MEA 130 - EXAM 3 (A)

15 November 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.

1. Which of the following statements concerning air pressure is true?
   a. air pressure indicates the weight of the atmosphere
   b. air pressure is also called barometric pressure
   c. air pressure always decreases with respect to height
   d. all of the above

2. The first barometer, which was invented by Torricelli in 1643, is most similar to which common barometer used today?
   a. aneroid
   b. mercury
   c. altimeter
   d. barograph

3. Although altimeters are calibrated to indicate _____ they actually measure_____.
   a. height, temperature
   b. pressure, height
   c. height, pressure
   d. pressure, density

4. The station pressure measured at the Raleigh-Durham Airport (elev.: 137 meters) is_____ its equivalent sea level pressure.
   a. always greater than
   b. always equal to
   c. usually greater than
   d. always less than

5. If a barometer located in the town Boone, NC, which is called the “kilometer high city” measures a station pressure of 910 mb, then under normal conditions, what would be the sea level pressure for this location?
   a. 1010 mb
   b. 920 mb
   c. 910 mb
   d. 1020 mb

6. If another barometer located in the town of Sea Level, NC, which is so named because of its elevation, measures a station pressure of 1020 mb, then under normal conditions, what would be the sea level pressure for this location?
   a. 1020 mb
   b. 920 mb
   c. cannot tell
   d. 1030 mb

7. Which of the following forces influence the upper-level wind?
    a. Horizontal Pressure Gradient Force (HPGF)
    b. Frictional Force (FF)
    c. Coriolis Force (CF)
    d. (a) and (c)

8. Which of the following forces influence the surface-level wind?
    a. Horizontal Pressure Gradient Force (HPGF)
    b. Frictional Force (FF)
    c. Coriolis Force (CF)
    d. all of the above

9. The height above the surface at which we ignore the Frictional Force and therefore differentiate between surface-level winds and upper-level winds is:
    a. 1,500 meters
    b. 150 meters
    c. 15,000 meters
    d. 15 meters

10. Which statement(s) below is correct concerning the HPGF?
    a. it is directed from low pressure to high pressure
    b. it impacts the wind direction but not its speed
    c. its magnitude is related to the pressure gradient
    d. all of the above

Questions 11 - 13 refer to the following equation for the Coriolis Force:

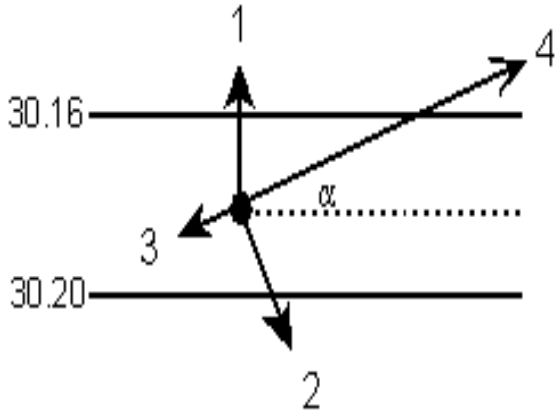
$$\mathbf{CF = 2\ S\ v \sin M}$$

11. The rotation rate of the earth is represented by:
    a. v
    b. CF
    c. **S**
    d. **M**

12. The magnitude of the Coriolis Force is always equal to zero:
    a. no where
    b at the equator
    c. near the surface
    d. at the north pole

13. Which of the following combinations produces the strongest Coriolis Force?
    a. weak winds, high latitudes
    b. strong winds, low latitudes
    c. strong winds, high latitudes
    d. weak winds, low latitudes

Questions 14 - 21 refer to adjacent figure.



14. This figure depicts _____ pressure pattern and resulting forces.
    a. a vertical cross section
    b. a surface-level
    c. an upper-level
    d. none of the above

15. The Coriolis Force (CF) is depicted by which arrow?
    a. 4
    b. 3
    c. 2
    d. 1

16. The Friction Force is depicted by which arrow?
    a. 4
    b. 3
    c. 2
    d. 1

17. The Horizontal Pressure Gradient Force is depicted by which arrow?
    a. 4
    b. 3
    c. 2
    d. 1

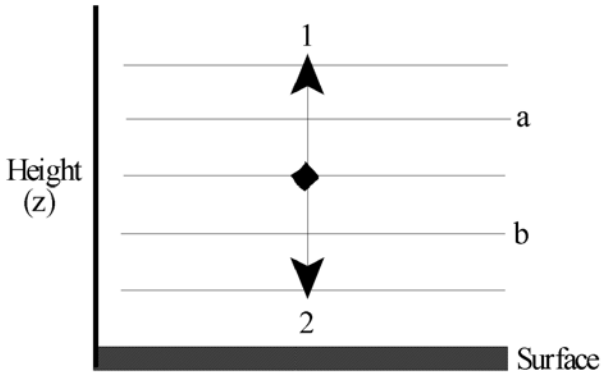
18. The Geostrophic Wind (V_g) is depicted by which arrow?
    a. 4
    b. 2
    c. 1
    d. none of the above

19. The angle which represents cross isobar flow is typically_____.
    a. 300^0
    b. 30^0
    c. 3^0
    d. none of the above

20. The lines labeled 30.16 and 30.20 are called:
    a. millibars
    b. isobars
    c. isotherms
    d. none of the above

21. The units of the lines labeled 30.16 and 30.20 are:
    a. meters per second
    b. millibars
    c. bars
    d. inches of mercury

Questions 22-24 refer to the adjacent figure, which depicts a vertical cross section of the lower atmosphere under normal conditions. The arrows represent forces and the lines isobars.



22. The arrow labeled 1 indicates the:
    a. Coriolis Force
    b. Horizontal Pressure Gradient Force (HPGF)
    c. Force due to Gravity (G)
    d. Vertical Pressure Gradient Force (VPGF)

23. The arrow labeled 2 indicates the:
    a. Coriolis Force
    b. Horizontal Pressure Gradient Force (HPGF)
    c. Force due to Gravity (G)
    d. Vertical Pressure Gradient Force (VPGF)

24. If the distance (Δ z) between the isobars labeled (a) and (b) is 100 meters, then the pressure difference between the two (Δ p) is:
    a. 0 mb
    b. 1 mb
    c. 10 mb
    d. 100 mb

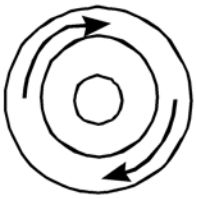
25. Hydrostatic equilibrium occurs when there is a balance between:
    a. the Horizontal Pressure Gradient Force and the Coriolis force
    b. the Frictional Force and the Coriolis force
    c. the Vertical Pressure Gradient Force and the Gravitational Force
    d. the Vertical and Horizontal Pressure Gradient Forces

26. Horizontal wind speeds are generally_____ than vertical wind speeds.
    a. about the same as
    b. much less
    c. much greater
    d. less

27. The air ____ above areas of surface high pressure, resulting in _____ weather.
    a. sinks, inclement
    b. rises, inclement
    c. rises, nice
    d. sinks, nice

28. The pressure pattern to the right depicts:
    a. an upper-level low pressure center
    b. an upper-level high pressure center
    c. a surface-level high pressure center
    d. a surface-level low pressure center

29. The pressure pattern to the right depicts:
    a. a surface-level high pressure center
    b. a surface-level low pressure center
    c. an upper-level low pressure center
    d. an upper-level high pressure center



30. Air masses are best characterized by homogeneous properties of ____ and ____.
    a. temperature (T), density (**D**)
    b. pressure (p), temperature (T)
    c. pressure (p), dewpoint temperature (T_d)
    d. temperature (T),dewpoint temperature (T_d)

31. Which of the following areas would <u>not</u> be a good source region for an air mass?:
    a. desert region
    b. mountain region
    c. ocean region
    d. both (b) and (c)

32. Which air mass is <u>least</u> likely to be found over NC?
    a. cP
    b. mP
    c. mT
    d. cT

33. Which air mass is <u>most</u> likely to be found over NC?
    a. cP
    b. mP
    c. mT
    d. cT

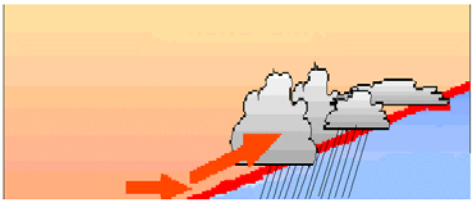
34. The word "frontogenesis" means:
    a. the analysis (or study) of fronts
    b. a front is dissipating
    c. one front is about to overtake another front
    d. a front is being generated

35. Which of the following are characteristics of a cold front?
    a. fast movement
    b. steep slopes
    c. convective precipitation
    d. all of the above

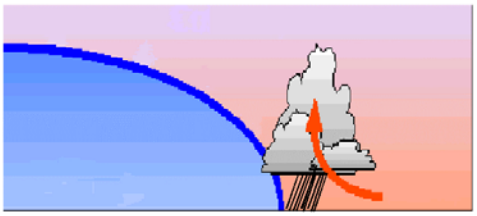
36. Which of the following are characteristics of a warm front?
    a. slow movement
    b. steep slopes
    c. convective precipitation
    d. all of the above

37. Occluded fronts typically occur when:
    a. a warm front overtakes a cold front
    b. a cold front overtakes a warm front
    c. a cold front overtakes a stationary front
    d. a warm front overtakes a stationary front

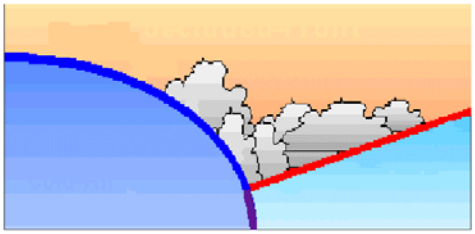
Questions 38-39 refer to the adjacent diagrams, which depict vertical cross-sections of fronts similar to those discussed in class. Each front is moving from left to right.



38. The top figure depicts which type of front?
    a. occluded front
    b. warm front
    c. cold front
    d. stationary front



39. The bottom figure depicts which type of front?
    a. stationary front
    b. warm front
    c. cold front
    d. occluded front



Questions 40 through 44 refer to the surface weather map shown below.

40. **cP** air would be found at point:
    a. A
    b. B
    c. C
    d. D

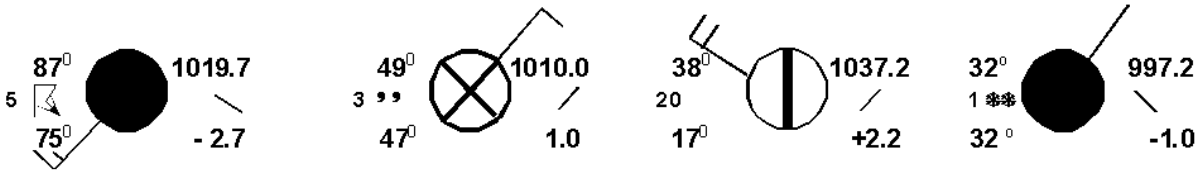
41. A warm front is between:
    a. 1 and 2
    b. 2 and 4
    c. 3 and 4
    d. 4 and 5

42. An occluded front is between:
    a. 1 and 2
    b. 2 and 4
    c. 3 and 4
    d. 4 and 5

43. Which area would most likely experience overrunning precipitation?
    a. A
    b. B
    c. C
    d. D

44. Which area would most likely have the <u>lowest</u> dewpoint temperature (T_d)?
    a. A
    b. B
    c. C
    d. D

Questions 45-50 refer to the four station plots reported at the Raleigh-Durham airport at various times during this year.



A **B** **C** **D**

45. Which observation had the lowest Relative Humidity?
    a. A
    b. B
    c. C
    d. D

46. Which observation had the most water vapor in the air?
    a. A
    b. B
    c. C
    d. D

47. Which observation most likely occurred before the passage of a cold front?
    a. A
    b. B
    c. C
    d. D

48. Which observation most likely occurred after the passage of a “Back Door” cold front?
    a. A
    b. B
    c. C
    d. D

49. Which observation was under the influence of a cP air mass?
    a. A
    b. B
    c. C
    d. D

50. Which observation was under the influence of a mT air mass?
    a. A
    b. B
    c. C
    d. D

Make sure your name, student id number and answers are filled in correctly on the answer sheet.

Write your test version (A) or (B) or (C) on the top of the answer sheet near the two black squares ( ) and place your sheet in the correct stack.