ABE – 201 **Fall 2016**

Homework 8
Due Wednesday 10/5 at the beginning of class

1. (5 pts) Dry air is bubbled through 25.0 liters of water at a rate of 15.0 liters (STP)/min. The air leaving the liquid is saturated with water at 25ºC and 1.5 atm. How long will it take for all of the water to vaporize?

2. (5 pts) Ethyl acetate has a vapor pressure of 118.3 mm Hg at 29.5°C and a normal boiling point of 77.0°C. Estimate the vapor pressure at 45°C using:
    a. The Antoine equation and the constants from Table B.4 of the textbook
    b. The Clausius-Clapeyron equation and the two given data points
    c. Linear interpolation between the two given points.
    d. Assuming the answer from part a) to be the actual vapor pressure, calculate the percentage error associated with the estimates from parts b) and c).

3. (10 pts) A hot-air dryer is used to reduce the moisture content of 1500 kg/min of wet wood pulp from 0.75 w/w water to 0.002 w/w water. Air is drawn from the atmosphere at 28°C, 760 mm Hg, and 50% relative humidity ($\frac{p_{H2O}}{p^*_{H2O}}$). The air is heated and then passes through the dryer. The air leaves the dryer at 80°C and 10 mm Hg (gauge). A sample of the air is drawn into a chamber and slowly cooled while keeping the pressure constant. A mist is observed to form on the mirror in the chamber at 40.0°C.
    a) What is the rate (kg/min) that water is removed from the wood?
    b) What is the volumetric flow rate of air entering the system to achieve this?