

## Spring 2008 Biology 111 Take Home Exam #3 – BioEnergetics

There is no time limit on this test, though I have tried to design one that you should be able to complete within 2 hours, except for typing. There are 3 pages for this test, including this cover sheet. You are not allowed to use your notes, old tests, the internet, or any books, nor are you allowed to discuss the test with anyone until all exams are turned in at 12:30 pm on Wednesday April 16. **EXAMS ARE DUE AT CLASS TIME ON WEDNESDAY APRIL 16.** You may use a calculator and/or ruler. The **answers to the questions must be typed on a separate sheet of paper** unless the question specifically says to write the answer in the space provided. If you do not write your answers in the appropriate location, I may not find them.

**-3 pts if you do not follow this direction.**

**Please do not write or type your name on any page other than this cover page.**

Staple all your pages (INCLUDING THE TEST PAGES) together when finished with the exam.

Name (please print):

### ANSWER KEY

Write out the full pledge and sign:

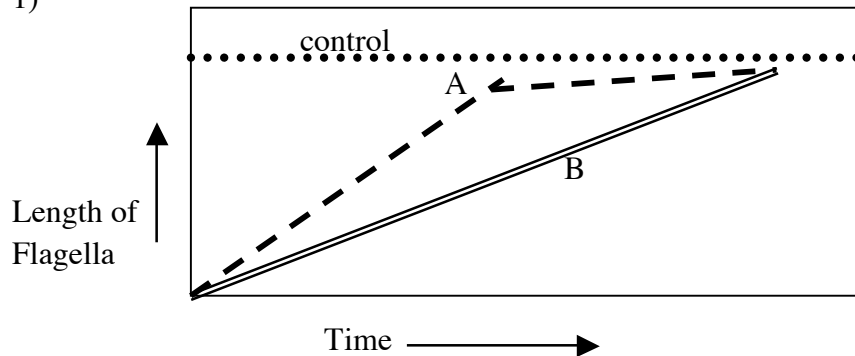
On my honor I have neither given nor received unauthorized information regarding this work, I have followed and will continue to observe all regulations regarding it, and I am unaware of any violation of the Honor Code by others.

How long did this exam take you to complete (excluding typing)?

Lab Question:

**6 pts.**

1)



**List** the three most significant results for the two populations of *Chlamydomonas* measured in the graph above. The two cell populations were deflagellated at exactly the same time but given two different chemical treatments (A and B) immediately after deflagellation. Control cells were never deflagellated. Assume all differences of more than a millimeter on your paper are significant.

1. B rate was linear
2. A rate was faster but slowed about half way through time
3. B and A both grew back to about the full length

Lecture Questions:

**5 pts.**

2) *In 2 sentences or less*, explain to a community group in the town of Davidson why the phrase “consume less energy” can produce a misconception in the general population.

Consume leads some to think the energy is gone, but it is only transformed to heat and entropy (first law of thermodynamics).

**6 pts.**

3) a. Explain how a plant can have an action spectrum that is different than the absorption spectrum of chlorophyll a.

Chlorophyll a is only one of several pigments so the plant can absorb more light than Chlorophyll can by itself.

b. Draw a picture that approximates the absorption spectrum and the action spectrum using two different colors for the two spectra.

Similar to what was in book.

**12 pts.**

4) a. *What* is the source of the majority of a tree's mass? Explain your answer in 2 sentences or less.

The carbon in cellulose comes from CO<sub>2</sub> in air that is fixed in dark reaction.

b. In 2 sentences or less, explain *why* plants need to consume water.

Plants need water to supply missing electrons to Photosystem II in the non-cyclic electron flow.

The water is split to supply the electrons and O<sub>2</sub> is a waste product.

c. In 2 sentences or less, explain *why* animals need to consume water.

Citric acid cycle consumes 2 water molecules so we always need more water to oxidize pyruvate.

**8 pts.**

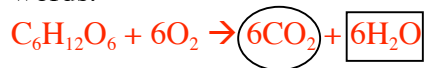
5) a. Draw the chemical structures of ATP production from ADP. In this picture, do NOT draw pictures of any proteins or protons.

Same as always.

b. What is the ΔG for this reaction? + 7.3 kcal/mole

**9 pts.**

6) a. Write the overall cellular respiration equation using chemical terms/symbols, not just words.



b. In your equation above, draw a box around a reduced product and a circle around an oxidized product.

c. Describe the ΔS for this reaction. +ΔS due to increased randomness of smaller products

**8 pts.**

7) a. What is cyclical about the citric acid cycle? Explain this in two sentences or less and be numerically accurate in your answer. Do NOT draw a picture of the cycle for your answer.

4 old carbons + 2 new carbons make 6 carbons, two are released as CO<sub>2</sub> and we are left with the same 4 old carbon sugar to start cycle over again.

b. In two sentences or less, compare (how are they similar) and contrast (how are they different) substrate level phosphorylation and oxidative phosphorylation.

Same = both produce ATP from ADP and inorganic phosphate

Different = oxphos produced ATP by ATP synthase powered by H<sup>+</sup> gradient, while substrate phosphorylation is produced by direct phosphate transfer onto ATP in glycolysis and citric acid cycle.

**6 pts.**

8) Explain in 3 sentences or less how the rate of a multi-step enzymatic reaction can be regulated.

Focus on the slowest enzyme and allosterically modulate it by feedback inhibition or activation.

**6 pts.**

9) a. Is there a nutritional difference between protein obtained from tofu and protein obtained from meat? Explain your answer in 2 sentences or less.

No, they are the same nutritionally, unless you consider the lower fat level in tofu.

b. Are there any components of protein that cannot be catabolized for energy? Explain your answer in 2 sentences or less.

NH<sub>2</sub> group cannot be catabolized so it is secreted as waste.