

Name: _____

Approx. time to complete: _____

CHEM 242: Problem Set 1
Due: Monday, September 14, 2026

1. Most proteinaceous amino acids do not contain chiral centers other than the α -carbon.

(A) Give the full name of all the proteinaceous amino acids that contain chiral centers at the β -carbon. Draw their structures at pH 8.0 in the space below. (2 pts)

(B) What are the one-letter and three-letter abbreviations of the amino acids you mentioned above? (2 pts)

(C) Classify each of these amino acids as non-polar/hydrophobic, polar, positively charged, or negatively charged. (2 pts)

2. For each pair of free amino acids below, circle the one that you would *expect* to be more soluble in water. (1 pt each)

(A) T V

(B) K L

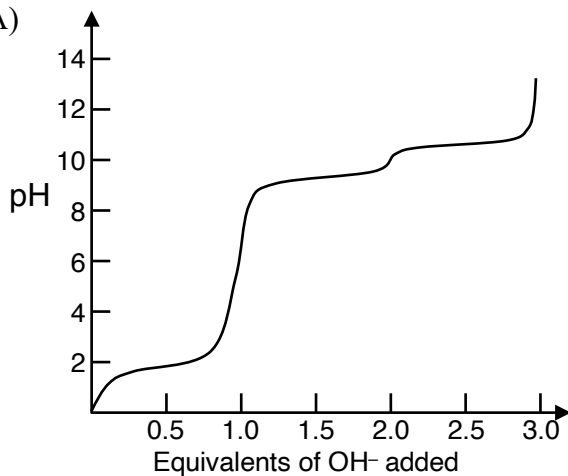
(C) L A

(D) N Q

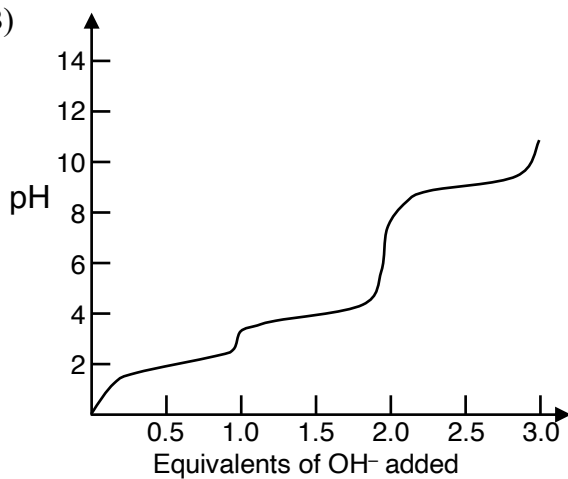
(E) S T

3. For each titration curve below, name all possible proteinaceous amino acids that the curve may represent and draw their predominant structures at pH 6.0. (4 pts each)

(A)



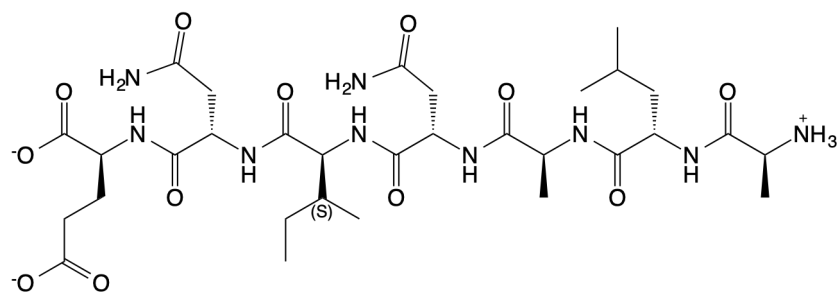
(B)



4. Peptide sequences.

(A) Draw the structure of the peptide containing the sequence “VALINE” at pH 7.0. (4 pts)

(B) What is the amino acid sequence of the peptide below using one-letter abbreviations? (2 pts)



Sequence:

5. Consider the pentapeptide: Trp-Glu-Lys-Asn-Ser

(A) What is the pentapeptide sequence in one-letter amino acid abbreviations? (1 pt)

(B) Sketch the theoretical titration curve for this pentapeptide. Label pK_a values and their corresponding equivalents of added base, OH^- . (5 pts)

(C) Draw the structure of the predominant pentapeptide species at pH 7.0, indicating stereochemistry where appropriate. What is the overall charge? (4 pts)

(D) Draw the structure of the predominant pentapeptide species at pH 12.0, indicating stereochemistry where appropriate. What is the overall charge? (4 pts)

(E) What is the approximate pI of the pentapeptide? (2 pts)

6. Sort the following peptides from lowest to highest pI and state the pI of each. (5 pts total)

(A) VWIRS

(B) AMLLT

(C) GPNHA

(D) ECSKP

7. Consider the types of protein secondary structure that we have studied.

(A) In which secondary structural element would you see the “*i*-th” amino acid hydrogen-bonded to the “(*i*+3)-th” amino acid? Name two amino acids that you would be *least surprised* to learn are part of this secondary structural element. Why? (3 pts)

(B) In which secondary structural element would you see the “*i*-th” amino acid hydrogen-bonded to the “(*i*+4)-th” amino acid? Name an amino acid that you would be *most surprised* to learn is part of this secondary structural element. Why? (3 pts)

8. Many proteins that pass through cellular membranes contain α -helices that traverse the membrane interior, which is a very hydrophobic environment. For each of the following amino acid sequences, do you think it will or will not be part of such a membrane-spanning α -helix? Briefly explain why or why not. (8 pts)

(A) EYQLRDCESMKI

(B) IPVLPVAWPMFLPA

(C) LLMAFWLFALAF

(D) SNTANSSANLVTN