CHAPTER 6

HUMIDITY, SATURATION, AND STABILITY

MULTIPLE CHOICE QUESTIONS

1. ______, annual precipitation is greater than annual evapotranspiration.
   a. On the ocean
   *b. On the continents

2. ______, annual precipitation is less than annual evaporation.
   *a. On the ocean
   b. On the continents

3. Evaporation is to condensation as deposition is to ______.
   a. evaporation
   b. precipitation
   c. evapotranspiration
   *d. sublimation
   e. None of these is correct.

4. Sublimation is to deposition as evaporation is to ______.
   a. evapotranspiration
   b. sublimation
   c. relative humidity
   d. deposition
   *e. condensation

5. Clouds are ______ to develop if a radiosonde sounding indicates unstable air.
   a. less likely
   *b. more likely

6. In an agricultural field, direct evaporation of water from the soil is usually ______
   transpiration of water by plants.
   *a. less than
   b. about the same as the
   c. more than

7. If the air temperature is 12 °C and the vapor pressure is the same as the saturation vapor
   pressure, the relative humidity is
   a. less than 100%.
   b. more than 100%.
   *c. 100%.
8. Air mass advection ______ change the relative humidity.
   *a. can
   b. cannot

9. On a clear and calm day, the relative humidity usually ______ between sunrise and early afternoon.
   a. rises
   *b. falls
   c. does not change

10. Rising air temperature causes the saturation mixing ratio to ______
    *a. increase.
    b. decrease.

11. The maximum pressure that water vapor molecules could exert if the air were saturated is called the
    *a. saturation vapor pressure.
    b. dewpoint.
    c. saturation mixing ratio.
    d. saturation relative humidity.
    e. saturation absolute humidity.

12. As the temperature of a saturated (cloudy) air parcel falls, its relative humidity ______.
    a. increases
    b. decreases
    *c. does not change

13. A temperature inversion is characterized by a(n) ______ of air temperature with altitude.
    *a. increase
    b. decrease

14. Conditional stability indicates that an air layer is
    a. stable for both saturated and unsaturated air parcels.
    *b. unstable for saturated and stable for unsaturated air parcels.
    c. stable for saturated and unstable for unsaturated air parcels.
    d. unstable for both saturated and unsaturated air parcels.
    e. None of the above is correct.

15. An example of sublimation is
    a. dew forming on grass.
    *b. ice disappearing while temperatures remain below freezing.
    c. melting snow.
    d. frost forming on glass.

16. A lapse rate of ______ Celsius degrees per 1000 meters is stable for unsaturated air parcels.
    a. 8
b. 7  
c. 2  
d. All of these are correct.  
e. None of these is correct.

17. The saturation vapor pressure ______ with rising air temperature.  
a. decreases  
b. increases

d. All of these are correct.  
e. None of these is correct.

18. If the temperature of an unsaturated (clear) air parcel does not change while its mixing ratio increases, the density of the parcel ______.  
a. increases  
b. decreases  
c. does not change

e. None of the above is correct.

19. In an isothermal temperature profile, the air temperature  
a. does not change with altitude.  
b. decreases with altitude.  
c. increases with altitude.

e. None of the above is correct.

20. Conditional stability indicates that an air layer is  
a. stable for both cloudy and clear air parcels.  
b. unstable for cloudy and stable for clear air parcels.  
c. stable for cloudy and unstable for clear air parcels.  
d. unstable for both cloudy and clear air parcels.  
e. None of the above is correct.

21. If a saturated (cloudy) air parcel is heated (say by absorption of radiation), its relative humidity ______.  
a. increases  
b. decreases  
c. does not change

e. None of the above is correct.

22. ______ air tends to suppress convection.  
a. Unstable  
b. Stable

23. If the mixing ratio of a parcel of air is 2 grams per kilogram and its saturation mixing ratio is 6 grams per kilogram, the relative humidity is ______ percent.  
a. 3  
b. 33.3  
c. 40  
d. 300  
e. 333

24. If the mixing ratio of a parcel of air is 6 grams per kilogram and the relative humidity is 25
percent, the saturation mixing ratio is _____ grams per kilogram.

a. 1.5  
b. 12  
c. 8  
d. 2  
*e. None of these is correct.

25. As an aircraft ascends within the troposphere, the external
a. air pressure increases.  
b. vapor pressure increases.  
c. saturation mixing ratio increases.  
d. air density increases.  
*e. None of the above is correct.

26. Two equal volumes of air have the same temperature and pressure. One contains more water vapor than the other.  
*a. Both volumes of air contain the same number of gaseous molecules.  
b. The more humid parcel contains more gaseous molecules than the other.  
c. The drier parcel contains more gaseous molecules than the other.  
d. None of the above is correct.

27. In winter, the precipitable water value is likely to be highest in ________.
*a. Miami, FL  
b. Denver, CO  
c. Milwaukee, WI

28. Two equal volumes of air at the same temperature and pressure have different amounts of water vapor in them. The air parcel with the higher relative humidity will
a. weigh more than the other parcel.  
b. contain more molecules than the other parcel.  
*c. contain the same number of molecules as the other parcel.  
d. weigh the same as the other parcel.

29. Suppose that the vapor pressure of the cold outside air is the same as the vapor pressure of the warm air indoors. If the door is opened and the cold air replaces some of the warm air, then the new relative humidity indoors would be
*a. higher than before.  
b. the same as before.  
c. lower than before.

30. Unstable air ______ vertical motion of air parcels.  
*a. enhances  
b. suppresses  
c. has no effect on

31. Stable air ______ vertical motion of air parcels.
a. enhances  
b. suppresses  
c. has no effect on

32. ______ on a Stüve diagram are isobars.  
a. Diagonal lines  
b. Horizontal lines  
c. Vertical lines

33. A lapse rate of ______ Celsius degrees per 1000 meters is unstable for unsaturated (clear) air parcels.  
a. 11  
b. 8  
c. 1  
d. 6  
e. None of these is correct.

34. A lapse rate of ______ Celsius degrees per 1000 meters is conditionally stable.  
a. 12  
b. 4  
c. 8  
d. 15  
e. 2

35. A lapse rate of ______ Celsius degrees per 1000 meters is stable for clear air and unstable for cloudy air.  
a. 3  
b. 7  
c. 13  
d. 5  
e. 11

36. If the air temperature drops with altitude such that the actual lapse rate (sounding) is 7 Fahrenheit degrees per 1000 feet, the air layer is ______ for saturated (cloudy) air parcels and ______ for unsaturated (clear) air parcels.  
a. stable...............stable  
b. unstable...............unstable  
c. stable...............unstable  
d. unstable...............stable

37. Rising parcels of saturated (cloudy) air do not cool as rapidly as rising parcels of unsaturated (clear) air because  
a. rising parcels of saturated air do work in expanding.  
b. expansional cooling of saturated air is partially compensated for by release of latent heat.  
c. saturated air parcels are always warmer than their surroundings.  
d. All of the above are correct.
38. A snow cover tends to ______ the overlying air.
   *a. stabilize
   b. destabilize

39. A relatively warm surface tends to ______ the overlying air.
   a. stabilize
   *b. destabilize

40. All of the following soundings (temperature profiles) always indicate stable atmospheric conditions with the exception of:
   a. temperature inversion.
   b. isothermal conditions.
   c. no change in temperature with altitude.
   *d. a drop of temperature with altitude.
   e. an increase in temperature with altitude.

41. Normally, the stratosphere is ______.
   *a. stable
   b. unstable
   c. conditionally stable

42. Cumulus clouds are more likely to form over
   a. snow-covered ground in winter.
   b. a lake surface in summer.
   *c. vegetated land surface in summer.
   d. frozen tundra in winter.
   e. an ice-covered lake.

43. As saturated (cloudy) air flows up the windward slopes of a mountain range,
   a. the relative humidity increases.
   b. the mixing ratio does not change.
   *c. the saturation mixing ratio decreases.
   d. the air temperature rises.
   e. None of these is correct.

44. As unsaturated (clear) air flows down the leeward slopes of a mountain range,
   a. the air temperature rises.
   b. the relative humidity decreases.
   c. the saturation vapor pressure increases.
   *d. All of the above are correct.
   e. None of the above is correct.

45. As an unsaturated parcel of air ascends dry adiabatically,
   a. its relative humidity decreases.
b. its saturation vapor pressure increases.
c. its temperature rises.
d. All of the above are correct.  *e. None of the above is correct.

46. A rain shadow is situated downwind from the ______ slopes of a high mountain barrier.
   a. windward
   b. southern  *c. leeward

47. Cumulus clouds are ______ likely to build into thunderstorm clouds when the air
    temperature profile (sounding) indicates unstable conditions.
   *a. most  
   b. least
   c. not

48. The windward side of mountain ranges are relatively ______ compared to the leeward side.
   a. dry  
   *b. wet

49. The greatest amount of latent heat is absorbed from the environment when
   *a. ice changes directly to vapor.
   b. ice melts.
   c. liquid water changes to vapor.
   d. liquid water freezes.
   e. frost forms.

50. As a clear parcel of air ascends dry adiabatically,
   a. its relative humidity increases.
   b. its saturation vapor pressure decreases.
   c. its temperature drops.
   *d. All of the above are correct.
   e. None of the above is correct.