

There are eight questions on five pages.

1. (10 points) Describe the five kinds of constraints that affect the stability of the α -helix.

2. (10 points) What amino acid(s) best fit(s) each of these descriptions?

This amino acid is rarely found in collagen, but it found in keratin.

What two amino acids are found in collagen, but rarely found in keratin?

What amino acid is oxidized by one of the treatments that is used to remove disulfide bonds?

What three amino acids are detected by their absorbance of UV light?

Give an example of an amino acid that has a side chain that is positively charged at pH 8.

3. (15 points) Draw the structure for the following peptide at pH 7. Then, **calculate the pI** for this peptide. Use $pK_a=8$ for the amino terminus group and $pK_a =3.4$ for the carboxy terminus group. You know all of the other pK_a values for the R groups.

RAWPIT

4 (10 points) The following peptide was cleaved with Pepsin and the resulting peptides were separated by anion exchange chromatography. What are the peptide fragments? What is their order of elution for these peptides at pH 8 from an anion exchange column. For all of the peptides, the N terminus amino group pK_a is 8 and the C terminus carboxyl pK_a is 3.4.

I G R N W Q F G V Y A K I L H F M E A D V

5 (25 points) A peptide was hydrolyzed with 6M HCl at 100°C overnight, and the following amino acids were detected:

H	1	S	1	N	1		
E	1	I	1	W	1	P	1
G	1	A	1	T	1	Q	1
R	1	C	2	M	1		

Another sample of the intact peptide was digested with an enzyme and then the sample was separated by anion exchange chromatography at pH 6. Only one fraction was obtained the first time the researcher did the anion exchange column. Then, the researcher realized that a step had been omitted in this process. A new sample of peptide was used for the appropriate reaction(s), and then the product was digested with the same enzyme. This time, there were two fractions when the mixture was separated by anion exchange chromatography. These two fractions were then subjected to Edman degradation.

These are the two sequences of the peptide fragments:

SWINCHAMP GQCTIGER

- What enzyme was used to cleave the peptide?
- Why was there only one fraction from the first anion exchange column?
- What step did the researcher forget the first time? What reaction(s) were needed?
- What is the sequence of the peptide?
- One more reaction could be done to determine the N-terminus of the peptide. Do you need to do this reaction to determine the sequence of this peptide? What is the reaction?
- Which of the fragments eluted first from the anion exchange column? Briefly explain your answer.

- 6 (5 points) Sometimes the pKa of an amino acid side chain is not the same inside a protein as it is outside of a protein. In protein X, aspartic acid was found to have a pKa of 6.2, explain this new pKa in terms of the environment of the aspartic acid residue inside the protein.

7. (10 points) Fully describe the main driving forces for the folding of globular proteins.

8. (15 points) Using complete sentences in well organized paragraph form, compare and contrast collagen and keratin.