

BMB 401 EXAM 2

March 04, 2004

Please write your name on your exam sheet and turn it in with your Scantron sheet!

Do not forget to include your student ID on the Scan Tron Sheet. It is not necessary to include a section number.

The test form you have is written on the last page of the exam. Please encode it.

1. A protein composed of 4 identical subunits can have which of the values below as the maximum Hill Coefficient?
 - a. 0
 - b. 1
 - c. 2
 - d. 4
 - e. 8

2. Which of the following Hill Coefficients corresponds to no observed cooperativity?
 - a. 0
 - b. 1
 - c. -1
 - d. 2
 - e. none of the above

3. Which of the following is an example of homotropic cooperativity?
 - a. Oxygen binding to myoglobin
 - b. Oxygen binding to hemoglobin
 - c. 2,3-bisphosphoglycerate binding to hemoglobin
 - d. CO₂ binding to hemoglobin
 - e. Both a and b

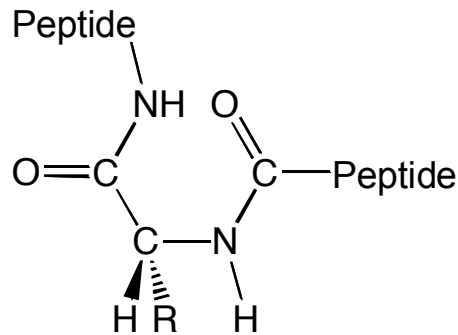
4. Which of the following statements is **false** concerning the nature of a peptide bond?
- One mole of water is liberated per mole of peptide bond formed.
 - The carbonyl of the peptide bond is shorter than a typical carbonyl.
 - The peptide bond is polar
 - The carbonyl oxygen and amide proton are typically in a trans configuration
 - The amide bond of the peptide bond is shorter than a typical amide bond.
5. An anemic individual, whose blood has only 1/2 of the normal hemoglobin content, may appear to be in good health. However, a normal individual is incapacitated by exposure to sufficient carbon monoxide to occupy only half of his/her heme sites. Why?
- Carbon monoxide hydration induces the Bohr effect, which results in greater binding of oxygen to deoxyhemoglobin
 - Carbon monoxide hydration induces the Bohr effect, which results in weaker binding of oxygen to deoxyhemoglobin
 - Carbon monoxide competes with carbon dioxide binding to hemoglobin, preventing it from being returned from the tissues.
 - Carbon monoxide binding to hemoglobin enhances oxygen binding through allostery, preventing it from being released in the tissues.
 - Carbon monoxide binding to one subunit denatures the entire protein
6. Which of the following pairs of phi and psi angles are sterically allowed?
Note: See structure above problem 24.
- $\phi = 0^\circ, \psi = 180^\circ$
 - $\phi = 180^\circ, \psi = 0^\circ$
 - $\phi = 0^\circ, \psi = 0^\circ$
 - $\phi = 180^\circ, \psi = 180^\circ$
 - Both c and d
7. An α -helix containing 24 amino acids will have how many hydrogen bonds associated with the helix backbond?
- 24
 - 20
 - 16
 - 48
 - 28

8. Which of the following is true about left-handed 3.6_{13} α -helices
- They are readily found in nature
 - They are formed from peptides containing poly-proline residues
 - They can form only with D-amino acids
 - All of the above
 - None of the above
9. If the following section of a polypeptide (**F-D-A-R-L-E-S-S**) is folded into a 3.6_{13} α -helix, to which amino acid is the carbonyl group of aspartate noncovalently bonded?
- Alanine
 - Arginine
 - Serine
 - Glutamate
 - Leucine
10. Which of the following forces is most relevant in the formation of repeating secondary structure?
- Covalent interactions
 - Van der Waals interactions
 - Hydrophobic interactions
 - Electrostatic interactions
 - Hydrogen bonds
11. Which of the following forces is least relevant in the formation of tertiary structures?
- Covalent interactions
 - Van der waals interactions
 - Hydrophobic interactions
 - electrostatic interactions
 - Hydrogen bonds
12. Which of the following sequences would most likely be found in an antiparallel β -sheet
- D-E-F-G-R-A-H-V-L-K
 - M-E-A-T-V-K-I-D-L-E
 - A-V-I-L-M-R-H-K-D-E
 - G-R-P-G-R-P-G-L-P-G
 - V-A-L-M-F-I-L-M-A-Y

13. If the pitch of a 3.6_{13} α -helix is 5.4 \AA , what is the length of an α -helix containing 20 amino acids?
- 70.2 \AA
 - 30 \AA
 - 117 \AA
 - 72 \AA
 - 19.4 \AA
14. Who is the scientist who systematically showed that in most peptides only a certain set of phi and psi angles are allowed?
- Pauling
 - Corey
 - Ramachandran
 - Sanger
 - Merrifield
15. What is the most important characteristic of a polypeptide that dictates its final tertiary structure?
- The number of disulfide bonds it can make
 - Its primary structure
 - Its post-translational modifications
 - The percentage of alternating hydrophobic and hydrophilic amino acids
 - Its size
16. If a given peptide composed of L-amino acids forms a right handed alpha helix at pH 7, what structure would it form if it were composed of alternating L and D-amino acids?
- A right-handed α -helix
 - A left-handed α -helix
 - It would have no defined secondary structure
 - A parallel β -sheet
 - A hairpin structure.
17. Which of the following techniques separates proteins based on their pI values.
- Gel-filtration chromatography
 - SDS-PAGE
 - Salting out
 - Isoelectric focusing
 - Affinity chromatography

18. Which of the following 3.6_{13} α -helices would be most stable at all pH values between 2 and 12?
- D-D-D-D-D-D-D-D-D-D
 - G-A-P-G-A-P-G-A-P-G-A-P
 - G-G-G-G-G-G-G-G-G-G
 - K-K-K-K-K-K-K-K-K-K
 - E-A-L-K-M-L-A-M-E-A
19. Which of the following amino acids is common in both collagen and silk?
- Proline
 - Hydroxyproline
 - Alanine
 - Lysine
 - Glycine
20. What is the growth rate, in turns per second, of the α helices in a hair that is growing 15 cm per year? Note: $1 \text{ \AA} = 1 \times 10^{10} \text{ M}$.
- 8.8
 - 0.036
 - 130
 - 32
 - 3200
21. Which of the following mutations would probably be most detrimental to a protein
- I to V
 - E to P
 - H to K
 - D to T
 - S to C
22. Chaotropic agents denature proteins by which of the following mechanisms
- They reduce disulfide bonds
 - They cause nonpolar residues to want to be solvent exposed
 - They interfere with Van der Waals interactions
 - They disrupt hydrogen bonds
 - They cleave covalent bonds

23. What is the link between citrus fruits and the disease, Scurvy?
- Citrus fruits are rich in proline which is important in collagen formation
 - Citrus fruits contain agents that help promote disulfide bond formation in α -keratin.
 - Citrus fruits contain ascorbic acid, which is important in the reaction that generates hydroxyproline for collagen stability
 - Citrus fruits are high in α -ketoglutarate, which is important for generating lysine crosslinks in collagen.
 - Citrus fruits are rich in glycine, which is a crucial amino acid in the collagen structure.



24. In the peptide shown above, what are the values of the angles respectively corresponding to psi and corresponding to phi? **Assume that all atoms along the peptide backbone lie in a plane.**
- $\phi=180^\circ$, $\psi=0^\circ$
 - $\phi=0^\circ$, $\psi=180^\circ$
 - $\phi=0^\circ$, $\psi=0^\circ$
 - $\phi=180^\circ$, $\psi=180^\circ$
 - Both c and d are correct
25. If the C_α -C bond (peptide shown above) were rotated such that the carbonyl group was perpendicular to the plane of the paper and facing towards you, and the C_α -N bond were rotated such that the carbonyl group was perpendicular to the plane of the paper and facing towards you, what would the resulting ϕ and ψ angles be?
- $\phi=90^\circ$, $\psi=90^\circ$
 - $\phi=-90^\circ$, $\psi=-90^\circ$
 - $\phi=90^\circ$, $\psi=-90^\circ$
 - $\phi=-90^\circ$, $\psi=90^\circ$
 - $\phi=0^\circ$, $\psi=90^\circ$

26. Two polypeptides, A and B, have similar tertiary structures, but A normally exists as a monomer, whereas B exists as a tetramer. What differences might be expected in the amino acid composition of A versus B?
- A would have more hydrophobic amino acids
 - B would have more hydrophobic amino acids
 - A would have more prolines
 - B would have more glycines
 - B would have more cysteines
27. Hemoglobin reversibly binds oxygen, protons, bisphosphoglycerate (BPG), carbon monoxide, and carbon dioxide. Which statement is correct about the nature of these bindings?
- oxygen binds to Fe^{3+} but not Fe^{2+} hemoglobin
 - hydrophobic interactions are the primary forces associated with BPG binding to hemoglobin
 - when oxyhemoglobin moves to a more acidic environment, it is more apt to release its oxygen
 - carbon dioxide binds to Fe^{2+} but not Fe^{3+} hemoglobin
 - carbon monoxide binds to Fe^{3+} but not Fe^{2+} hemoglobin

You have test form 3