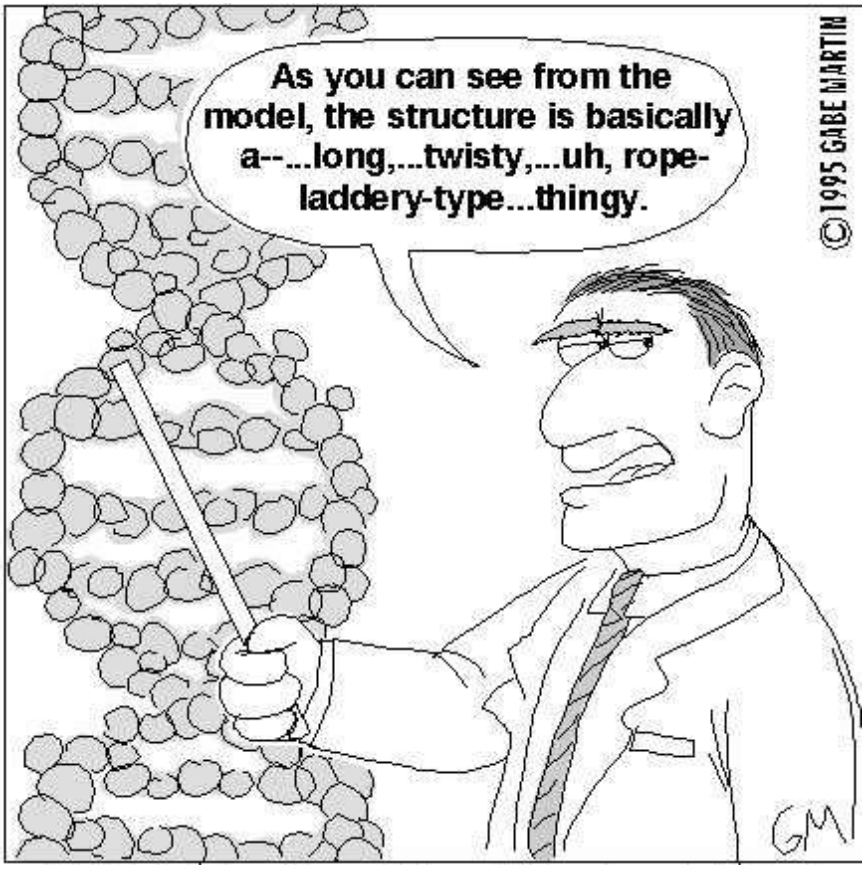
BCH2333A **Midterm 2 2016**

NAME_____**KEY**_____

Student number_____



Multiple choice questions. ***Note there may be more than 1 correct answer. Select all that are correct.***

1. Which group of three amino acids only contain ionizable amino acids

a. NDE

b. CFY

c. RKG

d. ECH

3. WTF

2. What is the charge of the peptide CRANKYWEED at pH 11?

a. -1

b. -2

c. -3

d. -4

e. -5

3. Circle or highlight the residues with polar side chains on this peptide.

L R R E V E K A R A L S

4. What is the most likely secondary structure for the peptide in question 3?

a. α-helix

b. β-sheet

c. type I β-turn

d. type II β-turn

e. polyproline II helix

5. Circle or highlight residues with non-polar side chains on this peptide.

F D V S L T V D F E V V A

6. What is the most likely secondary structure for the peptide in question 5?

a. α-helix

b. β-sheet

c. type I β-turn

d. type II β-turn

e. polyproline II helix

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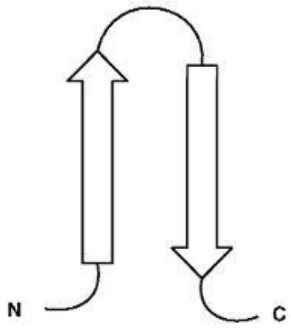
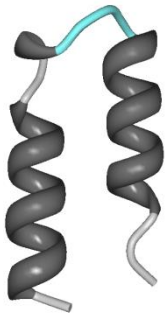
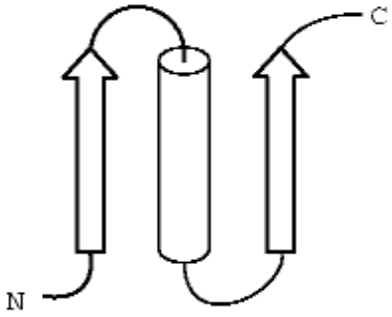
Match three of these five sequences (a-e) to the three motifs shown in the questions below.

a. LEELEEFTGPNKKLRKFSV
b. QRVTIWVGGTPEELKKLKEEAKKPNIRVTF
c. SGGTGVGGRGGKGGSGTPKGADGAPG
d. DRVYAHPFGHAPNLKNYSAGFIM
e. SLRFDVSLTIDPGVEVTVSINADF

7. 

___E___

8. 
___A_____

9. 

_____B _____

10. Of the remaining two sequences, one can adopt secondary structure, which one and what type?

C, polyproline II helix

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11. Advantages of SDS-PAGE over native PAGE are?

a. the SDS-based recycling process makes the use of paper more sustainable.

b. large net charge on SDS-coated peptides cause migration towards the negative pole.

c. no electic field is used in native PAGE

d. polypeptides migrate faster in SDS-PAGE

e. fibrous and globular proteins of the same length migrate at similar rates

Fill in the blank questions

12. What is the *n* and ρ for a π helix?

N ____4.4_____ ρ _____5.2Å_____

13. The sequence "CVSFTIQ" is a β-strand from an antiparallel β-sheet. What is the distance in Angstroms (Å)from the α-carbon of Val to the α-carbon of Ile?

d _____14Å_____ *(13.6 is also OK)*

14. A 3_{10} helix of 12 residues makes how many full turns?

_____4_____

15. An alpha helix of 15 residues is how long in Å?

_____22.5Å_____

16. What two residues when together are highly suggestive of a tight turn?

_____Gly, Pro_____

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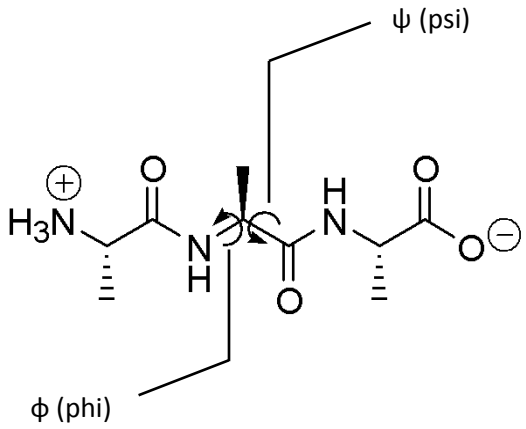
17. Draw a Ala-Ala-Ala tripeptide. Using the central Ala, show where the Phi and Psi angles are.



Give the approximate Phi, Psi angles for

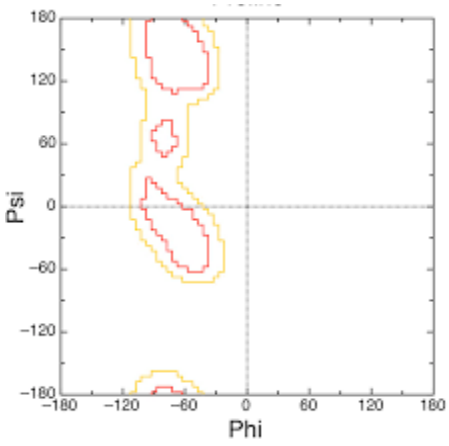
α-helix **ϕ – 60, ψ – 50**

Left-handed helix **ϕ 60, ψ 50**

antiparallel β-sheet **ϕ – 140, ψ 140**

polyproline II helix **ϕ – 80, ψ 145**

18. The Ramachandran plot shown below is for what amino acid?



Proline (Pro, P)

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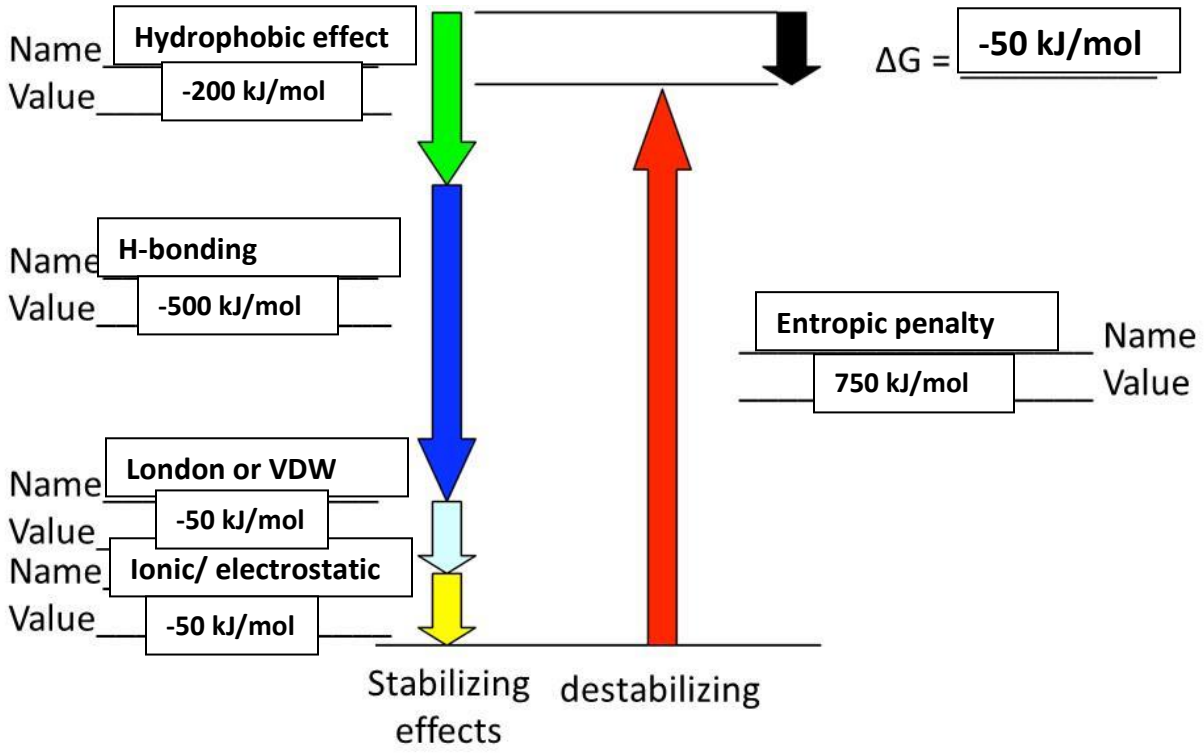
19. During protein folding, there is a destabilizing and four stabilizing energetic contributions. Draw an energy diagram, label the energies, and show the approximate magnitude of these energies in kJ/mol. Give the approximate overall stability (ΔG) for a folded protein.



When a protein is heated up it unfolds. Many of these energetic contributions change in magnitude. Identify <u>one</u> and explain how and why heat impacts the magnitude of its effect (in 60 words or less).

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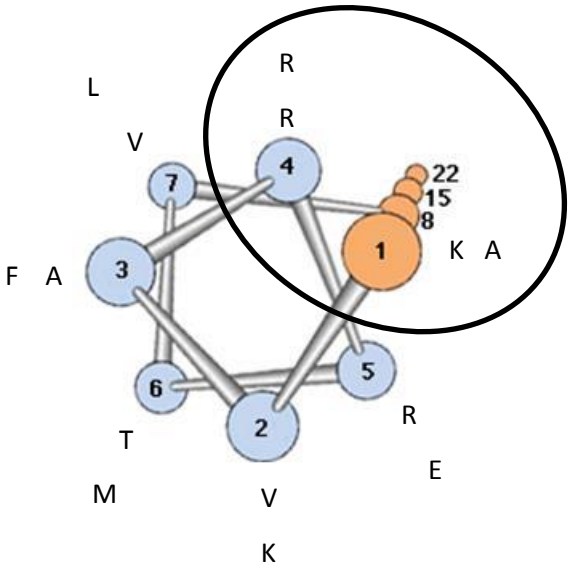
Short answer questions

20. The sequence shown below is involved in binding to DNA

K V A R R T V A K F R E M L

a) Circle the hydrophobic residues in the above sequence.

b) Fit the sequence to the helical wheel model.



c) Which face of the helix likely interacts with DNA? Circle it in your model shown above.

d) What kind of interaction stabilizes the interface between the helix and DNA?

Ionic (salt bridge) with charged basic residues and DNA phosphate backbone.

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21. The sequence shown below is part of the viral capsid of the zika virus. Trypsin will digest this protein sequence.

a) Show all the cleavage site on the above peptide by placing a vertical line between the amino acids that are cleaved

1 2 3 4 5 6 7 8 9

F R | I V N M L K | R | G V A R | V S P F G G L K | R | L P A G L L L G H G P I R | M V L A I L A F L R | F T A I

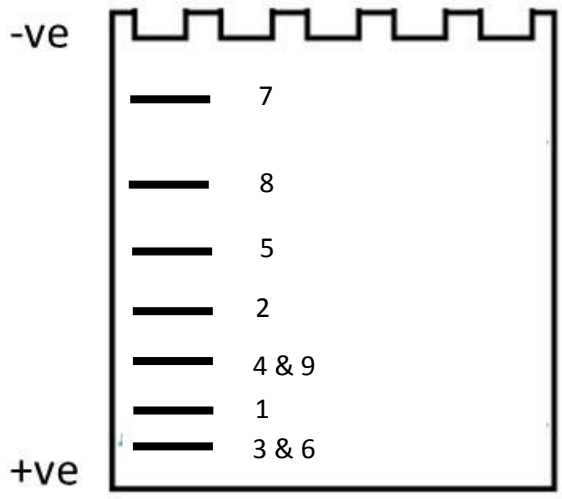
b) Label the fragments numerically starting from the N-terminus of the original protein.

c) How many fragments will be generated? **9**

d) Which peptide fragments will have a +1 net charge at pH = 7.4? List the numbers below.

1, 2, 3, 4, 5, 6, 7, 8

e) Using a single lane of the SDS-PAGE image below place the fragments generated from the tryptic digest (use their numerical labels from above) in the correct order they would occur after performing the electrophoretic separation.



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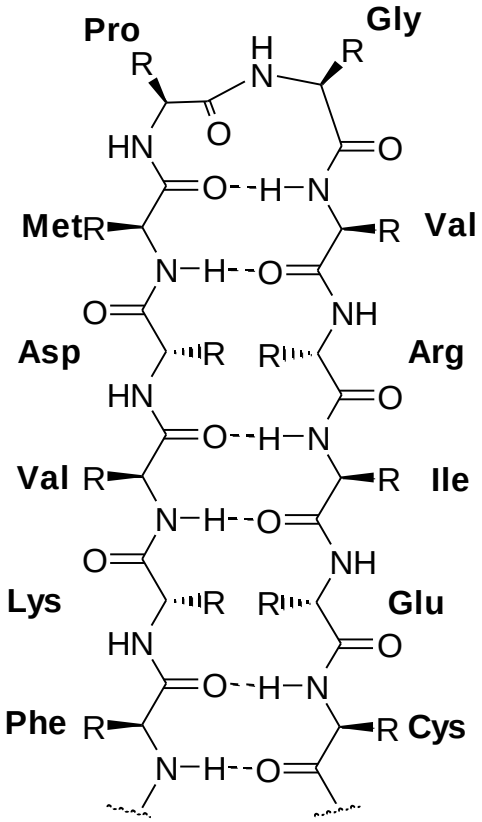
22. The sequence shown below forms a β-hairpin with a type II β- turn. Show the backbone hydrogen bonding pattern for the β-sheet and the turn (you don't need to draw the side chains in). Place the three letter code residues at each alpha carbon. Indicate which face of the β-sheet is hydrophobic and which is charged.

FKVDMPGVRIEC



Top face is hydrophobic

Bottom face is charged/polar

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