**Chemistry 4055 (Spring 2013)**

**Biochemistry I- Introduction to the Chemistry of the Animal Cell**

**Chapter 5 HW Assignment**

1. Insulin binds to the insulin receptor with a Kd of 1x10-10 M. At what concentration of insulin will θ = 0.1 and 0.5?

2. If a modified version of insulin binds to the insulin receptor with a Ka of 1x109, does it have a stronger or weaker affinity to the receptor than normal insulin?

3. The Tm of a transporting protein is 65 °C and shifts to 75 °C in the presence of its native ligand. What does the shift in Tm tell you?

4. What factor contributes to the weaker affinity of CO to the porphyrin core in myoglobin?

5. Why would myoglobin serve as a poor transport vehicle for O2?

6. O2 binding to hemoglobin disturbs several of the stabilizing ion pairs of the rigid T state structure. What happens to the structure of the protein on a tertiary and quaternary level? Is the structure more compact than in the absence of O2 binding? Explain what information in the crystal structure indicates this to you.

7. Derive the Hill Equation from the following equilibrium expression.

P + nL PLn

The Hill Coefficient, n, never equals the number of binding sites in practice. But what does this number tell you about the protein-ligand interaction?

8. The hydration of CO2 is expressed below. Based on Le Chatelier’s principle, what happens to the system when the [H+] decreases?

CO2 + H2O H+ + HCO3-

9. What causes for the high pKa of His HC3 in the T state of hemoglobin?

10. In what way does 2,3-bisphosphoglycerate (BPG) serve as a heterotropic modulator of O2 binding to hemoglobin?

11. How does Val substitution of Glu at critical position 6 in the two β chains of hemoglobin lead to protein structural changes that result in sickle cell anemia?

12. Why do sickle cell anemia patients have difficulty breathing?

13. How can the understanding of antibody-antigen interactions be used in a workflow for protein isolation, purification, and identification?

14. You obtain a crude protein extract from blood and want to detect the presence of the 80 kDa transferrin protein by Western Blot. You use a monoclonal primary antibody and ultimately detect a dark band at 80 kDa and a lighter band at 60 kDa. What do the presence of these bands and their respective intensities tell you?