIEW

1. Briefly explain the movement of water in the hydrologic cycle.
2. Basically, how do the three states of water differ?
3. What are the primary factors that influence evaporation?
4. Explain why condensation occurs primarily when the air is cooled.
5. How are evaporation and condensation related to saturated air above a flat water surface?
6. How does condensation differ from precipitation?
7. Why are specific humidity and mixing ratio more commonly used in representing atmospheric moisture than absolute humidity? What is the only way to change the specific humidity or mixing ratio of an air parcel?
8. In a volume of air, how does the actual vapor pressure differ from the saturation vapor pressure? When are they the same?
9. What does saturation vapor pressure primarily depend upon?
10. Explain why it takes longer to cook vegetables in the mountains than at sea level.
11. (a) What does the relative humidity represent?
   (b) When the relative humidity is given, why is it also important to know the air temperature?
   (c) Explain two ways the relative humidity may be changed.
12. Explain why, during a summer day, the relative humidity will change as shown in Fig. 4.12, (p. 97).
13. Why do hot and humid summer days usually feel hotter than hot and dry summer days?
14. Why is the wet-bulb temperature a good measure of how cool human skin can become?
15. Explain why the air on a hot humid day is less dense than on a hot dry day.
16. (a) What is the dew-point temperature?
    (b) How is the difference between dew point and air temperature related to the relative humidity?
17. Why is cold polar air described as “dry” when the relative humidity of that air is very high?
18. How can a region have a high specific humidity and a low relative humidity? Give an example.
19. Why is the air from the Gulf of Mexico so much more humid than air from the Pacific Ocean at the same latitude?
20. How are the dew-point temperature and wet-bulb temperature different? Can they ever read the same? Explain.
21. When outside air is brought indoors on a cold winter day, the relative humidity of the heated air inside often drops below 25 percent. Explain why this situation occurs.
22. Describe how a sling psychrometer works. What does it measure? Does it give you dew point and relative humidity? Explain.
23. Why are human hairs often used in a hair hygrometer?

QUESTIONS FOR THOUGHT

1. Would you expect water in a glass to evaporate more quickly on a windy, warm, dry summer day or on a calm, cold, dry winter day? Explain.
2. How can frozen clothes “dry” outside in subfreezing weather? What exactly is taking place?
3. Explain how and why each of the following will change as a parcel of air with an unchanging amount of water vapor rises, expands, and cools:
   (a) absolute humidity;
   (b) relative humidity;
   (c) actual vapor pressure; and
   (d) saturation vapor pressure.
4. Where in the United States would you go to experience the least variation in dew point (actual moisture content) from January to July?
5. After completing a grueling semester of meteorological course work, you call your travel agent to arrange a much-needed summer vacation. When your agent suggests a trip to the desert, you decline because of a concern that the dry air will make your skin feel uncomfortable. The travel agent assures you that almost daily “desert relative humidities are above 90 percent.” Could the agent be correct? Explain.
6. On a clear, calm morning, water condenses on the ground in a thick layer of dew. As the water slowly evaporates into the air, you measure a slow increase in dew point. Explain why.
7. Two cities have exactly the same amount of water vapor in the air. The 6:00 A.M. relative humidity in one city is 93 percent, while the 3:00 P.M. relative humidity in the other city is 28 percent. Explain how this can come about.
8. Suppose the dew point of cold outside air is the same as the dew point of warm air indoors. If the door is opened, and cold air replaces some of the warm inside air, would the new relative humidity indoors be (a) lower than before, (b) higher than before, or (c) the same as before? Explain your answer.
9. On a warm, muggy day, the air is described as “close.” What are several plausible explanations for this expression?
10. Outside, on a very warm day, you swing a sling psychrometer for about a minute and read a dry-bulb temperature of 38°C and a wet-bulb temperature of 24°C. After swinging the instrument again, the dry bulb is still 38°C, but the wet bulb is now 26°C. Explain how this could happen.
11. Why are evaporative coolers used in Arizona, Nevada, and California but not in Florida, Georgia, or Indiana?
12. Devise a way of determining elevation above sea level if all you have is a thermometer and a pot of water.
13. A large family lives in northern Minnesota. This family gets together for a huge dinner three times a year: on Thanksgiving, on Christmas, and on the March solstice. The Thanksgiving and Christmas dinners consist of turkey, ham, mashed potatoes, and lots of boiled vegetables.
The solstice dinner is pizza. The air temperature inside the home is about the same for all three meals (70°F), yet everyone remarks about how “warm, cozy, and comfortable” the air feels during the Thanksgiving and Christmas dinners, and how “cool” the inside air feels during the solstice meal. Explain to the family members why they might feel “warmer” inside the house during Thanksgiving and Christmas, and “cooler” during the March solstice. (The answer has nothing to do with the amount or type of food consumed.)

PROBLEMS AND EXERCISES

1. On a bitter cold, snowy morning, the air temperature and dew point of the outside air are both —7°C. If this air is brought indoors and warmed to 21°C, with no change in vapor content, what is the relative humidity of the air inside the home? (Hint: See Table 1, p. 102.)

2. (a) With the aid of Fig. 4.14b (p. 99), determine the average July dew points in St. Louis, Missouri; New Orleans, Louisiana; and Los Angeles, California.
   (b) If the high temperature on a particular summer day in all three cities is 32°C (90°F), then calculate the afternoon relative humidity at each of the three cities.
   (Hint: Either Fig. 4.10, p. 95, or Table 1, p. 102, will be helpful.)

3. Suppose with the aid of a sling psychrometer you obtain an air temperature of 30°C and a wet-bulb temperature of 25°C. What is
   (a) the wet-bulb depression,
   (b) the dew point, and
   (c) the relative humidity of the air?
   (Use the tables in Appendix D at the back of the book.)

4. If the air temperature is 35°C and the dew point is 21°C, determine the relative humidity using
   (a) Table 1, p. 102;
   (b) Fig. 4.10, p. 95; and
   (c) Tables D.1 and D.2 in Appendix D.

5. Suppose the average vapor pressure in Nevada is about 8 mb.
   (a) Use Table 1 (p. 102), to determine the average dew point of this air.
   (b) Much of the state is above an elevation of 1500 m (5000 ft). At 1500 m, the normal pressure is about 12.5 percent less than at sea level. If the air over Nevada were brought down to sea level, without any change in vapor content, what would be the new vapor pressure of the air?

6. In Yellowstone National Park, there are numerous ponds of boiling water. If Yellowstone is about 2200 m (7200 ft) above sea level (where the air pressure is normally about 775 mb), what is the normal boiling point of water in Yellowstone? (Hint: See Fig. 1, p. 96.)

7. Three cities have the following temperature (T) and dew point (Td) during a July afternoon:
   Atlanta, Georgia, T = 90°F; Td = 75°F
   Baltimore, Maryland, T = 80°F; Td = 70°F
   Norman, Oklahoma, T = 70°F; Td = 65°F
   (a) Which city appears to have the highest relative humidity?
   (b) Which city appears to have the lowest relative humidity?
   (c) Which city has the most water vapor in the air?
   (d) Which city has the least water vapor in the air?
   (e) For each city use Table 1 on p. 102 and the information on the same page to calculate the relative humidity for each city.
   (f) Using both the relative humidity calculated in (e) and the air temperature, determine the heat index for each city using Fig. 4.19 (p. 104).

Visit the Meteorology Resource Center at academic.cengage.com/login for more assets, including questions for exploration, animations, videos, and more.