

PLSC 532: Fall 2006
Problem Set 2
Due October 5

Please show your work in answering the following questions (you may use separate sheets of paper).

1. You measure the air temperature in your greenhouse to be 26 C, and its relative humidity 70%.
What is the water vapor density of this air?
 $\sim 17 \text{ g m}^{-3}$
2. What is the relative humidity of air whose water vapor density is 14 g m^{-3} and temperature is 20 C?
 $\sim 80\%$
3. What is the dew point temperature of the air described in (2) above?
 $\sim 16 \text{ C}$
4. Calculate the transpiration rate, in $\text{mg m}^{-2} \text{ s}^{-1}$, of a leaf having the following internal and external environments:
leaf temperature = 26 C
air temperature = 25 C
air relative humidity = 0.6
leaf $\approx -1.0 \text{ MPa}$
boundary layer conductance = 50 mm s^{-1}
leaf conductance = 5 mm s^{-1}
assume relative humidity of leaf = 0.99 at of -1.0 MPa
- ~~5. Express the transpiration rate you calculated in the above question (3) in $\text{mmol m}^{-2} \text{ s}^{-1}$. OMIT~~
6. How many mL of water would 30 *Arabidopsis* plants transpire in 4 hours, if each has 20 leaves, if the average area of a leaf is 1.2 cm^2 , with each leaf transpiring at an average rate of $50 \text{ mg m}^{-2} \text{ s}^{-1}$ during the 4 hours?
7. The dry weight of the *Arabidopsis* foliage in #6 above = 6.5 g.
(a) What is the total leaf area of the above *Arabidopsis* plants in dm^2 ?
(b) What is its average specific leaf weight (express as g dm^{-2})?
(c) What is its average specific leaf area in g (express as $\text{dm}^2 \text{ g}^{-1}$)?
8. How many grams of water would a dogwood tree transpire in 1 hour, if its total leaf area is 20 m^2 , with leaves transpiring at an average rate of $3 \text{ mmol m}^{-2} \text{ s}^{-1}$?
9. How many liters of water would 10 square meters of bermuda grass transpire in 1 day, if the leaf area in each square meter of the turf is 2.4 m^2 , with leaves transpiring at an average rate of $3 \text{ mmol m}^{-2} \text{ s}^{-1}$ during daylight hours? Assume 14 hours of daylight, and assume no transpiration during the night.