

CE 203 Comprehensive Exam  
From Xu Liang

1. An air mass at 900 mb has an initial temperature of 25°C. Its dew-point temperature is 15°C. Use the pseudoadiabatic chart (attached) in which the constant potential temperature ( $\theta$ ) and constant equivalent potential temperature ( $\theta_e$ ) lines are in °K, and the saturation mixing ratio ( $\omega_s$ ) lines are in g/kg. Please find the following quantities for the air mass:
  - (1) Lifting condensation level in mb,
  - (2) Potential temperature in oC and equivalent potential temperature in oK,
  - (3) Wet-bulb temperature and web-bulb potential temperature in oC,
  - (4) Mixing ratio and saturation mixing ratio in g/kg,
  - (5) Relative humidity,
  - (6) If such an air mass is forced to go over a mountain range that is at 650 mb level, how much water would be condensed?
  - (7) If we assume all the water condensed drops off the air mass, what is the temperature (in oC) of this air mass when it descends to the 900 mb on the other side of the mountain?
  
2. Please write briefly and clearly (for readability) in answering the following questions:
  - (1) Identify *three* core principles or equations that you consider to be fundamental to hydrologic analysis or hydrologic modeling.
  - (2) Describe these principles or equations.
  - (3) Explain how they are used and why you choose them as your core principles or equations.
  - (4) Draw a diagram that relates other main topics and ideas in the surface water hydrology to the ones you have selected as your three core principles or equations.
  - (5) List three existing problems in surface water hydrology that you consider to be important and/or big and explain your choices.