MEA 130 - EXAM 2(A)

23 October 2001

Using a #2 pencil **only**, fill in your name (last name first, first name last) and student number on the answer sheet. Select the best answer to each question and clearly indicate your choice on the answer sheet by completely filling in the appropriate bubble. Indicate, near the two black boxes ( ) on side one of the op-scan sheet which test version (**A** or **B** or **C**) you have. Keep this exam as a study guide for the final.

1. Identify the cloud type shown on slide 1 that often produces a halo around the sun.
    a. altocumulus
    b. cirrostratus
    c. stratus
    d. nimbostratus

2. Identify the cloud type shown on slide 2 that often results in light and continuous rain.
    a. cumulonimbus
    b. nimbostratus
    c. cirrostratus
    d. altostratus

3. Identify the cloud type shown on slide 3 that is often referred to as a “Mackerel Sky”.
    a. cirrocumulus
    b. cumulus
    c. cumulonimbus
    d. stratus

4. Identify the cloud type shown on slide 4 that is often called a “fair weather” cloud.
    a. stratus
    b. cumulus
    c. altostratus
    d. cirrus

5. Identify the type of fog shown on slide 5 that often forms in valleys.
    a. upslope fog
    b. steam fog
    c. radiation fog
    d. advection fog

6. We know that precipitation is the major sink of water vapor from the atmosphere. Which of the following processes is a source of water vapor to the atmosphere?
    a. transpiration
    b. sublimation
    c. evaporation
    d. all of the above

7. As the air temperature (T) decreases, its capacity for holding water vapor:
    a. increases
    b. remains constant
    c. decreases
    d. is unrelated to air temperature and can either increase or decrease

8. When the dewpoint temperature (T_d) increases, the actual vapor pressure (e):
    a. increases
    b. decreases
    c. remains constant
    d. increases until the temperature reaches 32^{o}F, then remain constant

9. Dalton's "Law of Partial Pressures" states that if water vapor comprises 1.0% of an air parcel, whose total pressure is 1020 mb, the water vapor pressure will be:
    a. 10.2 mb
    b. 1020.0 mb
    c. 102.0 mb
    d. 1.02 mb

10. When the Relative Humidity (RH) is less than 100 %, which of the following is true?
    a. $T > T_d$
    b. $T = T_w$
    c. $e > e_s$
    d. none of the above

11. Which instrument uses wet and dry bulb temperature to obtain the Relative Humidity?
    a. infrared hygrometer
    b. sling psychrometer
    c. electric hygrometer
    d. hair hygrometer

12. When water vapor, through deposition, appears on grassy surfaces during the early morning hours, its called:
    a. frozen dew
    b. frost
    c. dew
    d. drizzle

13. During a typical day, the Relative Humidity (RH) is usually at a minimum:
    a. during the middle of the night
    b. after sunrise
    c. just before sunrise
    d. during the late afternoon

14. The temperature to which air must be cooled in order to become saturated is the:
    a. wet bulb depression temperature ($T - T_w$)
    b. dew point temperature (T_d)
    c. dry bulb temperature (T)
    d. wet bulb temperature (T_w)

15. The lowest temperature to which air can be cooled by evaporating water into it is the:
    a. wet bulb depression temperature ($T - T_w$)
    b. dewpoint temperature (T_d)
    c. dry bulb temperature (T)
    d. wet bulb temperature (T_w)

The cartoons below depict various scenarios along with temperature and dewpoint data. Use this information and the table below to answers questions 16-21.

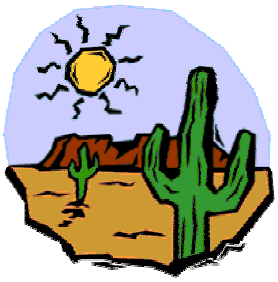
Snow scenario

$T = 25^{o}$ F $T_d = 25^{o}$ F

Beach Scenario

$T = 85^{o}$ F $T_d = 75^{o}$ F

Desert Scenario



$T = 95^{o}$ F $T_d = 35^{o}$ F

The table below provides the vapor pressure (e) and saturation vapor pressure (e_s) for various dewpoint temperatures (T_d) and air temperatures (T), respectively.

Temp. (^{o} F)	Pressure (mb)
25	4.6
35	6.9
45	10.2
55	14.8
65	21.0
75	29.6
85	41.0
95	56.2

16. The vapor pressure (e) for the desert scenario is:

a. 56.2 mb b. 4.6 mb c. 6.9 mb d. none of the above

17. The saturation vapor pressure (e_s) for the snow scenario is:

a. 14.8 mb b. 10.2 mb c. 4.6 mb d. none of the above

18. The Relative Humidity (RH) for the beach scenario is:

a. 88.2 % b. 72.2% c. 80.2 % d. cannot determine

19. Which scenario has the highest LCL (Lifted Condensation Level)?

a. beach b. desert c. snow d. cannot determine

20. Which scenario(s) has the <u>least</u> water vapor in the air?

a. beach b. desert c. snow d. Both (a) and (b)

21. Which scenario has the <u>lowest</u> wet bulb temperature (T_w)?

a. desert b. snow c. beach d. cannot determine

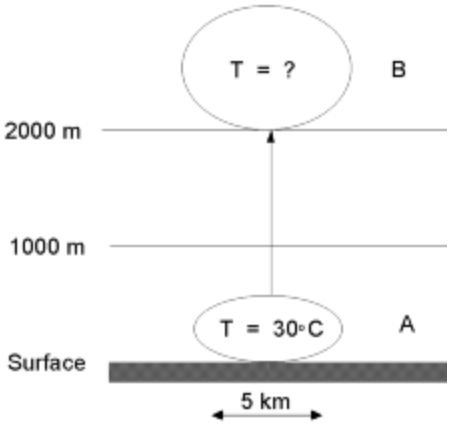
22. The "Heat Index" provides an apparent temperature based on calculations using:
    a. temperature and wind speed
    b. temperature and cloud cover
    c. relative humidity and wind speed
    d. relative humidity and temperature

23. The type of fog that usually forms in the San Francisco Bay area of California is:
    a. steam fog
    b. upslope fog
    c. advection fog
    d. radiation fog

24. If you observe steam fog forming over a lake, the temperature of the water in the lake must be _____ the air temperature surrounding the lake.
    a. warmer than
    b. colder than
    c. the same as
    d. cannot tell

Using the adjacent figure, which depicts a parcel of air, rising, expanding and cooling at the dry adiabatic lapse rate, answer questions 25-27.

25. The air temperature (T) within Parcel B will be:
    a. 20° C
    b. 10° C
    c. 0° C
    d. cannot tell

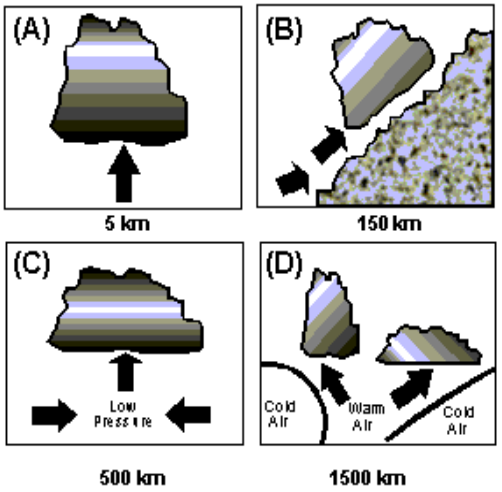


26. Noting the scale, which of the four major lifting mechanisms that produce clouds is depicted?
    a. topographic lifting
    b. convection
    c. surface convergence
    d. frontal lifting

27. Which type of cloud would most likely form as the result of this lifting?
    a. cumulus
    b. cirrostratus
    c. stratus
    d. altostratus

28. Which of the following associations related to Cloud Condensation Nuclei (CCN) is correct?
    a. hygroscopic nuclei = water repelling nuclei
    b. hydrophobic nuclei = water seeking nuclei
    c. Aitken nuclei = small nuclei
    d. all of the above

Questions 29 - 31 refer to the adjacent figure, which depicts the four major mechanism responsible for cloud development.



29. Which figure: (A) (B) (C) (D), depicts cloud formation associated with topographic plifting?

30. Which figure: (A) (B) (C) (D), depicts cloud formation associated with convection?

31. Which figure: (A) (B) (C) (D), depicts cloud formation associated with surface convergence?

32. Which cloud type is most likely to produce precipitation that reaches the ground?
    a. altostratus
    b. stratocumulus
    c. nimbostratus
    d. cirrocumulus

33. Which association below is not correct?
    a. cirrocumulus = high cloud
    b. cumulonimbus = vertical cloud
    c. stratus = low cloud
    d. altostratus = low cloud

34. Thunderstorms are associated with which cloud type?
    a. stratocumulus
    b. altocumulus
    c. cumulonimbus
    d. nimbostratus

35. Which cloud group is completely glaciated?
    a. middle clouds
    b. high clouds
    c. low clouds
    d. vertical clouds

36. Cumulonimbus clouds are comprised of:
    a. ice crystals
    b. supercooled water droplets
    c. liquid water droplets
    d. all of the above

37. Stratus clouds are always _____ than cirrus clouds and therefore emit radiation according to Stephan-Boltzmann's Law.
    a. colder; more
    b. warmer; more
    c. colder; less
    d. warmer; less

38. During our weather discussions at the beginning of class, we have been able to identify large lakes (i.e Jordan Lake) on the nighttime infrared satellite images. These lakes have appeared _____ than the surrounding landscape because they are than the surrounding landscapes.
    a. darker, warmer
    b. darker; colder
    c. lighter; warmer
    d. lighter; colder

39. The GOES satellite series:
    a. are Geostationary satellites
    b. account for the majority of satellite images we have examined in class
    c. utilize both visible and infrared cameras
    d. all of the above

40. Which of the following is <u>not</u> an important factor in the production of precipitation by the collision-coalescence process?
    a. updrafts within the clouds
    b. the number of ice crystals in the cloud
    c. size distribution of the cloud droplets
    d. the cloud thickness

41. Which of the following would have the smallest terminal velocity?
    a. large cloud condensation nuclei
    b. Aitken cloud condensation nuclei
    c. drizzle
    d. Giant cloud condensation nuclei

42. If you observe <u>large</u> raindrops falling, then it is likely that the cloud overhead is _____ and has _____ updrafts.
    a. thick, strong
    b. thin, weak
    c. thin, strong
    d. thick, weak

43. Given that a typical cloud droplet has a radius of 10 μ and a typical rain droplet has a radius of 1000 μ, how many typical size cloud droplets does it take to produce a typical size rain drop? [The volume of a sphere = $4/3\ B\ r^3$]
    a. 1,000
    b. 10,000
    c. 100,000
    d. 1,000,000

44. Convective showers are associated with _____ clouds, while stratiform rain is associated with _____ clouds.
    a. nimbostratus; cumulonimbus
    b. cumulonimbus; nimbostratus
    c. stratus; nimbostratus
    d. stratus; cumulonimbus

45. During the Bergeron process of precipitation formation:
    a. both liquid cloud droplets and ice crystals are present in the cloud
    b. liquid cloud droplets greatly outnumber ice crystals
    c. ice crystal grow larger at the expense of the liquid cloud droplets
    d. all of the above

46. Snow is most often produced by which cloud type?
    a. nimbostratus
    b. cirrocumulus
    c. cumulus
    d. cumulonimbus

47. During the blizzard of January, 2000, the RDU airport recorded 20.0 inches of snow. Approximately, how much liquid equivalent precipitation would have been reported by the National Weather Service for that day.
    a. 0.20 inches
    b. 20.0 inches
    c. 2.0 inches
    d. no liquid equivalent - since the precipitation fell in a frozen form

48. RADAR gathers information about precipitation by measuring the:
    a. amount of energy absorbed by the precipitation
    b. amount of energy reflected back by the precipitation
    c. amount of energy emitted by the precipitation
    d. all of the above

49. As discussed in class, the majority of precipitation that falls on the eastern half of the United States originates from the:
    a. Pacific Ocean
    b. Atlantic Ocean
    c. Gulf of Mexico
    d. Great Lakes

50. Which region of North Carolina experiences the greatest precipitation variability?
    a. Piedmont
    b. Mountains
    c. Coastal Plain
    d. Coast