AT350
Homework questions for exam 3

Winds/forces

1. If the pressure gradient force remained constant and the earth's rotation became slower than it is now, would you expect the speed of the geostrophic wind to change? If so, how? Why?
2. If the pressure gradient force remained the same but the earth's rate of rotation decreased slightly, would you expect the speed of the geostrophic wind to increase, decrease or remain about the same?
3. If the earth were to begin rotating in the other direction, would air still rise in the center of surface low pressure?
4. Be sure to thoroughly understand the wind flow patterns and forces around high and low pressure centers in the Northern and Southern Hemispheres. Be able to do this at the surface and aloft.
5. If the earth did not rotate, how would you expect winds to blow with respect to high and low pressure centers?
6. Explain why closely-spaced contour lines on an upper-level isobaric chart are associated with fast winds.
7. Draw a simple Northern Hemisphere upper-air pressure pattern consisting of several straight, uniformly-spaced contour lines running from left to right across your paper. Assume that lower heights are found at the top of your chart. Use arrows to indicate the direction that the wind would blow and the direction of the pressure gradient force and Coriolis force acting on a moving parcel of air.
8. Explain why strong upper-level divergence will cause the pressure in the center of a surface low to decrease.
9. Explain why it is often windy at the beach. What forces are responsible, and how do beachfront conditions differ from conditions farther inland?
10. Be sure to thoroughly understand the wind and pressure patterns associated with the land/sea breeze and Hadley circulations.
11. You are hiking on a mountain trail at sunrise when you smell the smoke from cooking bacon. You can't see where the smoke is coming from. Would you expect the camp to be above you or below you on the mountain?
12. In the late afternoon, would you expect a well-developed sea breeze circulation to cause clouds to form over the land or over the ocean?
13. Explain in detail the physical processes that lead to the sea-breeze. During summer, during what time of day would you expect thunderstorms to form over Florida? Explain.
14. Explain in detail why afternoon thunderstorms typically form over the mountains before they form over eastern Colorado.
15. Describe the one cell mode. Why doesn't the one-cell model apply to the real atmosphere?
16. On a large circle, show where the major pressure and wind belts would be found according to the 3-cell model of the earth's general circulation. Where would you expect to find the most/least precipitation? Explain.
17. Explain the difference between a thermally direct and indirect circulation. Where are these found on the earth? What are their names? What drives these cells?

18. Explain why the climatological mean atmosphere is not perfectly "zonally symmetric" (zonal means east-west).
19. Averaged over NH winter, where would you expect to find surface lows and surface highs? How is summer different?
20. What is the ultimate source of energy for the general circulation of the atmosphere?
21. Where does the atmosphere lose momentum to the earth? Where does it gain momentum from the earth?
22. When a warm and cold air mass collide, the warm air is forced upward. Why does this occur?
23. Draw side views of a typical warm and cold front. Clearly indicate the temperatures of the separate air masses and show their directions of motion. What types of clouds would you expect to find and where? Where would you expect precipitation to occur?
24. Describe some of the changes in weather conditions (winds, temperature, clouds, precipitation, pressure changes) you would expect to observe as a cold front approaches and passes through your location.
25. How would a warm front, a cold front, and a center of low pressure appear on a surface weather map in the Southern Hemisphere?
26. Describe or illustrate the various phases in the life cycle of a middle latitude storm.
27. Draw a sketch of a 500 mb chart that clearly shows a trough and a ridge. Where would you expect to find converging and diverging wind motions? Below what point on your 500 mb chart would you expect middle latitude storm development to occur?
28. Describe, in words or with a sketch, a wind flow pattern that will result in upper-level divergence.
29. Describe some of the ways in which the upper-level wind flow pattern can influence the development and movement of a middle latitude storm system.
30. When making a weather forecast, which kind of chart is more important: a surface chart or a 500 mb chart?
31. Outline the basic ideas behind baroclinic instability (why midlatitude storms develop).
32. Why don't baroclinic waves form in the tropics?
33. What is the vertical structure of a developing midlatitude storm? Know where the precipitation, rising motion, lower and upper level convergence/divergence are occuring.
34. Why aren’t the ‘lows’ vertically stacked in a midlatitude storm?