ATMO 336 -- Exam 1 Name _____

Multiple Choice (2 Points Each)

1. The atmospheric "greenhouse effect" keeps the average surface temperature of the Earth about 60˚ F warmer than if there were no atmosphere. The two gases that are mainly responsible for this (most important greenhouse gases) are _____.
   (a) nitrogen and oxygen
   (b) oxygen and ozone
   (c) carbon dioxide and ozone
   (d) carbon dioxide and water vapor

2. Which two molecules prevent UV radiation from penetrating to the surface?
   (a) nitrogen and oxygen
   (b) oxygen and ozone
   (c) carbon dioxide and ozone
   (d) carbon dioxide and water vapor

3. Which heat transfer mechanism allows energy from the sun to reach the Earth?
   (a) conduction (b) conduction (c) advection (d) radiation

4. Without an atmosphere, Earth's daytime temperatures s would be much hotter and its nighttime lows would be much colder. (True/False)

5. If an air parcel's temperature remains constant but its density doubles, then its pressure would _____?
   (a) Increase by a factor of 2 (b) decrease by a factor of 2 (c) remain constant

6. Which process cools the surrounding environment?
   (a) Condensation (Gas → Liquid)
   (b) Evaporation (Liquid → Gas)
   (c) Deposition (Gas → Vapor)

7. Raindrops falling from clouds can evaporate before hitting the ground. (True / False)

8. If the air temperature is 60° F and the dew point temperature is 30° F, what percentage of the air is composed of water vapor?
   (a) 50% (b) 30% (c) less than 4 %

9. When you can "see your breath" on a cold morning, you are seeing an air parcel _____.
   (a) that contains a high concentration of water vapor coming from your mouth
   (b) that contains a high concentration of CO_2 coming from your mouth
   (c) that contains a low concentration of O_2
   (d) that contains tiny droplets of liquid water

10. Albuquerque NM is 1631 m (5352 ft) above sea level. Las Vegas NV is 663 m (2174 ft) above sea level. Which city will have the lowest station air pressure measured with a barometer?
   (a) Albuquerque (b) Las Vegas (c) Sometimes Albuquerque; sometimes Las Vegas.

11. The sea level pressure that is plotted on a surface weather map for Las Vegas is _____ than the station air pressure measured with a barometer.
   (a) always lower (b) always higher (c) sometimes lower; sometimes higher

12. Higher than about 20,000 ft above sea level, people have trouble breathing. The reason is that _____.
   (a) the air pressure and density are too low to get enough oxygen
   (b) the percentage of oxygen molecules in the air drops below 21%
   (c) the air temperature is too cold to breathe
   (d) the ozone levels are too high

13. Consider a glass of ice water. If no water condenses onto the outside of the glass, which of the following is most likely true?
   (a) The dew point temperature of the air is below 0° C
   (b) The dew point temperature of the air is exactly 0° C
   (c) The dew point temperature of the air is above 0° C

14. On a given day, the wind chill equivalent temperature in Cleveland OH is lower than it is in Pittsburgh PA. Which of the following MUST be true?
   (a) The air temperature in Cleveland is lower than it is in Pittsburgh
   (b) The wind speed in Cleveland is faster than it is in Pittsburgh
   (c) The rate of heat loss from the human body is slower in Cleveland than it is in Pittsburgh
   (d) The rate of heat loss from the human body is faster in Cleveland than it is in Pittsburgh

15. On a given day, the heat index in Phoenix is higher than it is in Tucson. Which of the following MUST be true?
    (a) The air temperature in Phoenix is higher than it is in Tucson
    (b) The dew point in Phoenix is higher than it is in Tucson
    (c) The rate of heat loss from the human body is slower in Phoenix than it is in Tucson
    (d) The rate of heat loss from the human body is faster in Phoenix than it is in Tucson

16. When you touch a metal object that is at room temperature (70° F) it often feels colder than a wooden object that is also at a temperature of 70° F. The best explanation for this is that _____.
    (a) metal is a better heat conductor than wood
    (b) wood is a better heat conductor than metal

Use the table of saturation mixing ratios to answer the next two questions. This is the same table you used in homework #3.

17. What is the relative humidity of air at a temperature of 100° F and a dew point temperature of 60° F?
    (a) 16% (b) 26% (c) 36% (d) 46%

18. If the air temperature is 70° F and the relative humidity is 85%, approximately what is the dew point temperature?
    (a) 35° F (b) 45° F (c) 55° F (d) 65° F

Temperature (ºF)	Saturation Mixing Ratio (g/kg)	Temperature (ºF)	Saturation Mixing Ratio (g/kg)
5	1.21	55	9.32
10	1.52	60	11.19
15	1.89	65	13.38
20	2.34	70	15.95
25	2.88	75	18.94
30	3.54	80	22.43
35	4.33	85	26.48
40	5.28	90	31.16
45	6.40	95	36.56
50	7.74	100	42.78

Locate the marked points labeled A, B, C, D and E on the 500 mb forecast map (left) and February climatology map (right) to answer questions 19-22. Use the maps to answer questions 23-24.

19. Which point is located under a tough?

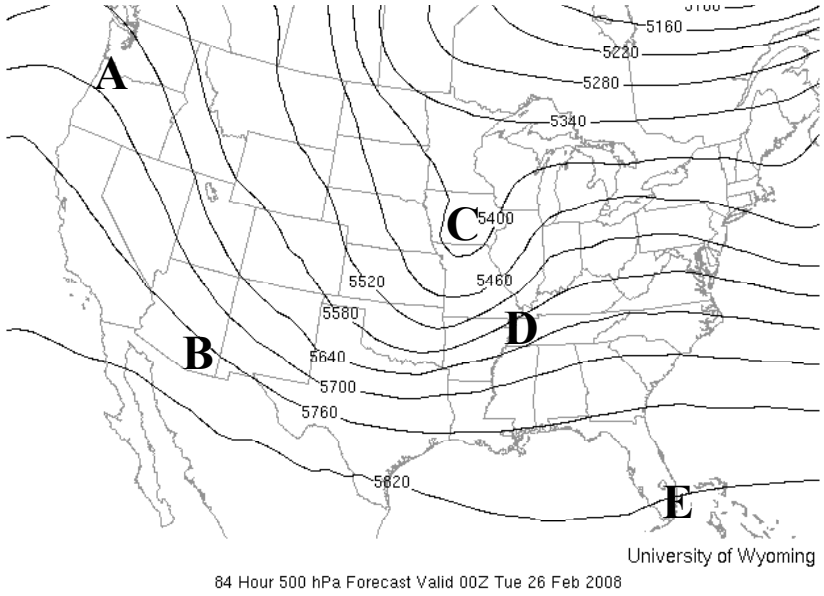
20. At which point would you expect temperatures to be the most above average?

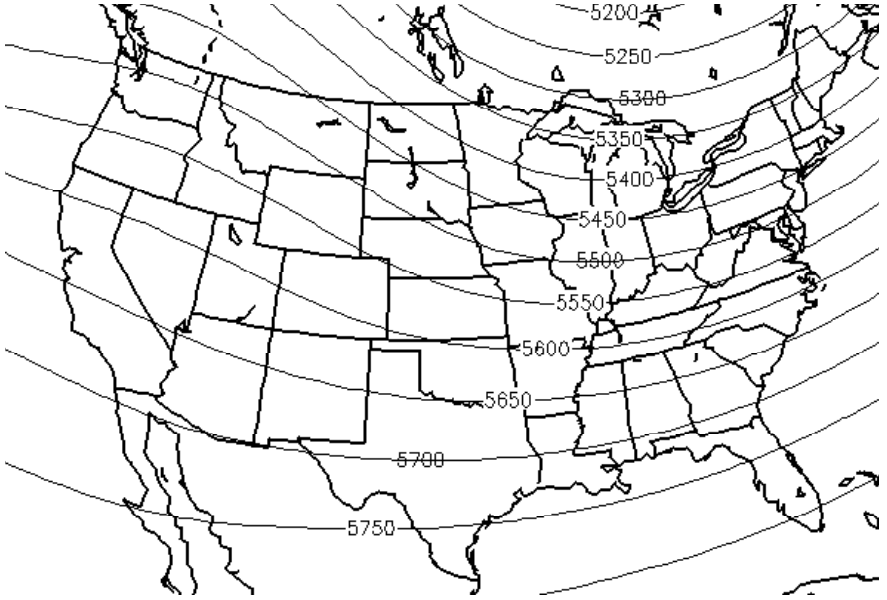
21. At which point would you expect the best chance for precipitation?

22. At which point would you expect to find the fastest geostrophic winds?

23. This map is forecast for 00Z on Tuesday, Feb 26. What is the local Tucson time?
    (a) 12 AM, Feb 26 (b) 5 AM, Feb 26 (c) 5 PM, Feb 25

24. What type of weather would you predict for Tucson (**B**)? (hint: it already happened!)
    (a) Sunny, cool (b) Sunny, warm (c) Rainy, cool (d) Rainy, warm





Short Answer Questions (Select 4 of the 7 Questions) -- 7 Points Each

Write your answers on the attached blank sheet. Let us know if you need more paper. Your answers should be concise and to the point. No more than a few sentences should be needed. Make sure you answer all parts of each question. **Points will be deducted for incorrect or unnecessary statements in your answer, even if the correct answer is found somewhere**. Be sure to clearly indicate which 5 questions you would like graded.

1. List the two main ways the human body responds to heat stress (core temperature getting too high) and briefly describe how they work. List the two main ways the human body responds to cold stress (core temperature getting too low) and briefly describe how they work.

2. Explain why winds close the ground tend to blow from higher to lower pressure.

3. Cyclones can deepen only underneath regions of upper divergence. Explain why divergence is necessary for a cyclone to develop.

4. People who move to the desert southwest from much more humid and much colder regions of the United States often say things like "40° (Fahrenheit) sure feels a lot colder here than it did back home." There is actually some truth to this statement. Keeping in mind that even when you are not obviously sweating, water is constantly moving from tissues beneath the skin to the skin surface, explain the above perception. (NOTE: I am not looking for answers like "the blood thins" or "those people are just not used to the cold anymore.")

5. In sauna rooms, people spend time in conditions of air temperature over 90° C (194° F) with a relative humidity near 10%. However, if you stick your arm into liquid water that is at a temperature of 90° C (194° F), you will be severely burned in less than one minute. Give two reasons why people are able to spend time in a sauna, but are severely burned by water at the same temperature.

6. In general, how do air pressure and density change as you move upward, away from the Earth's surface? Explain why.

7. A thermos contains "dead air" between its reflective inner liner and outer case. Explain how its construction serves to minimize heat transfer from the inside the liner to outside the thermos.