Atmospheric Sciences 5130
Exercise #3
Due Friday, Feb 3, 2012

This exercise deals with moist (saturated) adiabatic processes and the skew T-log p chart.

1. To help you get familiar with moist (saturated) adiabatic processes and how they are represented on the *SkewT/Log-P Diagram*, you are strongly encouraged to use the *Skew-T Mastery* program at `http://www.meted.ucar.edu/mesoprim/skewt` (or use the *Skew-T Mastery* link on the class web page). Work through the following items in the *Parameters* section under *Temperatures/Levels*): Equivalent Temperature, Equivalent Potential Temperature, Wet-Bulb Temperature, Wet-Bulb Potential Temperature.

2. *This is a continuation of Problem 2 from Exercise 2. Please use the same graph that you used for that problem.*

   Consider a parcel that ascends dry adiabatically from $p = 1000$ mb, where $T = 20°$C and relative humidity = 50%, to its *saturation pressure* (also known as *lifting condensation level*, or LCL), *and then ascends moist adiabatically from the LCL to 700 mb.*

   Use the skew T-log p chart and calculations (but only as needed) to obtain the quantities listed below for the parcel. *Plot the quantities at 25 mb intervals and at the LCL on the accompanying graph.* Use colored pencils as indicated to plot the variables.
   (a) Relative humidity (black).
   (b) Vapor pressure, e (red); saturation vapor pressure, e_s (blue).
   (c) Mixing ratio, w (red); saturation mixing ratio, w_s (blue).
   (d) Potential temperature, θ (green); temperature, T (red); dewpoint temperature, T_d (blue).

3. *This is a continuation of Problem 3 from Exercise 2. Please use the same graph that you used for that problem.*

   Use the skew T-log p chart and calculations (but only as needed) to obtain the quantities listed below for a parcel that ascends adiabatically from $p = 1000$ mb, where $T = 10°$C and relative humidity = 50%, to its LCL, *and then ascends moist adiabatically from the LCL to 700 mb.*

   Plot the quantities at 25 mb intervals on a new graph.
   (a) Relative humidity.
   (b) e (red), e_s (blue).
   (c) w (red), w_s (blue).
   (d) θ (green), T (red), T_d (blue).

4. Use the results from Problem 2 to *calculate* the equivalent potential temperature θ_e using the formula given in the text for the process described in that exercise. Hint: You will need to know the temperature at the LCL (the *saturation temperature*). Compare the calculated value to the true value of θ_e obtained directly from the skew-T log p chart.

5. For the parcel described in Problem 3, determine its equivalent potential temperature θ_e, and wet-bulb potential temperature θ_w from the skew-T log p chart. Also *calculate* the parcel's θ_e.

p	RH	e	e_s	w	w_s	θ	T	T_d	T_v
(mb)	(%)	(mb)	(mb)	(g/kg)	(g/kg)	(K)	(K)	(K)	(K)
700									
725									
750									
775									
800									
825									
850									
875									
900									
925									
950									
975									
1000									

p	RH	e	e_s	w	w_s	θ	T	T_d	T_v
(mb)	(%)	(mb)	(mb)	(g/kg)	(g/kg)	(K)	(K)	(K)	(K)
700									
725									
750									
775									
800									
825									
850									
875									
900									
925									
950									
975									
1000									