

Problem 1

- Which substitution would be more likely to disrupt a protein's structure?
- Val replaced by: Ala or Phe
- Lys replaced by: Asp or Arg
- Gln replaced by: Glu or Asn
- Pro replaced by: His or Gly

Problem 2

- At pH 7.0, in what order would the following 3 peptides be in an isoelectric focusing gel with a pH range of 3-9 (with pH 3 at the top)?
 - Protein 1: A 10%, E 5%, F 5%, G 10%, H 5%, I 10%, K 10%, L 10%, R 10%, P 5%, S 5%, W 10%, Y 5%
 - Protein 2: A 5%, C 5%, D 5%, E 5%, F 5%, G 10%, I 5%, K 5%, L 5%, M 5%, N 5%, P 10%, R 5%, S 5%, T 5%, V 5%, W 5%, Y 5%
 - Protein 3: A 10%, C 5%, D 10%, E 10%, F 5%, G 5%, H 5%, L 5%, M 5%, N 5%, P 5%, Q 5%, R 5%, S 5%, T 5%, V 5%, Y 5%

Problem 3

Which of the following amino acid side chains is polar and uncharged?

1. Glu
2. Trp
3. Tyr
4. Phe
5. Ile

Problem 4

How many charged groups (not residues) are present on the peptide below at physiological pH ?

- | | | |
|----|---|------------------------------------|
| 1. | 1 | Arg-Asp-Cys-Tyr-Gln-Val-Glu |
| 2. | 2 | |
| 3. | 3 | |
| 4. | 4 | |
| 5. | 5 | |

Problem 5

What is the net charge of the peptide below at physiological pH ?

Ala-Arg-Asn-Asp-Glu-Ser-Gly

1. -2
2. -1
3. 0
4. +1
5. +2

Problem 6

Which of the following amino acids has a side chain that can form covalent cross-links in proteins?

1. Ser
2. Met
3. Trp
4. Cys
5. Thr

Problem 7

Which of the following pairs of amino acids might form an ionic interaction with each other (salt bridge)?

1. Thr, Glu
2. Tyr, Ser
3. Glu, Asp
4. Lys, Arg
5. Lys, Asp

Problem 8 (for after exam!)

Which residue would be more likely to be _____?

1. On a protein's surface: Trp or Gln
2. In the protein interior: Ser or Val
3. In the middle of an alpha-helix: Gly or Leu
4. In a beta-sheet: His or Pro

Problem Answers

Problem 1

Phe – too large

Asp – wrong charge

Glu – adds charge

His – doesn't have constraint like Pro, Gly can more easily mimic constraint

Problem 2

Protein A = 5% -, 25% + = net 20% + = Basic

Protein B = 10% -, 10% + = net 0 = neutral

Protein C = 20% -, 10% + = net 10% - = Acidic

Migrate near top C, B, A near bottom

Problem 3

3. Tyr

Problem 4

5. Five net charge: (pH 7) N of Arg, Arg, Asp, Glu, C of Glu
(Cys only 5% charged)

Problem 5

2. -1 net charge, due to +1 N-term, -1 C-term, +1 Arg, -1 Asp, -1 Glu

Problem 6

4. Cys

Problem 7

5. Lys Asp

Problem 8

Gln—polar

Val—nonpolar

Leu—Gly's flexibility disrupts

His—Pro's constraint disrupts