

BIOLOGY 102

problem set 2

This problem set consists of two (2) questions. The answer to each question must be typewritten on a separate sheet and the two sheets stapled together to be submitted. Each answer must be 1.5 or double spaced using 12 point type and may not exceed one page with minimum margins of 1 inch. Each page must contain your name at the top and is to be numbered in the bottom center. Late papers will be penalized 10% per day (or part of a day) late. Any printed materials may be used to answer the questions. Reference this material. Unless web sites are specifically mentioned as a resource, it is best to avoid using them unless you are able to accurately judge the value of the material. References must be in scientific journal form and on a separate reference page (page 3) of the problem set. Answers will be judged by how well all aspects of a question are addressed (thoroughness), how well information is used in the response (accuracy), and how well the answer is written (clarity). This is an individual assignment but you may work in mentoring groups.

December 12, 2009 Due Date: December 19, 2009

Problem 1 One fine morning, you are working on your senior thesis project in the lab and you are a bit “foggy” from the night before. You successfully completed a DNA amplification using PCR (the polymerase chain reaction) with the following reaction components:

14.39 ul	water
2.00 ul	DNA
0.61 ul	primers
2.00 ul	10X reaction buffer
1.00 ul	Taq enzyme at 2 units/ul
20.00 ul	

... for a total reaction volume of 20 ul. This morning, your thesis advisor (whom you admire almost to the point of worship) wants you to maintain the same proportions of each reagent in the reaction but do it larger, in a total volume of 50 ul. This would be easy except that the Taq enzyme he gives you is not 2 units/ul as above but is 20 units/ul. The fog sets in.

- How many ul of the 20 units/ul enzyme do you use in a 50 ul reaction to keep the amount of enzyme proportional to the total volume?
- Write out how much of each component you will put into the reaction using the list format in the question above so that the total volume is 50 ul.

Problem 2. Oxygen consumption by mitochondria can be measured with an oxygen electrode in a test tube. In Figure 1, the graph is of oxygen consumption (Y axis) vs time in minutes (X axis). At the time indicated “mt added”, a suspension of mitochondria was added to a solution of β -hydroxybutyrate, a compound which can be oxidized (electrons

ripped off) to generate NADH. The line slopes sharply downward (a-b) because oxygen is being used. After an initial, rapid burst, oxygen consumption slowed to a background rate (shallow slope b-c). When the rate of oxygen consumption stabilized, ADP was added causing a rapid increase in oxygen consumption (sharp slope downward c-d) which soon leveled off to the background rate (d-e).

A. Why did the rate of oxygen consumption increase dramatically over the background rate (c-d) when ADP was added?

B. Why did oxygen consumption return to the background (d-e) after less than a minute?

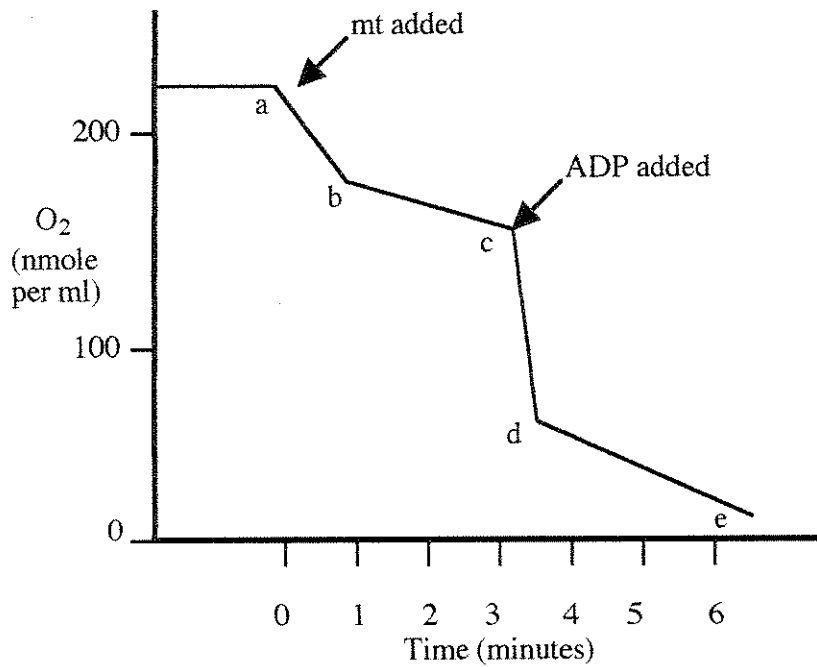


Figure 1. A graph of mt oxygen use under various and varying conditions.