

CHEM-342 Introduction to Biochemistry  
Mid-term Examination - Group Part  
Friday, 27 March 2007  
H. B. White - Instructor  
25 Points

Group Members \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Average = 17.5/25 Range = 13 – 24/25 (6 groups)**

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

1. Write your names or group number on each page of the exam you turn in.
2. This part of the examination is closed book and closed notes.
3. Please read each question carefully and make sure that you have thought it through with **everyone's** input **before** converging on a solution.
4. If you do not agree with your group, you may submit the examination under your own name for separate grading.

1. (10 Points) Zinoffsky describes conditions in which horse hemoglobin is soluble and conditions where he can crystallize it. Assume you would like to obtain a crystal of horse hemoglobin suitable for x-ray crystallography. Using Zinoffsky's information, design an vapor diffusion experiment that likely would yield the crystals you want. Draw a picture to represent your experiment and describe it in words.

2. (15 Points) Construct a concept map based on the slightly modified passages from the Lehninger textbook presented below. Include the highlighted words in bold letters and any others you want to add. Post-it notes will be provided.

“The first breakthrough in understanding the **three-dimensional structure** of a **globular protein** came from **x-ray diffraction** studies of **myoglobin**. Myoglobin is a relatively small ( $M_r$  16,700), oxygen-binding protein of **muscle cells**. It functions both to store **oxygen** and to facilitate oxygen diffusion in rapidly contracting muscle tissue. Myoglobin contains a single **polypeptide chain** of 153 **amino acid residues** of known **sequence** and a single **iron protoporphyrin**, or **heme**, group. The same heme group is found in **hemoglobin**, the oxygen-binding protein of **erythrocytes**, and is responsible for the deep red-brown color of both myoglobin and hemoglobin. Myoglobin is particularly abundant in the muscles of **diving animals** such as the whale, seal, and porpoise. Storage and distribution of oxygen by muscle myoglobin permit these animals to remain submerged for long periods of time.”

“Hemoglobin ( $M_r$  64,500) is a **tetrameric** protein containing four heme **prosthetic groups**, one associated with each polypeptide chain. Adult hemoglobin contains two types of **globin**, two  **$\alpha$  chains** (141 residues each) and two  **$\beta$  chains** (146 residues each) Although fewer than half of the amino acid residues in the polypeptide sequences of the  $\alpha$  and  $\beta$  subunits are identical, the three-dimensional structures of the two types of **subunits** are very similar. Furthermore, their structures are very similar to that of myoglobin even though the three polypeptides are identical at only 27 positions.”