BMSSC - Spring 2020 - Assignment 1
Deadline: Feb 13, 2020 - Just before the class

Clearly mention your sources for each question (must be a textbook, review or a research article - For example, wiki/facebook/reddit are not sources for higher education!):

(1) Draw titration curves of Histidine and Glutamic acid. Mark relevant points (pKa and pI). Mark the points where each of the species are prevalent.

(2) What is post-translational modification? Given five examples with chemical structures and reactions.

(3) Take an example of a cell signaling pathway and explain it.

(4) Depict the structures of amino acids that have stereocenters in the sidechain. Depict and label the stereochemistry around both Calpha and the sidechain.

(5) Amino acids may be classified as essential and nonessential. What is the basis of such classification? Which of the 20 amino acids comprise these two classes?

(6) In addition to the 20-amino acids, there exist two additional amino acids. Depict the structures of these amino acids and explain why these amino acids are listed among the standard ones.

(7) Carbon atom is unique in the sense that it forms about 62% of the total dry weight (*sans* water) of human body. How do you explain this?

(8) What is isoionic point? Calculate the isoionic point of 0.1 M alanine.

(9) What are the structural features of these secondary structures: (a) 2.27 ribbon; (b) Left-handed polyglycine II and polypro line II helices; (c) Collagen helix.

(10) Calculate the dimension (along the helical axis) of an alpha-helix with 30 residues. Estimate its length in the completely extended form - all trans.

(11) van der Waals interactions are always attractive, but electrostatic interactions could be either attractive or repulsive. Explain.