Problem Set #2

1. Air at 20 °C with a vapor pressure of 20 mb is cooled by conduction to the ground and by long-wave radiation until it reaches 10 °C. Is fog produced? If so, calculate its liquid water content. Assume the pressure is 1000 mb.

2. Beginning with the definitions of mixing ratio $w = \frac{\rho_v}{\rho_d}$ and specific humidity $q = \frac{\rho_v}{\rho_v + \rho_d}$, show that specific humidity can be expressed as a function of mixing ratio alone.

3. Evaporative air conditioners (a.k.a. “swamp coolers”) cool air by passing it through a wetted mesh typically made of aspen wood. Given a temperature of 25 °C, a dew point temperature of 5 °C, and a pressure of 1000 mb, what is the coldest possible temperature obtainable by this type of cooling system? Why do we see these in Phoenix and not Miami?