

#1 (10 points) At the end of the day, the temperature is  $30^{\circ}\text{C}$  and the relative humidity is 30%. By 3 AM, the temperature has dropped to  $20^{\circ}\text{C}$ . What is the relative humidity at this time?

#2 (10 points) The triple point of  $\text{CO}_2$  is  $-57^{\circ}\text{C}$ , 5 atm. At  $-78^{\circ}\text{C}$ , the vapor pressure of the solid is 1 atm. The enthalpy of melting is 8300 J/mole. Determine the enthalpy of vaporization.

#3 (10 points) Express  $(dh/dv)_T$  [this is partial derivative of  $h$  with respect to  $v$ , holding  $T$  constant] in terms of the EOS variables  $\alpha$  and  $\beta$

Solve either #4a or #4b

#4a (20 points) One mole of solid A at 1000 K is dissolved adiabatically in 3 moles of liquid B at 1200 K. The resulting solution obeys regular solution theory with an interaction energy of  $-30$  kJ/mole. Find the final temperature of the solution. The melting temperature of A is 1100 K and its heat of fusion is 20 kJ/mole. The heat capacities of liquid and solid A and of liquid B are all equal to 25 J/mole-K.

#4b (20 points) The phase diagram below represents an A-B system in which the liquid solution is ideal but the solid is nonideal. Calculate the activity coefficient of A on the solidus curve at 880 C. The heat of melting of pure A is 25 kJ/mole.



