

Biochemistry Quiz Review II

A general note: Short answer questions are just that, short. Writing a paragraph filled with every term you can remember from class won't improve your answer— just answer clearly, succinctly, and in your own words.

1. Of the 20 standard amino acids, only _____ is not optically active. The reason is that its side chain _____.

- A. alanine; is a simple methyl group
- B. glycine; is a hydrogen atom
- C. glycine; is unbranched
- D. lysine; contains only nitrogen
- E. proline; forms a covalent bond with the amino group

2. Two amino acids of the standard 20 contain sulfur atoms. They are:

- A. cysteine and serine
- B. cysteine and threonine
- C. methionine and cysteine
- D. methionine and serine
- E. threonine and serine

3. In a highly basic solution, pH = 13, the dominant form of glycine is:

- A. $\text{NH}_2\text{—CH}_2\text{—COOH}$
- B. $\text{NH}_2\text{—CH}_2\text{—COO}^-$
- C. $\text{NH}_2\text{—CH}_3^+\text{—COO}^-$
- D. $\text{NH}_3^+\text{—CH}_2\text{—COOH}$
- E. $\text{NH}_3^+\text{—CH}_2\text{—COO}^-$

4. An octapeptide composed of four repeating glycyialanyl units has:

- A. one free amino group on an alanyl residue
- B. one free amino group on an alanyl residue and one free carboxyl group on a glycylyl residue
- C. one free amino group on a glycylyl residue and one free carboxyl group on an alanyl residue
- D. two free amino and two free carboxyl groups
- E. two free carboxyl groups, both on glycylyl residues

5. In a mixture of the five proteins listed below, which should elute second in size-exclusion (gel-filtration) chromatography?

- A. cytochrome c *m.w.* = 13,000
- B. immunoglobulin G *m.w.* = 145,000
- C. ribonuclease A *m.w.* = 13,700
- D. RNA polymerase *m.w.* = 450,000
- E. serum albumin *m.w.* = 68,500

6. Which of the following refers to particularly stable arrangements of amino acid residues in a protein that give rise to recurring patterns?
- Primary structure
 - Secondary structure
 - Tertiary structure
 - Quaternary structure
 - None of the above
7. All of the following are considered “weak” interactions in proteins, *except*:
- hydrogen bonds
 - hydrophobic interactions
 - ionic bonds
 - peptide bonds
 - van der Waals forces
8. Which of the following best represents the backbone arrangement of two peptide bonds?
- C—N—C—C—C—N—C—C
 - C—N—C—C—N—C
 - C—N—C—C—C—N
 - C—C—N—C—C—N
 - C—C—C—N—C—C—C
9. A D-amino acid would interrupt an α helix made of L-amino acids. Another naturally occurring hindrance to the formation of an α helix is the presence of:
- a negatively charged Arg residue
 - a nonpolar residue near the carboxyl terminus
 - a positively charged Lys residue
 - a Pro residue
 - two Ala residues side by side
10. Analysis of x-ray diffraction data yields a(n) _____; analysis of 2D NMR data yields a(n) _____.
- electron density map; count of hydrogen atoms in the molecule
 - shadow of protein’s outline; estimate of protein’s molecular volume
 - table of interatomic distances; electron density map
 - electronic density map; table of interatomic distances
 - 3-d protein structure; 2-d protein structure
11. The amino acid substitution of Val for Glu in Hemoglobin in sickle cell anemia (Hemoglobin S) results in aggregation of the protein because of _____ interactions between molecules.
- covalent
 - disulfide
 - hydrogen bonding
 - hydrophobic
 - ionic

12. You need to make 300 mL of 0.20 M Acetic Acid buffer at pH 5.4. You find an available stock bottle of 1.00 M Acetic Acid at pH 4.76 (pKa 4.76). You also have stocks of 5.00 M HCl, 5.00 M NaOH, and ddH₂O. Which chemicals do you need to add, and what volume?

13. In your own words, what is an enantiomer?

14. Draw the amino acid Glutamic Acid:

15. 1 2 3 4 5

 Asp-Glu Gly-Arg Trp-Tyr His-Glu Leu-Val

Which one of the above dipeptides (1 through 5):

(a) Is most negatively charged at pH 7?

(b) Contains the largest number of nonpolar R groups?

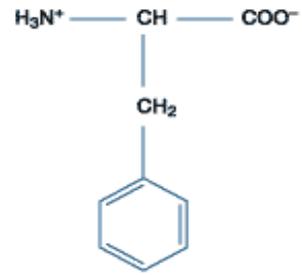
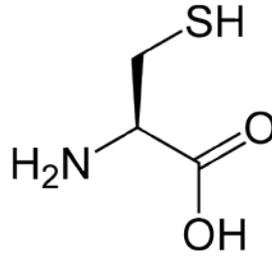
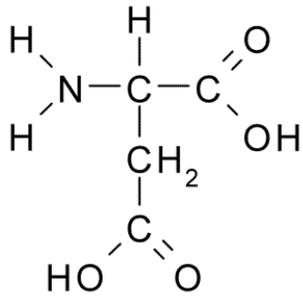
16. Glycine has two dissociable protons: one with a pKa of 2.3, the other with a pKa of 9.6. Draw the structure of Glycine and indicate where these protons are attached.

17. Under what pH range or ranges would glycine have good buffering power?
18. When proteins are purified by gel electrophoresis, SDS (sodium dodecyl sulfate) is often included with the protein. What is the purpose of this SDS, and what does it enable biochemists to investigate?
19. In your own words, what is the primary structure of a protein?
20. Describe the general shape that β strands form. What forces hold the strands in this form?
21. Name two amino acid residues you would not expect to commonly be found in an α helix:
22. What type of amino acid residue is typically found in the interior of a water-soluble globular protein? Why?
23. Explain why a denatured protein might not refold *in vitro*.

24. Only a small portion of our genomic DNA is translated into protein. What is the rest of the DNA for?
25. What is the role of a dideoxy nucleotide triphosphate in Sanger DNA sequencing?
26. Which would you expect to be larger, the % of the human genome that is translated into protein, or the % of a bacterial genome that is translated into protein. Why?
27. Describe the difference between secondary and tertiary structure in proteins.
28. β -fibroin is a primary constituent of silk. In your own words, describe the structure of fibroin on the molecular level.
29. Why does NMR generate multiple, similar structures for a given protein?
30. Chaperones assist in what process?

31. What is a “motif”, as applied to protein structure?

32. Name the following amino acids with full name and 1 letter code:



33. Draw the complete tetrapeptide HDTL at pH 7.0: