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CHEN 5103 - Biochemical Engineering

Homework Assignment #1

Due January 21, 2022 at 11:59 pm

1.Describe the major differences between prokaryotes and eukaryotes

Prokaryotes do not have a nucleus / distinct organelles but eukaryotes do

2.a. Match the appropriate description with the following atoms and molecules

descriptions: cation, anion, polar, non-charged, nonpolar, non-charged

NH_3 Polar - non charged

Na^+ Cation

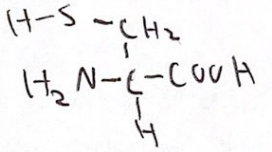
O_2 non-Polar - non charged

Cl^- anion

b. Check **all** the appropriate terms to describe the side chains of the amino acids

	Charged	Non Charged	Polar	Non Polar	Hydrophobic	Hydrophilic
Glutamic Acid	X		X			X
Valine		X		X	X	
Lysine	X		X			X
Asparagine		X	X			X
Leucine		X		X	X	
Cysteine		X	X		X	X

c. Explain your answer for cysteine.



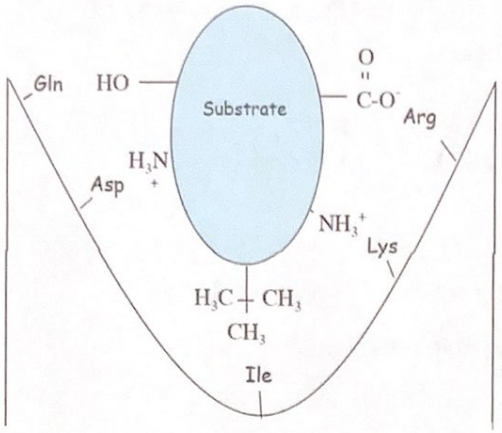
S has a slightly higher electronegativity than H

3. Examine the following amino acid chain. Circle the portion of the sequence you would expect to be embedded within the phospholipid bilayer and explain why.

NH3 - trp - asp - arg - his - ser - gly – pro - thr - leu - ile – trp- phe - ile - trp - - gly - ser - asp - lys - ile - ala – val - phe - leu - leu – arg - pro - gly - cys - ser - lys - ala - tyr - ala - lys -- val- ser - asp - lys - gly - glu – COOH

These are all non-Polar molecules and since many of them are together they would be strong enough to stay in the hydrophobic region

4. Examine the active site of the following enzyme



Determine if there is a favorable interaction between each chemical groups on the substrate and the closest amino acid side chains. If there is a favorable interaction, please state which is the strongest interaction. (Choose from ionic bond, covalent bond, hydrogen bond, and van der Waals force)

	Favorable or Not	Strongest interaction
Gln	Favorable	Hydrogen bond
Asp	favorable	Hydrogen bond
Ils	Not	~~Vanderwaal~~
Lys	Not	
Arg	Favorable	Hydrogen Bond

5. Protein A circulates the human body freely within the blood vessels (Hint: what is the major molecular component of blood). Which of the following amino acids are most likely on the outer shell of Protein A and why? (Lysine, Alanine, Leucine, Serine, Arginine, and Valine)

~~Leucine, Valine, Alanine~~ Lysine, Serine, Arginine are likely to surround protein A because blood is mostly water and these amino acids are hydrophilic.

6. Briefly explain why H_2S is a gas, but H_2O is a liquid at room temperature and 1 ATM pressure. (in term of chemical interactions).

H_2O is a liquid because it can hydrogen bond due to the O_s, and H_s but H_2S does not have N, O, F so it can't hydrogen bond