

Homework #4
AOS 101 – Section 305
DUE: February 29th 2008

Name:

#1. A convective thermal plume cools as it rises at a rate of $9.8\text{ }^{\circ}\text{C}/\text{km}$ (this quantity is called the dry adiabatic lapse rate). If a thermal plume starts out at 28°C at the surface and rises 1.5 km, what will be its new temperature? Show all work.

#2. One summer morning it is 65°F in both Iowa City, IA and Madison, WI. However, the day begins with a blanket of heavy fog and low stratus clouds over Iowa City, and the clouds don't begin to clear until 5:00 PM that afternoon. In Madison, it is sunny all day. In which city would we be more likely to see the development of cumulus clouds in the afternoon? Explain.

#3. A highway sign warns that the bridge surface may become icy before the road surface. To simplify the problem, let's say the road is paved with blacktop and the bridge is paved with cement. Given this bit of information, why is the first statement true? Make sure your answer includes terms related to energy transfer covered in lab.

#4. On the attached map are contours of 850mb temperature every 2°C (solid lines are 0°C and above, and dashed lines are below 0°C). Also plotted are 850mb winds in knots. Circle regions associated with warm air advection (label it **WAA in RED**) and cold air advection (label it **CAA in BLUE**). Also label a region where there appears to be neutral advection (label this **NA in BLACK**).

#5. Last week in lab, we saw how fast liquid Nitrogen (LN2) evaporates once it hits the free atmosphere. Also, LN2 is known to exist in liquid form at -196°C. Lets say there is a glass of champagne at room temperature sitting on the head table at a wedding reception. The best man is a mad scientist and decides to dump a bit of liquid Nitrogen into the glass of champagne to cool it. Explain (in terms of heat transfer and the Second Law of Thermodynamics) how liquid Nitrogen can successfully be used to chill this glass of champagne.