

# BMB 401 EXAM 2

## March 22, 2001

1. The linear arrangement of amino acids in a protein via peptide bonds is referred to as which of the following.
  - a. The protein hydrolysate.
  - b. The protein's primary structure.
  - c. A posttranslational modification.
  - d. The protein's secondary structure.
  - e. A four-helix bundle.
2. The following small peptide (A-N-W-F-K-P-R-Q-M) was subjected to acid hydrolysis in 6 N HCl for 24 h at 110°C. Which of the following would represent the actual amino acids recovered in the hydrolysate?
  - a. A, P, Q, W, F, N, K, R, M
  - b. F, D, W, K, P, R, M, A, Q
  - c. Q, F, A, K, M, R, P, N.
  - d. E, F, K, D, A, R, P, M
  - e. Q, F, E, W, M, R, P, K, A
3. If the following peptide (K-P-M-F-C-V-S-D-F-G-L-M-E-A) were incubated with radiolabeled iodoacetic acid, followed by treatment with cyanogen bromide and chymotrypsin, in which of the following peptide fragments would the radioactivity elute?
  - a. K-P-M-F-C-V-S-D-F-G-L-M-E-A
  - b. F-C-V-S-D
  - c. K-P-homoSer
  - d. V-S-D-F-G-L-homoSer
  - e. C-V-S-D-F

4. Insulin is a protein hormone that contains two short polypeptide chains linked by two interstrand disulfide bonds. In which order would the following events take place in order to sequence the protein.

A: The peptides are reduced with  $\beta$ -mercaptoethanol.

B: The peptides are sequenced via Edman degradation.

C: The peptides are separated by chromatography techniques.

D: The peptides are alkylated with iodoacetamide.

a. A, D, C, B

b. C, A, D, B

c. C, B, A, D

d. A, B, C, D

e. D, B, C, A

5. Determine the amino acid sequence of the following oligopeptide from the experimental data below.

A: The amino acid composition is found to be A, K, F, M, V, plus some decomposition products.

B: The peptide has a molecular weight around 700 g, and absorbs light at 280 nm.

C: Treatment with carboxypeptidase produces an amino acid and a pentapeptide. The pentapeptide does not absorb light at 280 nm.

D: CNBr treatment yields a tetrapeptide and a dipeptide.

E: Trypsin digestion produces an amino acid and a pentapeptide with methionine on the amino end.

F: Chymotrypsin digestion yields a dipeptide and a tetrapeptide.

a. W-K-M-V-F-A

b. W-A-F-V-M-K

c. K-M-V-F-A-W

d. K-A-V-F-M-W

e. A-M-V-F-K-W

6. Rotational degrees of freedom are found in which bonds in the peptide backbone?

a.  $\text{NH}-\text{C}_\alpha$ .

b.  $\text{C}_\alpha-\text{CO}$ .

c.  $\text{CO}-\text{NH}$ .

d. Both a and b.

e. All of the above

7. The repeating secondary structures as found in  $\alpha$ -strands,  $\alpha$ -turns, and  $\alpha$ -helices of folded proteins primarily result from
- hydrogen bonding
  - hydrophobic interactions
  - electrostatic interactions
  - van der Waals interactions
  - covalent interactions
8. The folding of proteins in aqueous solution is driven primarily by
- a decrease in the entropy of the peptide upon folding
  - an increase in the entropy of the solvent upon folding
  - a decrease in the enthalpy of the peptide upon folding
  - an increase in the enthalpy of the solvent upon folding
  - both a and c
9. In a  $3.6_{13}$   $\alpha$ -helix, which of the following does the 3.6 refer to?
- The typical number of amino acids that are in the entire helix.
  - The diameter of the helix (ignoring the side chains).
  - The number of amino acids per turn of the helix.
  - The number of degrees that separate two adjacent amino acids along a helix wheel.
  - The dipole of the helix.
10. Along a  $3_{10}$  helix wheel, each amino acid would be separated by how many degrees?
- $36^\circ$
  - $100^\circ$
  - $360^\circ$
  - $120^\circ$
  - $10^\circ$
11. A polypeptide in its fully extended form would have which of the following  $\phi$  and  $\psi$  rotational angles, respectively?
- $0^\circ, 0^\circ$
  - $-135^\circ, 140^\circ$
  - $180^\circ, 180^\circ$
  - $-60^\circ, 135^\circ$
  - $-90^\circ, 90^\circ$

12. Which of the following treatments would be expected to irreversibly cleave disulfide bonds.
- performic acid
  - dithiothreitol
  - $\beta$ -mercaptoethanol + iodoacetic acid
  - all of the above
  - a and c only
13. Subsequent to derivatization with phenylisothiocyanate (PITC), which of the following amino acids would be expected to migrate the slowest on a hydrophobic column using high-performance liquid chromatography (HPLC).
- A
  - T
  - K
  - R
  - F
14. Which of the following concerning the peptide bond is incorrect.
- It is rigid and planar.
  - In most cases, the carbonyl oxygen and amide hydrogen are in a cis configuration.
  - The CO bond is longer than normal carbonyl bonds.
  - It is very unreactive.
  - It is polar
15. Which of the following amino acids would you expect to act as an  $\alpha$ -helix breaker?
- P
  - C
  - K
  - G
  - R

16. In which of the following sequences would you expect hydrophobic amino acids to stack-up along one side of a  $3_{10}$   $\alpha$ -helix.

- a. D-F-Q-G-C-N-R-V-T-Y-I
- b. F-G-H-S-W-L-M-P-V-W
- c. W-L-R-Y-K-V-F-M-H-I-K
- d. G-H-F-F-V-K-L-M-A-T-S
- e. V-T-V-H-I-W-E-C-R-K

17. Which of the following peptides describes a  $\beta$ -pleated sheet in which one face of the sheet contains only hydrophobic residues.

- a. W-G-F-H-M-N-Y-E-V-S-W-D
- b. W-G-G-W-H-E-Y-C-T-F-D-D
- c. I-V-Y-F-W-W-V-C-T-S-D-E-R
- d. K-W-E-F-T-V-A-Y-G-I-R-V-D
- e. both a and d

18. If the pitch of a  $3.6_{13}$   $\alpha$ -helix is  $5.4 \text{ \AA}$ , what is the length of an  $\alpha$ -helix containing 78 amino acids?

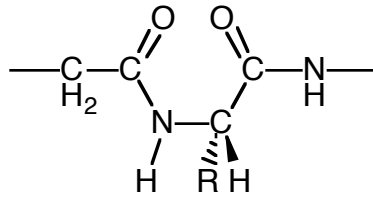
- a.  $421.2 \text{ \AA}$
- b.  $32.4 \text{ \AA}$
- c.  $117 \text{ \AA}$
- d.  $280.8 \text{ \AA}$ .
- e.  $421.2 \text{ nm}$

19. A Ramachandran plot is used to designate which of the following?

- a. The sterically allowed  $\phi$  and  $\psi$  torsion angles of model polypeptides.
- b. The solubility of various peptides in water.
- c. The hydrophobicity of various peptides.
- d. The propensity of a peptide to be membrane bound.
- e. The strength of peptide bonds in various model polypeptides.

20. In general, the ability of a protein to fold into its correct 3-dimensional structure is determined **primarily** by which of the following?

- The size of the protein.
- The concentration of oxygen in solution.
- The concentration of  $\beta$ -mercaptoethanol in solution.
- The concentration of folding enzymes in the cell.
- Its primary structure



21. Assuming that all of the atoms along the **peptide backbone** shown above lie in a plane, what are the corresponding  $\phi$  and  $\psi$  angles of the peptide?

- $\phi=180^\circ$ ,  $\psi=0^\circ$
- $\phi=0^\circ$ ,  $\psi=180^\circ$
- $\phi=0^\circ$ ,  $\psi=0^\circ$
- $\phi=180^\circ$ ,  $\psi=180^\circ$
- Both c and d are correct

22. Which of the following statements concerning  $\beta$ -turns is incorrect?

- They frequently contain glycine and proline residues.
- They help to define the boundaries of globular proteins by allowing changes in direction.
- They are a secondary structure motif stabilized by hydrogen bonding.
- All of the above are true.
- Only a and c are true.

23. Which of the following is incorrect about  $\alpha$ -keratin?
- It is a fibrous insoluble protein.
  - It contains  $\alpha$ -helices that are intertwined in coiled-coil motifs.
  - It contains a large number of hydroxyproline residues.
  - none of the above is incorrect
  - both b and c are incorrect
24. 5-hydroxylysine residues are incorporated into the structural protein collagen by which of the following processes.
- via ribosomal translation with a novel 5-hydroxylysine tRNA.
  - via an enzymatic posttranslational modification in which the hydroxyl group derives from molecular oxygen ( $O_2$ )
  - via an enzymatic posttranslational modification in which the hydroxyl group derives from water.
  - via enzymatic hydrolysis of the peptide bond by trypsin
  - via enzymatic hydrolysis of the peptide bond by chymotrypsin.
25. The triple helices of collagen normally contain what amino acid at the junctures of the three peptide strands?
- G
  - P
  - hydroxylysine
  - R
  - A
26. Which of the following is not a common tertiary structure motif?
- The four-helix bundle
  - The beta bulge
  - The coiled-coil
  - The Greek Key
  - All are common tertiary structure motifs

27. Which of the following statements about spontaneity is correct?
- a reaction with a  $\Delta G^\circ = -8.4 \text{ kJ/mol}$  will be spontaneous
  - all reactions which have a positive  $\Delta H$  will not be spontaneous
  - all reactions in which  $\Delta G$  is not equal to zero will be spontaneous
  - all reactions in which  $\Delta G$  is negative will be spontaneous
28. The standard free energy of a reaction is related to the equilibrium constant. How many kJ/mol change is required for the equilibrium constant to change by 10 at 25°C.
- 1.4 kJ/mol
  - 5.6 kJ/mol
  - 7.9 kJ/mol
  - 18.8 kJ/mol
  - 100 kJ/mol
29. Stabilization of which species, relative to all others, is essential for enzyme catalysis
- $EX^*$
  - ES intermediate
  - EP intermediate
  - both ES and EP
  - both ES and  $EX^*$  to the same extent
30. What symmetry element best describes the protein shown on the transparency at the front of the auditorium?
- octahedral
  - D4
  - D2
  - C2
  - C4