Plant Ecology, Examination 2, November 9, 2000 Name _____

Please restrict your response to the space available. Answer directly and fully - don't beat around the bush. The point values for each question are given in parentheses. Your notes added to the Winston's PDF printout may be helpful in answering the exam. All page references refer to Winston Weatherby's notebook. Question #7 is a bonus.

1 (15). Most people would find it odd that the photosynthetic data on page 106 indicate that CO_2 is evolved from leaves of *A. caudatus* in the dark (PFD = 0), but not from leaves of *A. cruentus*? What strikes you as odd about this difference between the two curves at the lowest PFD levels? Could it be that Winston incorrectly plotted one of these data sets?

2 (12). OK, let's stay on page 106. Full sunlight has a PFD value of about 2.0 mmol m^{-2} s^{-1}. Assuming that leaves of the two amaranth species have similar leaf absorptance characteristics, is it unusual or to be expected that the slope of the relationship between net photosynthesis and incident PFD (over the range 0-1 mmol m^{-2} s^{-1}) is approximately the same between the two species? Explain your answer.

3 (15). On page 107, why is the relationship between net photosynthesis by amaranth leaves and leaf nitrogen content linear? Explain your answer.

4 (12). What we now know is that there were some wispy trees shading parts of the field when Wanda collected the data on page 109. Provide the correct mechanistic explanation for why the internodal distance between successive leaves is responding to the red-to-far-red ratio within the amaranth canopy.

5 (15). Regarding the data on page 110, provide a simple mechanistic explanation for why the growth of a plant (measured in g m^{-2}) should be positively correlated with carbon isotope discrimination. Justify your answer. Remember that this is "carbon isotope discrimination" and **not** "carbon isotope ratio".

6 (16). OK, please help Winston with his data on page 111. Please fill in the correct carbon isotope ratios for these samples. Remember the values are -29.1, -25.8, -16.2, and -15.9 per mil. From page 112 of Winston's notebook (which you did not have access to earlier), we now know that the carbon isotope ratio values are only different from each other if the values differ by more than 0.3 per mil.

amaranth leaf, well watered _____ per mil

amaranth leaf, limited water _____ per mil

wheat leaf, well watered _____ per mil

wheat leaf, limited water _____ per mil

7 (15). OK, let's think about the data on page 108. It turns out that all of these data were collected from the same leaf, simply by changing the incident PFD levels and observing the response. Using an Ohm's Law analogy, what was the intercellular CO_2 within the leaf when the leaf conductance was 300 mmol m^{-2} s^{-1}? [Show your calculations.]

8 (15). OK, a bit more about the data on page 108. What does a linear relationship between net photosynthesis and leaf conductance say about the values of intercellular CO_2 over the leaf conductance range of 50 - 350 mmol m^{-2} s^{-1}? Specifically, over the leaf conductance range of 50 - 350 mmol m^{-2} s^{-1}, is the intercellular CO_2 value constant, increasing, and/or decreasing? Justify your answer.