

**CHEM-342 Introduction to Biochemistry  
Final Examination - Group (Part II)  
Tuesday, 27 May 2008  
9:00 – 10:00 PM  
H. B. White - Instructor**

**Group Members**

---

---

---

---

---

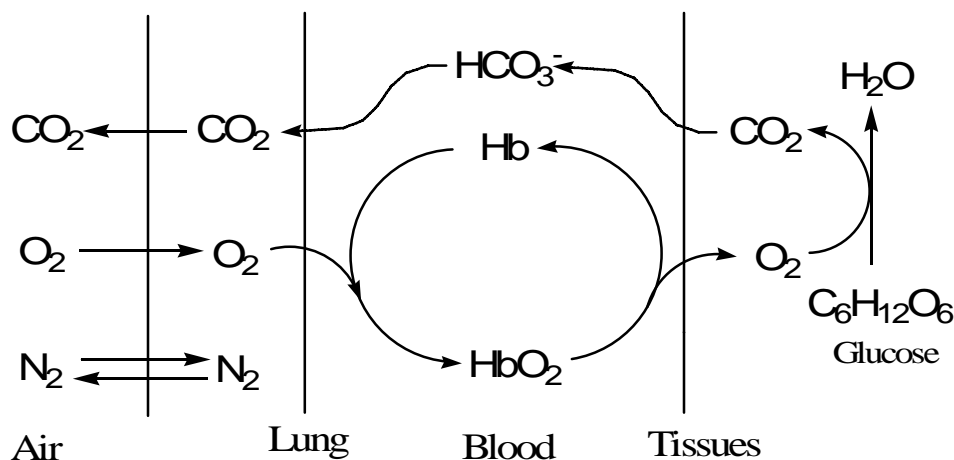
---

**Group Scores 19-30 out of 30**

**Important - Please read this before you turn the page.**

- You must sign your name on this page to receive the group grade. In case of lack of consensus, you may hand in your answer separately from your group for individual grading.
- You may refer to your notes, course reader, handouts, or graded homework assignments. Textbooks and reference books are not permitted.
- In CHEM-342, hemoglobin is a vehicle for learning how to learn by asking questions and pursuing answers to those questions. Undoubtedly you have learned a lot about hemoglobin in the process but you also should be developing habits of mind that will enable you to solve problems in other courses and throughout your life. This part of the final examination provides an opportunity for you and the other members of your group to display problem-solving skills as a team. It is extremely unlikely that anyone in your group or in the class has encountered the information on the following pages. Your answers should display your collective:
  - breadth of knowledge (not limited to hemoglobin or biochemistry)
  - ability to analyze, make connections, and ask probing questions
  - sense of logic and organization
  - skill at generating models (testable hypotheses)

1. (25 Points) Biochemists often make numerical estimates based on simplifying assumptions in order to get the big picture and set limits on various processes. That is what this question asks of you. *Assume that all* of the oxygen you breathe in each day gets bound to hemoglobin, is transported throughout the body, and then used to oxidize glucose via respiration as depicted in the figure below.



- (10 Points) Estimate within a factor of 2 the maximum number of grams of glucose your group would consume in a day? You will be provided with a plastic Ziploc bag, straws, and a ruler to estimate the amount of air you breathe each day. Show your work. (If you have forgotten particular unit conversions from general chemistry, they are on sale for one point each.)
  - (10 Points) If hemoglobin were a stoichiometric rather than a catalytic carrier of oxygen (i.e. not recycled), what fraction of your groups body weigh or multiple of the body weight in hemoglobin would be required to transport the oxygen used by your group each day?
  - (5 Points) Estimate within a factor of two the maximum number of 250 mL glasses of “metabolic” water your group produces each day.
2. Bonus Question (5 Points), Only work on this if your group has finished parts *a* and *b* before 10 PM.

Although the above unbalanced equation for respiration is written with glucose as the substrate and water and carbon dioxide as the products, other substrates such as fats and amino acids are also oxidized and there are many metabolic reactions underlying the net reaction implied by the simple equation. Instead of glucose, assume your body is oxidizing fatty acids. Write a balanced equation for the oxidation of palmitic acid to carbon dioxide and water and estimate within a factor of 2 the maximum number of grams of palmitic acid ( $\text{C}_{16}\text{H}_{32}\text{O}_2$ ) your group would metabolize in a day.