Chem 109 C

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Practice problem 1

Explain why, when the imidazole ring is protonated, the double-bonded nitrogen is the nitrogen that accepts the proton.
Do any other acids in Table 22.2 have more than one asymmetric center?
Draw the predominant form of glutamic acid in a solution with the following pH

a. 0
b. 3
c. 6
d. 11
Draw the predominant form of the following amino acids at pH 7.4

a. aspartic acid
b. histidine
c. glutamic acid
d. lysine
e. arginine
f. tyrosine
Think about the question in PROBLEM 13 (page 1064).

(Literature and website searches indicate that the method can be used)
A mixture of amino acids that do not separate sufficiently when a single technique is used can often be separated by two-dimensional chromatography. In this technique, the mixture of amino acids is applied to a piece of filter paper and separated by liquid chromatography, then the paper is rotated $90^\circ$ and the mixture is separated by electrophoresis. The resulting chromatogram is called a fingerprint.

Identified the spots in the fingerprint below obtained from a mixture of Ser, Glu, Leu, His, Met, and Thr.
A mixture of amino acids that do not separate sufficiently when a single technique is used can often be separated by two-dimensional chromatography. In this technique, the mixture of amino acids is applied to a piece of filter paper and separated by liquid chromatography, then the paper is rotated 90° and the mixture is separated by electrophoresis. The resulting chromatogram is called a fingerprint.

Identified the spots in the fingerprint below obtained from a mixture of Ser, Glu, Leu, His, Met, and Thr.
Practice problem 5

In what order would histidine, serine, aspartate, and valine be eluted (washed out) with a buffer of pH 4 from a column packed with an anion-exchange resin Dowex 1)?
Practice problem 6

Draw the structure of aldehyde needed to prepare tyrosine by the Stecker synthesis.
Draw the structure of alkyl bromide needed to prepare leucine by the N-phthalimidomalonic ester synthesis
Using three-letter abbr., write all possible tripeptides containing one each of Ala, Gly, and Met
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Assign the absolute configuration to each asymmetric center in oxytocin.
Show steps in the synthesis of Leu-Phe
A decapeptide undergoes partial hydrolysis to give peptides whose amino acid compositions are shown. Reaction of the intact decapeptide with Edman’s reagent releases PTH-Gly. What is the sequence of the decapeptide?

1. Ala, Trp  
2. Val, Pro, Asp  
3. Pro, Val  
4. Ala, Glu  
5. Trp, Ala, Arg  
6. Arg, Gly  
7. Glu, Ala, Leu  
8. Met, Pro, Leu, Glu
Practice problem 12

Indicate peptides that would result from cleavage by the indicated reagent

a. His-Lys-Leu-Val-Glu-Pro-Arg-Ala-Gly-Ala by trypsin
b. Leu-Gly-Ser-Met-Phe-Pro-Tyr-Gly-Val by chymotrypsin
A decapeptide undergoes partial hydrolysis to give peptides whose amino acid compositions are shown. Reaction of the intact decapeptide with Edman’s reagent releases PTH-Gly. What is the sequence of the decapeptide?


Gly-Arg-Trp-Ala-Glu-Leu-Met-Pro-Val-Asp
Determine the amino acid sequence of a polypeptide from the following data

a. Complete hydrolysis gives Arg, 2Gly, Ile, 3Leu, 2Lys, 2Met, 2Phe, Pro, Ser, 2Tyr, Val

b. Edman’s reagent gives PTH-Gly

c. Carboxypeptidase A releases Phe

d. Treatment with BrCN gives three peptides:
   3. Leu-Pro-Phe

e. Trypsin gives the following four peptides
   2. Ser-Met-Gly-Leu-Tyr-Lys  4. Met-Leu-Pro-Phe
Amino acids can be prepared by treating an aldehyde with ammonia/trace acid, followed by hydrogen cyanide, followed by acid-catalyzed hydrolysis.

a. Draw the structure of the two intermediates in this process.
b. What amino acid would be formed from 3-methylbutanal?
c. What aldehyde would be needed to prepare phenylalanine?
Alanine has pKa values of 2.34 and 9.69. At what pH will alanine exist in the indicated form

a. \( \text{H}_2\text{N}-\text{CH}_2-\text{COO}^- \) 50%  \( \text{H}_3\text{N}^+-\text{CH}_2-\text{COO}^- \) 50%

b. \( \text{H}_3\text{N}^+-\text{CH}_2-\text{COO}^- \) 100%

c. \( \text{H}_3\text{N}^+-\text{CH}_2-\text{COO}^- \) 50% \( \text{H}_3\text{N}^+-\text{CH}_2-\text{COOH} \) 50%