

Chapter 7 Answers

Portrait of an Allosteric Protein

Study excursions 1 through 6 and chapter problems 3, 4 and 5

- 1) Hemoglobin reversibly binds:
 - a) CO_2
 - b) Phosphoenol pyruvate
 - c) CO
 - d) H_2O
 - e) all of the above

- 2) The affinity of hemoglobin for oxygen decreases with
 - a) an increase in pH
 - b) a decrease in the concentration of BPG
 - c) a decrease in $p\text{O}_2$
 - d) the iron in the +2 oxidation state
 - e) all of the above

- 3) An enzyme whose substrate binding was found to have a hill coefficient of 1.0 indicates:
 - a) That carbon monoxide is activating the enzyme
 - b) the substrate binding curve will be hyperbolic
 - c) a sigmoidal binding curve will be found
 - d) that this enzyme is allosterically regulated
 - e) none of the above

- 4) Deletion in genes for the hemoglobin alpha chain results in:
 - a) HbS
 - b) HbM
 - c) Hb Saskatoon
 - d) thalassimia

- 5) The affinity of hemoglobin for oxygen increases with:
 - a) A decrease in pH
 - c) A decrease in $p\text{O}_2$
 - b) an increase in $p\text{O}_2$
 - d) an increase in the concentration of hydrogen ions

- 6) T/F For hemoglobin, the hill coefficient is greater than one

- 7) The primary force holding the heme in place in hemoglobin is:
 - a) hydrogen bonding
 - b) salt bridges
 - c) disulfide bonds
 - d) hydrophobic interactions

8) Draw the O₂ dissociation curve for both the normal forms of hemoglobin and hemoglobin that has a mutation for sickle cell.

9) Describe the solubility of sickle cell hemoglobin and normal hemoglobin in high pO₂ vs. low pO₂.

10) Why does the coordination of oxygen to the heme Fe⁺² effect structure of hemoglobin. How is this different in myoglobin?

11) To bind oxygen, the iron in hemoglobin must have a

- a) +2 oxidation state
- b) +3 oxidation state
- c) +1 oxidation state
- d) the oxidation state does not matter, just the coordination of the histadine
- e) any oxidation state

12) As the pH decreases, the ability of hemoglobin to bind to oxygen

- a) increases
- b) decreases
- c) stays the same
- d) drops to zero

13) Explain why the pH alters the affinity of hemoglobin for oxygen.

14) How does the reaction of carbon dioxide with water help explain the Bohr effect? Include the equation for the formation of bicarbonate ion from CO₂ and water, and explain the effects of H⁺ and CO₂ on hemoglobin oxygenate

15) Carbon dioxide binds to which site of the hemoglobin molecule?

- a) the N terminus
- b) the C-terminus
- c) the heme iron
- d) an important histadine
- e) it doesn't bind to hemoglobin

16) The contact points between hemoglobin subunits

- a) tightly associates the two subunits together
- b) occurs by interactions of different amino acids in the T and R forms
- c) occurs only my hydrophobic interactions

d) uses the same amino acids regardless of the conformation of hemoglobin

Don't forget to be able to discuss the specific changes that occur to alter the hemoglobin affinity for oxygen. pH, CO₂ binding, CO binding BPG and the alternative forms of hemoglobin