Name ___________________________ Fall Semester 1999

Biology 13 Make-Up Third Hour Exam (29 November 1999)

Some tips: Breathe deeply... Relax... Read the questions carefully and answer the question asked, not some different question (i.e. Don’t go into data dump mode.). If the question asks for a diagram, draw a diagram. Do the easy questions first, and budget your time. Good Luck!

(60 Points Total)

1. It is 1893. You are Eduard Strasburger investigating the mechanisms of xylem flow in trees. You’re doing experiments whereby you cut down 20m tall trees and stand them up in big basins filled with a poison that kills the living cells in the tree. You do another experiment whereby you cut down a tree that has dropped its leaves (because it is fall) and stand it in the poison. What parts of this tree would die (if any)? What parts would NOT die in the near future (if any)? Why or why not? (6 pts.)

2. It is a hot, dry summer day, and you are studying the levels of CO₂ inside photosynthesizing leaves of both C₃ and C₄ plants. As the stomates open and close, you find that the CO₂ levels fluctuate in both kinds of leaves. In what ways would the CO₂ levels inside the C₃ and C₄ leaves differ from each other? Why? In what ways would the timing of opening and closings of the stomates differ between the C₃ and C₄ leaves? Why? Use diagrams and graphs as appropriate to illustrate your answer. (8 pts.)
3. Here are a few questions about the light reactions.... (15 pts. total)
   a). Diagram below, in some detail, the path of electrons from Photosystem II through Photosystem I in non-cyclic photosynthesis. Indicate clearly the donor of the electrons and the final acceptor of electrons. Make sure that you indicate where ATP and NADPH are produced, and what powers each step. Label the components of the pathway. (10 pts.)

   b). Most herbicides work by interfering with the function of the electron transport chain in chloroplasts. Think about the pathway of an herbicide from the application on the leaf to blocking electron transport. What one physical characteristic must herbicides have in order to be useful commercially? Think about the barriers it has to cross. (2 pts.)

   c). Say that you are working at Dupont on a new type of herbicide that blocks Photosystem I from functioning. When this herbicide is applied to chloroplasts that do only non-cyclic photophosphorylation, what will happen to the following? (3 pts.)

   The production of O₂ -
   The production of ATP -
   The production of NADPH -
4. Improvement of the heavy clayey soil by working in compost and degraded organic matter into the ground is one of the fundamental things that gardeners in Ohio can do to improve their gardens. Knowing that most compost and organic matter is **acidic**, why would the application of compost in the soil help plant growth? (6 pts.)

5. You are investigating the fixation of CO$_2$ in the dark reactions in C$_3$ plants using radiolabelled $^{14}$CO$_2$ to trace where the radiolabel ends up. You find that a lot of 3 and 5 carbon sugars are initially radioactive, but that relatively few 6-carbon sugars are radioactive initially. Why is this? Use a diagram(s) and enough text to justify your answer. (6 pts.)

6. Mutations are one of the primary tools used by plant biologists to figure out the roles that different hormones play in plants. These mutations may be in the production of the hormone, the reception of the hormone, or the downstream biochemical effects after the reception of the hormone. Think specifically about Phinney’s work in the 1950’s with gibberellins and the mutant dwarf corn whereby the external application of gibberelin caused the corn to grow to normal height. What is the most likely type of mutation that is present in Phinney’s corn? Why? (3 pts.)
7. The use of active transport to move ions, solutes, and water is critical to fluid transport in plants. Compare and contrast the active transport system(s) in xylem in the roots to phloem transport in the leaves and roots. Use diagrams to illustrate your answer. (16 pts.)