

MDCM601 2020 Exam 3

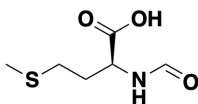
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1 Problems

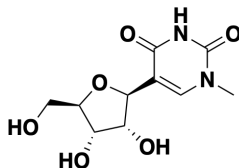
Problem 1. Where is amino acyl attached to a tRNA?

Problem 2. *N*-formyl-L-methionine is the first amino acid incorporated into a nascent polypeptide chain. Click on the formamide group in its structure.



Problem 3. Calculate isoelectric point of tyrosine. $pK_a(\text{acid}) = 2.20$; $pK_a(\text{ammonium}) = 9.11$; $pK_a(\text{phenol}) = 10.07$.
 pK_a of tyrosine is _____ (Show you answer with three sigfigs.)

Problem 4. 1-Methylpseudouridine (abbreviated m1) is a special nucleoside found in tRNA. In the structure shown, click on the carbon atom that in uridine would have been anomeric.

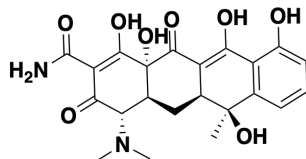


Problem 5. In β -sheet structures, amino acid sidechains alternate between orientation above or below the plane of the sheet. True or false?

Problem 6. What is the orientation of amino acid side chains in α -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 7. Click on the phenolic oxygen in the structure of tetracycline.



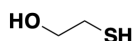
Problem 8. Which amino acid is often found at the site where polypeptide chain changes from helix to a loop or when there is a bend in a helix? Use the 3-letter abbreviation and capitalize first letter. _____

Problem 9. What is the nature of interactions between Leu sidechains in the zipper structures they form?

1. hydrogen bonds
2. ionic
3. Van der Waals
4. polar

Problem 10. All hemes in hemoglobin bind oxygen with equal affinity. True or false?

Problem 11. In biochemistry, research what is one of the main uses of the reagent shown?

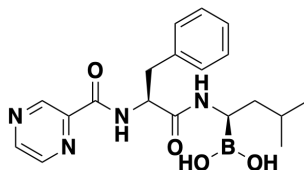


1. Induce trimer formation in rhodopsins
2. Facilitate translation of polypeptide chain into the ER
3. Reduce disulfide bonds
4. Activate aminoacyl tRNA complex in the active site of tRNA synthetase

Problem 12. Radioactive (^{14}C -labeled) cysteine is charged onto its tRNA. This ^{14}C -cysteinyl-tRNA^{Cys} is then reduced with Raney nickel. Raney nickel converts thiols to hydrogens. When this tRNA was incubated with mRNA, ribosome and other tRNAs, a polypeptide was obtained that showed radioactivity associated with which amino acid residue?

1. Oxidized (disulfide bond) cysteine
2. Alanine
3. Serine
4. Amino acids were not incorporated into polypeptide chain.

Problem 13. 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 14. Amino acid often found coordinating metal cations in protein structures is:

Problem 15. Proteins are synthesized in _____ to _____ direction.

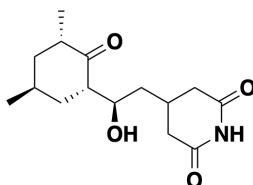
Problem 16. What is the mass of a ribosome if it consists of 7,500 amino acids and 4,600 ribonucleotides. Average MW of an amino acid is 111 g/mol, and of a ribonucleotide 313 g/mol?

Mass of a ribosome is _____ megadaltons (three significant figures).

Problem 17. NASA mission returned a sample of Martian protein with secondary structure shown in the image. What did the scientists call this structure?



Problem 18. Which two statements are true about the molecule shown?



1. It inhibits protein translation in prokaryotes.
2. It inhibits protein translation in eukaryotes.
3. It is an imide.

4. It is an antibiotic.

Problem 19. 3_{10} helix and π -helix are less commonly seen helical structures than α -helices, with hydrogen bonding occurring between each 3rd or 5th amino acid backbones, respectively (as opposed to 4 in α -helices). Select the correct statement.

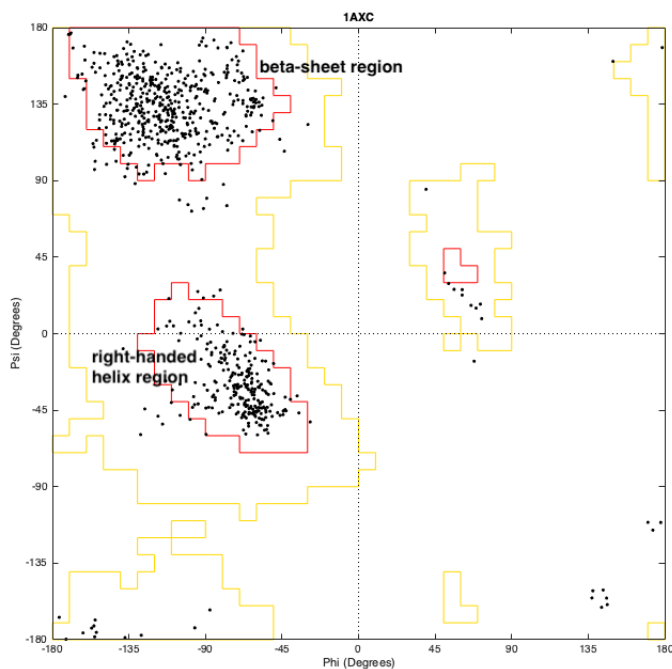
1. 3_{10} helix is tighter and π -helix wider than α -helix
2. 3_{10} helix is wider and π -helix tighter than α -helix
3. 3_{10} helix and π -helix are about as wide as α -helix

A.

Problem 20. In histone proteins lysine (Lys, K) is often trimethylated. Do you expect this positively charged species to be neutralized as pH increases? Yes or no.

Problem 21. Wobble hypothesis explains the fact that there are more _____ than there are _____ molecules. Non-Watson-Crick base pairing can occur between the _____ position of a codon on mRNA and the corresponding nucleotide on _____ .

Problem 22. Consult the image below and determined what combination of dihedral angles (Ψ and Φ) corresponds to a right-handed helix structure?



Problem 23. 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

2 Solutions

1. 3' OH Of A
- 2.
3. 5.66
- 4.
5. True
6. 2
- 7.
8. Pro
9. 3
10. False
11. 3
12. 2
13. False
14. histidine
15. N to C
16. 2.27
17. left-handed helix
18. 2 and 3
19. 1
20. No
21. codons; tRNA; third; tRNA
22. $\Psi = -45$; $\Phi = -60$
23. 2