

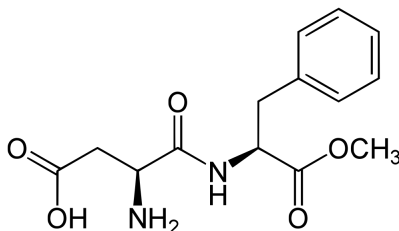
# MDCM601 2021 Exam 3

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## 1 Problems

**Problem 1.** Aspartame (shown) is an artificial sweetener. It is a dipeptide esterified at its carboxyl terminus. What is the overall charge of this molecule at the physiological pH of 7.4? pKa of an ammonium is 9, and pKa of an acid is 4.



**Problem 2.** Which four of the following amino acids have sidechains that have hydrogen-bonding capacity?

Ala, Gly, Ser, Phe, Glu, Tyr, Ile, Thr

**Problem 3.** Examine the segment of a protein shown. Use 3-letter abbreviations to refer to the amino acids in your answers.

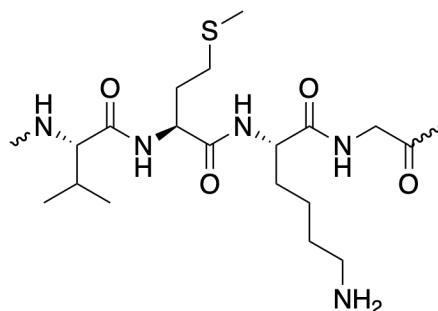
Which amino acid is at the N-terminal end? \_\_\_\_\_

Which amino acid is at the C-terminal end? \_\_\_\_\_

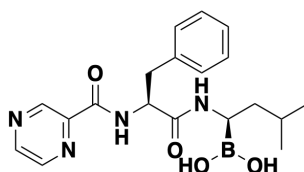
What is the basic amino acid in this segment? \_\_\_\_\_

What is the non-polar amino acid in the segment whose sidechain contains a heteroatom?  
\_\_\_\_\_

The 3 stereocenters are of the same stereochemical designation. What is it? \_\_\_\_\_

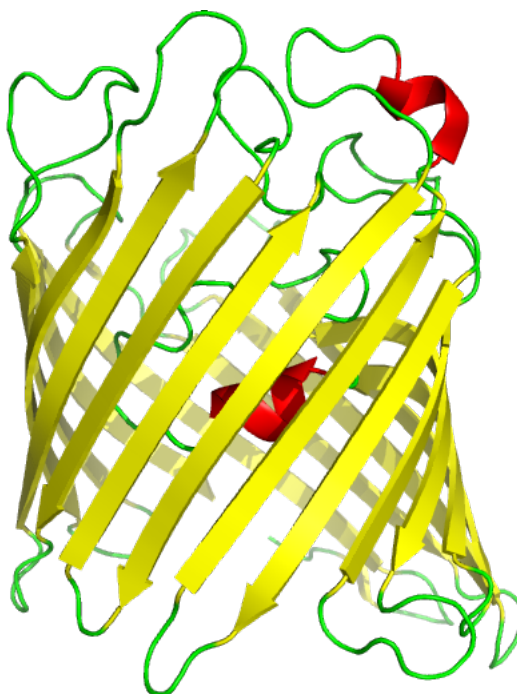


**Problem 4.** Bortezomib (shown), a proteasome inhibitor, contains an unusual functional group for a drug – a boronic acid. Boron atom in this group is a Lewis base. True or False?



**Problem 5.** Amino acid often found coordinating metal cations in protein structures is:  
\_\_\_\_\_

**Problem 6.** Consider the  $\beta$ -barrel structure of *E. coli* porins shown in the image. What is the best description of the secondary structure found in it?



1. Parallel  $\beta$ -sheets

2. Left-handed  $\alpha$ -helices
3. Right-handed  $\alpha$ -helices
4. Anti-parallel  $\beta$ -sheets

**Problem 7.** What is the orientation of amino acid side chains in  $\alpha$ -helix structures?

1. Parallel to the main cylinder of the helix.
2. Perpendicular to the main cylinder of the helix.
3. Pointing towards the central axis of the helix.
4. Alternating between the plane above or below the plane of the helix.

**Problem 8.** Where is amino acyl group attached to a tRNA?

**Problem 9.** What is the best description for the secondary structure shown?

1. Right-handed sheet
2. Right-handed helix
3. Left-handed sheet
4. Left-handed helix



**Problem 10.** A template strand of DNA in a gene reads:  
3 CCA AGC TCT 5

Using the codon chart provided, what is the amino acid sequence produced when this gene is translated?

1. Ser-Arg-Gly
2. Gly-Ser-Arg
3. Ser-Gly-Gly
4. Gly-Leu-Ser

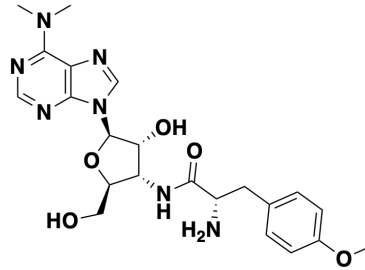
		Second letter				
		U	C	A	G	
First letter	U	UUU } Phe UUC } UUA } Leu UUG }	UCU } UCC } Ser UCA } UCG }	UAU } Tyr UAC } UAA Stop UAG Stop	UGU } Cys UGC } UGA Stop UGG Trp	U C A G
	C	CUU } CUC } Leu CUA } CUG }	CCU } CCC } Pro CCA } CCG }	CAU } His CAC } CAA } Gln CAG }	CGU } CGC } Arg CGA } CGG }	U C A G
	A	AUU } AUC } Ile AUA } AUG Met	ACU } ACC } Thr ACA } ACG }	AAU } Asn AAC } AAA } Lys AAG }	AGU } Ser AGC } AGA } Arg AGG }	U C A G
	G	GUU } GUC } Val GUA } GUG }	GCU } GCC } Ala GCA } GCG }	GAU } Asp GAC } GAA } Glu GAG }	GGU } GGC } Gly GGA } GGG }	U C A G
						Third letter

**Problem 11.** Which amino acid is often found at the site where polypeptide chain changes from helix to a loop or when there is a bend in a helix? Use the 3-letter abbreviation and capitalize first letter. \_\_\_\_\_

**Problem 12.** Order of amino acids matters in the polypeptide sequence. How many tripeptides can possibly be made from three amino acids (e.g. Ala, Cys and Lys) if repetition of amino acids in sequence is allowed? \_\_\_\_\_

**Problem 13.** Proteins are synthesized in a C to N direction. True or false?

**Problem 14.** Puromycin stops the translation by capturing the aminoacyl group from the aminoacyl-tRNA bound to the ribosome before the oncoming aminoacyl-tRNA can do so. Click on the atom in the structure of puromycin that is acylated in this step.



## 2 Solutions

1. 0
2. Ser, Glu, Tyr, Thr
3. Val; Gly; Lys; Met; *S*
4. False
5. histidine
6. 4
7. 2
8. 3' OH of A
9. 4
10. 2
11. Pro
12. 27
13. False
14. NH<sub>2</sub> group