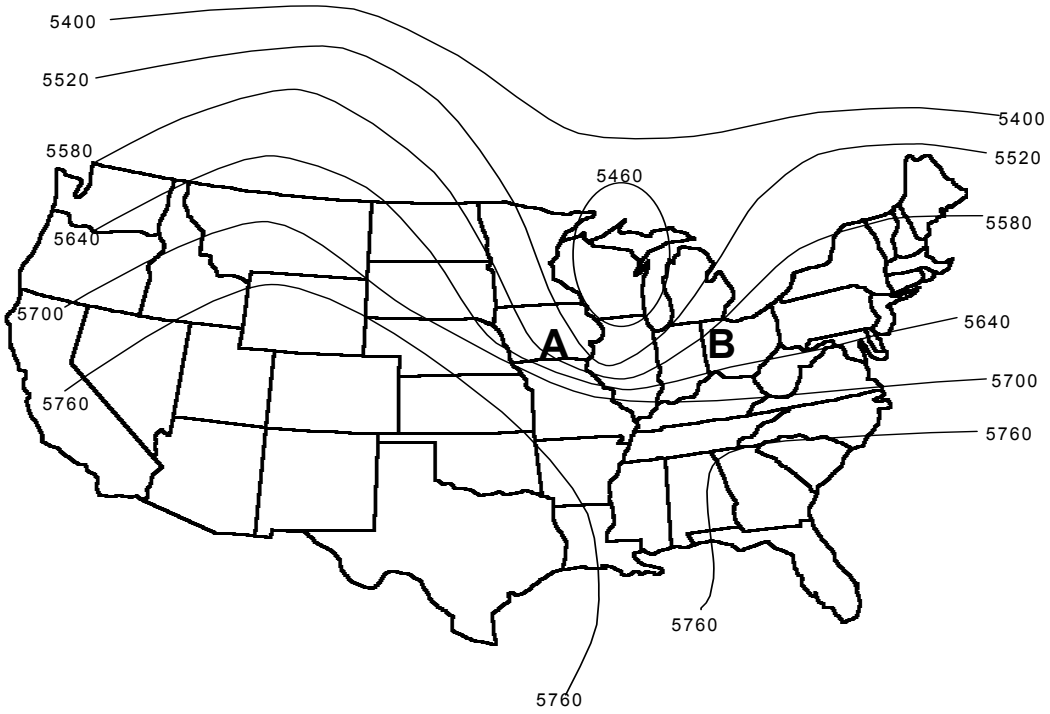
Name: _____ Section/TA: _____

Atmospheric Sciences 101, Spring 2003

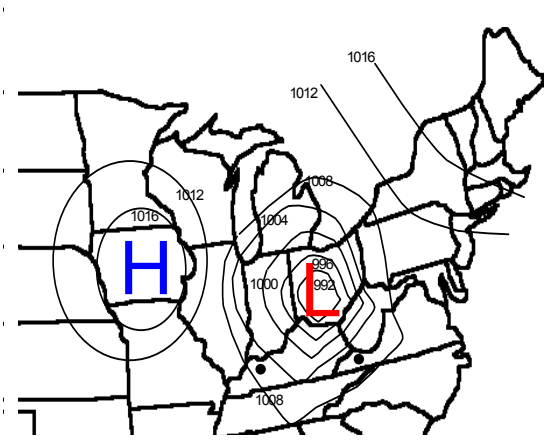
Homework #4 – Due the beginning of section Thu/Fri, 8/9 May 2003

Answer questions 1 and 2 using the 500-mb and surface maps below, and EOM pages 218-223:

500mb Map(contours of 500mb height in meters):



Surface Map(contours of sea-level pressure in mb):



1.

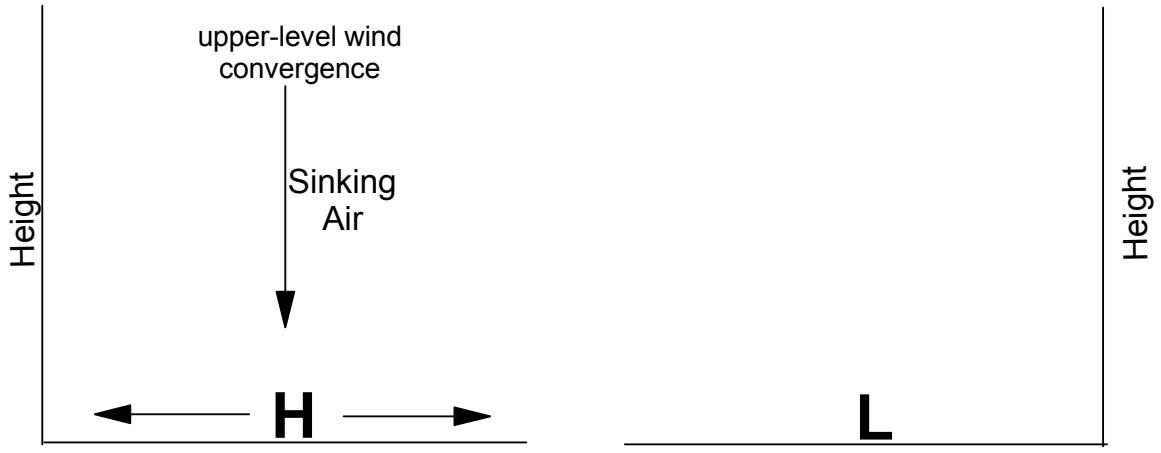
a. Label the upper-level ridge and upper-level trough on the 500mb map.
b. On the surface map, draw arrows around the High pressure and Low pressure indicating the direction of winds at the surface (*hint*: these winds will be either counterclockwise/clockwise and also either converging in towards or diverging out away from the H and L)
c. Now consider the 500mb map, circle the correct answer (either convergence or divergence):

   At the location labeled A, there is convergence / divergence of the upper-level wind.

   At the location labeled B, there is convergence / divergence of the upper-level wind.

2.

a. Draw a vertical cross-section that indicates convergence/divergence of the winds at the 500mb level and draw arrows indicating winds at the surface near the location of the surface Low pressure center. For help, consider the cross-section that has already been done for you and represents the winds occurring at the surface and at the upper-levels above the High pressure center. In your drawing, indicate convergence or divergence at the upper-levels, rising or sinking air between the surface and upper-level, and arrows indicating surface winds.



   b. On the surface map, draw the location of the cold front and warm front.

   c. Now look at the black dots on the surface map located in western Virginia and western Kentucky. Based on their locations relative to the fronts you drew on the surface map, answer the following (circle the correct answer):

      The location in western Virginia will be warmer / colder than the location in western Kentucky.

      The winds at the Virginia location will be out of the south / north.

3. It is a typical winter day in Fairbanks, Alaska—sunny, with a temperature of –22°F (-30°C) and a relative humidity of 70%. Using the table below of temperature (T) and saturation vapor pressure (SVP), answer the following questions. Please show work where necessary, so that you may receive partial credit if the final answer is incorrect.

T (°C)	SVP (mb)	T (°C)	SVP (mb)	T (°C)	SVP (mb)	T (°C)	SVP (mb)	T (°C)	SVP (mb)	T (°C)	SVP (mb)	T (°C)	SVP (mb)
-40	0.19	-30	0.51	-20	1.26	-10	2.87	0	6.11	10	12.27	20	23.37
-39	0.21	-29	0.56	-19	1.37	-9	3.10	1	6.57	11	13.12	21	24.86
-38	0.23	-28	0.62	-18	1.49	-8	3.35	2	7.06	12	14.02	22	26.43
-37	0.26	-27	0.67	-17	1.62	-7	3.62	3	7.58	13	14.97	23	28.09
-36	0.28	-26	0.74	-16	1.76	-6	3.91	4	8.13	14	15.97	24	29.83
-35	0.31	-25	0.81	-15	1.92	-5	4.22	5	8.72	15	17.04	25	31.67
-34	0.35	-24	0.89	-14	2.08	-4	4.55	6	9.35	16	18.17	26	33.61
-33	0.38	-23	0.97	-13	2.26	-3	4.90	7	10.01	17	19.36	27	35.66
-32	0.42	-22	1.06	-12	2.45	-2	5.28	8	10.72	18	20.63	28	37.81
-31	0.46	-21	1.15	-11	2.65	-1	5.68	9	11.47	19	21.96	29	40.07

   a. To the nearest full degree Celsius, what is the dew-point temperature?

   b. Jack keeps his house heated to 80°F (27°C). One day Jill is at his place and Jack complains to her that his skin is always very dry in the winter. She suggests that he should lower his heat to 65°F (18°C). Jill's claim is that, in addition to saving a lot of money on his heating bill, his skin won't be as dry if he keeps his house cooler. Assuming dry skin is caused by living with low indoor relative humidity, answer the following questions to see if you can support Jill's proposal.

      Assuming the vapor pressure in the air inside Jack's house is twice what it is outside, what is the relative humidity inside when the heat is set to 80°F (27°C)?

      What would the indoor relative humidity be if Jack lowered his heat to 65°F (18°C)?

   c. Jack's house has some better insulating windows with three panes of glass and some windows with only a single pane of glass. He notices that frost forms on the inside of the single-pane windows, but not the three-pane windows. Help Jill explain to him why this is happening.

4. Classify each of the following fog situations as radiation, advection, upslope, or steam fog.

    a. An overcast morning in Santa Barbara

    b. Steam rising off your coffee on a cold morning

    c. Morning fog observed over a field in Montana after a cold winter night

    d. Fog on the eastern slopes of the Rockies in the presence of an easterly wind.

    e. A contrail forming behind a jet engine.

5. Refer to the pictures on the following website to answer this question: http://www.atmos.washington.edu/2003Q2/101/HW/HW4_5.html. The website shows six photos of clouds. Indicate which photo shows which of the following clouds (note that one of the photos is meant to illustrate two cloud types).

    a. Noctilucent:

    b. Cirrostratus:

    c. Cirrocumulus:

    d. Altostratus:

    e. Cumulus (humilis):

    f. Cumulus congestus:

    g. Stratus: