Atmospheric Sciences 101 (Autumn 2004)

Homework #5 (Due at the beginning of lecture on Wednesday, November 10, 2004)

1. Match the following statements with the fog types located on the right:

   i. _____ Involves adiabatic expansion.           A. Advection fog
   ii. _____ Most likely to form before sunrise.    B. Radiation fog
   iii. _____ Forms when warm water subtends a very cold air mass.   C. Steam fog
   iv. _____ Involves warm humid air moving over a cold surface.    D. Upslope fog
   v. _____ Often forms in valley bottoms.

2. Imagine an air parcel moving up and over a mountain ridge. As the parcel is lifted from Seattle (assume sea level), it cools until it is saturated at the lifting condensation level or LCL (elevation 0.5km) where it begins to precipitate. When the parcel reaches the peak of its ascent at the crest of the Cascades (elevation 2.0km) all of the liquid water has been lost. Use the diagram below to answer the following questions. Assume that Ellensburg has an elevation of 0.5km. [5]

   A. If at the surface the air parcel is 10°C, what is its temperature at the LCL? ______________
   B. If the parcel is continually lifted, what is the temperature at the crest? ______________
   C. Why does the parcel cool faster in layer between Seattle and the LCL, than in the layer between the LCL and the crest of the Cascades? Mention only the physical principle involved.
   D. As the parcel descends on the leeward side of the mountain, at what rate will the parcel warm?
   E. How will the temperature of the air parcel in Ellensburg compare to that of the temperature it was in Seattle?
3. Atmospheric Stability

What is the value of the **DRY ADIABATIC LAPSE RATE?** ______________________ [1/2]

What is the value of the **MOIST ADIABATIC LAPSE RATE?** ______________________ [1/2]

The lapse rate indicated on the following diagrams represents the *environmental* lapse rate. On the three figures below, using a straight-edge, neatly draw in lines representing the **dry adiabatic lapse rate** and the **moist adiabatic lapse rate** starting at the same surface temperature (17°C). The lines should be identical for all three diagrams. Based on these figures, indicate the *stability* of the three environments below and the *general cloud type* which would typically form in the three environments. [1 point for drawing the lapse rates correctly]

![Diagram 1](image1)

**STABILITY:** ___________________________________________________________ [1/2]

**GENERAL CLOUD TYPE:** ______________________________________________ [1/2]

![Diagram 2](image2)

**STABILITY:** ___________________________________________________________ [1/2]

**GENERAL CLOUD TYPE:** ______________________________________________ [1/2]
STABILITY: ____________________________________________________________ [1/2]

GENERAL CLOUD TYPE: ______________________________________________ [1/2]

4. Refer to the cloud pictures on the class web site to answer this question. Indicate a photo that contains the following cloud types (note that some of the photos illustrates more than one type).


   A. Cirrostratus . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Photo Number ___________ [1]

   B. Altostratus . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Photo Number ___________ [1]

   C. Cirrocumulus . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Photo Number ___________ [1]

   D. Stratus . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Photo Number ___________ [1]

   E. Cumulus congestus. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Photo Number ___________ [1]